

Health and Risk Communication in Ontario Newspapers:

The Case of Wind Turbines

by

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Authors Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Introduction: The mass print media are a widely-distributed, and often primary, source of health information for the public. Health information in newspapers can amplify or attenuate readers' perceptions of risk depending on how it is presented. This thesis examines how health information related to wind energy was communicated in Ontario newspapers and includes separate analyses for the presence of fright factors, readability, emergent themes, and emotional tone and sensationalism. As an emerging technology, public understanding of and response to associated health risks and uncertainties towards wind energy can be influenced by media coverage.

Methods: Five geographically discontinuous wind energy installations in Ontario and their surrounding communities were selected based on 2006 Canadian Census data. Newspapers serving each community were identified and searched for articles from May 2007-April 2011 on the topic of health effects from wind energy developments. A total of 421 articles from 13 community and 4 national/provincial newspapers were retrieved. In Study #1, a directed content analysis was used to develop a coding instrument based on fright factors known to affect the public's perception of risk. In Study #2, each newspaper article was analyzed for text readability using the Simple Measure of Gobbledygook (SMOG) readability formula. In Study #3, and as a qualitative component, a semi-directed content analysis was used to find emerging themes and subthemes. Finally, in Study #4, a list of loaded and positive words, informed from previous studies on sensationalism in media reporting and a random sample of newspaper articles included in this study, and the frequency of their appearance was used as a quantitative measure of sensationalism.

Results: Study #1: The most commonly reported fright factors were 'dread', 'poorly understood by science', 'involuntary exposure', and 'inequitable distribution', occurring in 94% (n=394), 58% (n=242), 45% (n=188), and 42% (n=177) of articles, respectively. The fright factors of 'dread', 'poorly understood by science', 'inequitable distribution', and 'inescapable exposure' occurred more frequently in community newspaper articles than in national/provincial ones ($p < 0.001$). Although the total number of occurrences of each fright factor increased following the Green Energy Act, only 'dread' ($p < 0.05$) and 'poorly understood by science' ($p < 0.01$) increased significantly. Study #2: The mean reading grade level (RGL) of 421 articles on wind turbines and health was at the post-secondary education level ($X \pm SEM$; 13.3 ± 0.1). Articles from

community and provincial newspapers were written at almost a full RGL lower (13.2 ± 0.2 and 13.1 ± 0.2) than those from national newspapers (13.9 ± 0.2) ($p < 0.05$). Additionally, opinion pieces such as editorial columns were written at a lower RGL than fact-based news articles (13.0 ± 0.2 and 13.5 ± 0.1 , respectively; $p < 0.01$). Study #3: The majority of newspaper articles described health effects of wind turbines in general, rather than specific, terms. The most commonly cited causes of health complaints were inadequate setbacks (27%, $n=114$), noise (21%, $n=90$), shadow flicker and vibrations (12%, $n=49$), and electrical exposure (6%, $n=27$). Other, non-health concerns such as environmental damage (28%, $n=117$), property values (20%, $n=86$), aesthetic concerns (18%, $n=77$), financial burden (18%, $n=74$), were prevalent and juxtaposed with health issues in 28% of articles ($n=118$). Concerns with the quality and availability of scientific evidence were frequent in the newspaper articles (34%, $n=143$), with many articles promoting a moratorium on wind energy developments until further research is conducted (25%, $n=103$). Study #4: Newspaper articles emphasized negative rather than positive/neutral tone, with community newspapers publishing a higher proportion of negative articles than provincial or national newspapers ($X^2=6.11$, $df=1$, $p < 0.05$).

Conclusion: These findings suggest that the health information related to wind turbines in Ontario newspapers contains a large quantity of fright factors that may produce fear and anxiety in readers, is written at a reading grade level that is too complex for the majority of the Ontario population to fully understand, contains inconsistent information on health effects that often links health concerns with non-health concerns, and is often negative in tone. The influence of the Ontario newspaper media on reader's risk perceptions of wind energy in Ontario will be important to determine empirically.

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Introduction

The general public considers newspapers as a major, and often primary, source of health and risk communication (Lundgren & McMakin, 2009). A variety of definitions of both health and risk communication exist, but those used to guide this thesis research were:

Health communication is “the scientific development, strategic dissemination, and critical evaluation of relevant, accurate, accessible, and understandable health information communicated to and from intended audiences to advance the health of the public” (Bernhardt, 2004, p. 2051).

Risk communication is defined by the WHO (2013) as “an interactive process of exchange of information and opinion on risk among risk assessors, risk managers, and other interested parties”.

Modern definitions of both health and risk communication include two-way communication. Therefore, the interactive nature of newspaper media, and their function to communicate both fact and opinion, make them an important contributor of health and risk communication. However, many newspaper editors consider stories for publication because of economic, political, or cultural relevance rather than to benefit public health (Hillier, 2006; McCarthy, Brennan, De Boer, & Ritson, 2008). Editors must look out for the financial well-being of their newspaper (and shareholders), which means that stories are sometimes selected with the goal of selling newspapers, not necessarily because of their potential health implications.

Public perceptions of health risk can be influenced by the way the media frames and covers a story, especially how and what elements are reported (Rowe, Frewer, & Sjöberg, 2000). Several factors including message content, tone of delivery, expert sources, and information accuracy influence whether the public attends to, understands, and acts on risk information (McCarthy et al., 2008). Additionally, media messages may include aspects of a topic that can heighten public perceptions of risk, known as “fright factors”, which can trigger a sense of alarm and worry (Bennett, 1999). One topic that has gained the attention of the mass media (including newspapers) over the past decade is the controversy of wind energy and potential health effects.

Globally, the response to climate change has positioned wind power as an increasingly important energy source, supplementing other resources such as fossil fuels, and nuclear power (European Wind Energy Association, 2012; Global Wind Energy Council, 2012). In Canada, wind energy generating capacity and production increased by 21% and 8.3%, respectively, in 2010 (National Energy Board [NEB], 2011). The increased production of wind energy is much greater relative to other energy sources, such as coal (+7.9%) and petroleum (+5.7%). All other sources of energy (e.g., hydroelectricity and natural gas) declined in production in 2010 (NEB, 2011). Ontario is a wind energy leader in Canada and wind is projected to provide 10% of all power in Ontario by 2030 (Ministry of the Environment [MOE], 2010). By implementing the Green Energy Act (GEA) in 2009, the province of Ontario streamlined the approval process for many renewable energy technologies, notably wind energy installations. As a result, the number of wind turbines in Ontario increased from 10 in 2003 to almost 700 currently in place or planned (MOE, 2010). This rapid and substantial increase in the number of wind turbines has been met with concerns by individuals and community organizations in part due to potential health effects.

Opponents to wind energy often cite issues such as visual impact on the landscape, harm to wildlife and the environment, intermittent and weather-dependent energy production, annoyance from noise pollution and shadow flicker, and possible health effects as barriers to the development of wind energy (Gray, Haggett, & Bell, 2005; Phadke, 2010; Todt, González, & Estévez, 2011; Warren & Birnie, 2009). In Ontario, many of the opponents to wind energy installations have mobilized to form grassroots organizations, some of which have been successful in influencing the political agenda of their local municipal office. One mechanism in which opponents to wind energy have voiced their concerns is through newspapers. Numerous characteristics, including controversy, conflict, a human angle, and the potential for public impact all make the issue of wind turbines and potential health effects newsworthy (Finnegan & Viswanath, 2002; Viswanath et al., 2008). Consequently, the news media has reported extensively on the issue of wind turbines and potential health effects.

The purpose of this study was to describe risk messages related to wind turbines and health in Ontario newspapers. The first chapter of this thesis presents a review of the literature on wind energy in Canada, the current scientific understanding of wind turbines and potential health effects, and the influence of media, specifically newspapers, on disseminating health information. In Chapter 2, the rationale, objectives, and hypotheses are outlined for each of the four studies conducted as part of this thesis. In Chapter 3, a content analysis for the presence of “fright factors” using the established risk typology of Bennett (1999) was conducted in Ontario newspaper articles on wind turbines and health. In Chapter 4, the reading complexity of the same sample of newspaper articles was assessed using the Simple Measure of Gobbledygook (SMOG) readability formula. Chapter 5 is semi-directed and conventional content analysis in which latent themes about wind turbines and health were identified. In Chapter 6, an analysis of media

sensationalism/emotional tone was conducted. The final chapter provides a discussion of key findings and how each component informs health and risk communication about wind energy in Ontario, as well as limitations and future directions for research on this topic.

Chapter 1: Literature Review

1.1 Wind Energy in Ontario

In recent years, the Ontario government has set strong goals for reducing greenhouse gas emissions through the Climate Change Action Plan (MOE, 2011). Part of this plan involves completely phasing out coal-fired power plants by 2014 and supplementing the power grid with renewable energy (Ministry of Energy [MOEn], 2012). In 2009, the Ontario government introduced the Green Energy Act (GEA) to encourage the development of renewable energy technologies by removing barriers to and promoting opportunities for solar, biofuel, and wind projects (Bill 150, 2009). As a result of the now simplified approval process for wind energy developers, there has been a substantial increase in the number of wind turbines built in Ontario (MOE, 2010). The Ontario government has made a strong push towards a renewable future and have set goals that will make the province one of the top energy producers in North America.

Both small and large-scale wind energy projects can link into the Ontario power grid as part of the Feed-In-Tariff (FIT) program, which provides stable prices and long-term contracts for energy generated using renewable technologies (MOE, 2010). There is, however, a substantial difference between small and large-scale wind energy projects. Although small-scale projects constitute a substantial portion of wind energy production in Ontario, they typically involve turbines powering a single home or small community. Large-scale wind energy developments employ one or several industrial wind turbines, and produce the majority of wind energy in Ontario. Industrial wind turbines range in size, but generally stand over 300 feet in height and have a power generation capacity of 0.65 to 2.5 MW each (CANWEA, 2011).

Industrial wind turbines can stand alone, or be grouped into “wind farms” or “wind energy developments”, which can consist of over 100 individual industrial wind turbines. Currently in Ontario, there are eight wind energy developments with over 50 individual wind turbines, and two wind energy developments with over 100 individual wind turbines (CANWEA, 2013). Appendix A illustrates the geographical distribution of several large wind energy developments in Ontario.

Ontario is not the only Canadian province that has strong renewable energy goals, especially concerning wind energy developments. Canada’s current installed wind energy capacity is 6568 MW, which is enough energy to power over 2 million homes or the equivalent of 3% of the country’s total electricity demand (CANWEA, 2013). The majority of Canadian wind energy is produced in Ontario, Quebec, and Alberta, each contributing 2043.2, 1716.2, and 1116.6 MW, respectively (see Figure 1). These provinces have also set large goals for wind energy production. The province of Quebec wishes to connect 4000 MW of wind energy to their grid by 2015 (Gouvernement du Quebec, 2012). The focus of energy in Alberta is predominantly on oil, so the majority of their long-term energy plans involve the more efficient extraction and consumption of fossil fuels. However, Alberta also boasts three times the national average of electricity generation capacity for wind turbines, and the provincial government intends to continue promoting renewable energies (Alberta Energy, 2012). Similarly, the province of British Columbia has traditionally focused on other forms of energy production. Although there are opportunities to use wind to generate electricity and studies have been conducted on wind energy potential, there are currently no “utility-scale” operations in the province (BC Hydro, 2013). However, according to CANWEA, the majority of wind power generating in British Columbia are generated from three large installations (>100 wind turbines) (CANWEA, 2013).

Other Canadian provinces have indicated a desire to increase renewable energy production. In 2011, 17.5% of Nova Scotia’s energy came from renewable sources, with wind composing 7% of that amount. However, the province of Nova Scotia has set a target of 40% of energy to come from renewable sources by 2020, which would require more than double the amount of installed wind energy (Nova Scotia Department of Energy, 2012). The last Canadian province to produce significant wind energy (approximately 300 MW) is New Brunswick. There are five regions throughout New Brunswick that are proposed for future wind energy development, and the government is committed to producing 10% of all provincial energy from wind energy by 2016 (NB Power, 2013). With few exceptions (notably in Northern Canada), the interest in developing wind energy as a significant source of power generation is consistent across the country.



*Adapted from CANWEA (2013)

Figure 1: Canada’s Current Installed Wind Energy Capacity (2013)

1.2 Health Effects from Wind Turbines

1.2.1 Public Health Concerns

Although proponents of wind energy believe wind turbines to be a clean, safe, and reliable source of electrical power, and part of a renewable energy solution to reduce greenhouse gases (CANWEA, 2011), opponents often cite concerns about the utility and safety of wind turbines (McMurtry, 2011). There are a variety of potential public health concerns associated with industrial wind turbines, including sound, electromagnetic exposure, shadow flicker, aesthetics, icing, structural failure, occupational safety, environmental impacts (Rideout, Copes, & Bos, 2010). There is published literature, and a variety of anecdotal evidence, which suggests a potential correlation between proximity to industrial wind turbines and adverse health effects (McMurtry, 2011; Pierpont, 2009). The best studied of the wind turbine health effects are those related to noise and infrasound; these are described below.

Noise, defined as unwanted sound, is one of the most common complaints from exposure to wind turbines. The turbulence caused by the rotating blades of a wind turbine generate noise has been described as an audible and recurring “swish” sound (Pedersen & Persson Waye, 2007). Provincial setbacks have been established to protect individuals living near potential and existing turbines from potential health and safety hazards of wind turbines, including noise and structural hazards (Chief Medical Officer of Health [CMOH], 2010). The minimum setback is 550 metres, but this can increase with the size of the wind energy development and the sound rating of the specific wind turbine technology. The primary reason for the setbacks is to limit the exposure to background noise to no more than 40 dB, which is the limit set by the World Health Organization (WHO) for the protection of public health from community noise (CMOH, 2010). Although this guideline results in noise levels below those that cause sleep disturbances, it is

nevertheless audible and complaints may occur (WHO, 2009). Scientific data indicate that sound levels associated with wind turbines are not sufficient to cause damage to hearing, but people may find the noise annoying (CMOH, 2010). Annoyance from sound has been extensively studied and is strongly correlated with individual perceptions of wind turbines (Pedersen & Persson Waye, 2008). Negative attitudes towards turbines were associated with increased annoyance, and positive attitudes were associated with decreased annoyance. Noise levels of wind turbines also appear to have a dose-response relationship with annoyance. A significantly larger proportion of survey respondents in the south of Sweden became “very annoyed” with wind turbines at noise levels above 40 dB (36%) compared to lower noise levels, such as 32.5-35 dB (8%) (Pedersen & Persson Waye, 2004). Additionally, wind turbine noise is unique in producing a swishing quality that fluctuates over a 24 hour period. The swishing quality of wind turbine noise has been demonstrated to be more annoying than transportation or industrial noise; this has been attributed, in part, because the latter is more constant and occurs at lower levels at night (Pedersen & Persson Waye, 2008).

Although, in isolation, annoyance is typically not considered a health effect (Colby et al., 2009), prolonged annoyance and psychosocial stress reported in people living near wind turbines may be physically manifest as adverse health effects. There is a large body of literature describing the influence of psychosocial stress on cardiovascular risk (e.g., von Kanel, 2012). Additionally, those who have a sensitivity to and negative perception of environmental stimuli have a higher propensity for depression and anxiety (Bakker & Moulding, 2012) and greater perceived symptoms of physical illness (such as bodily aches and pains and nausea) (Benham, 2006). Benham (2006) proposes two potential explanatory mechanisms for the relationship between sensitivity to environmental stimuli and reported symptoms of ill health. The first is that

increased sensitivity can lead to greater overall physiological arousal and may result in subsequent adverse health effects. For example, psychological stress has been associated with elevated cortisol levels (Kirschbaum et al., 1995), and chronically elevated cortisol levels have been associated with cardiovascular disease (Vogelzangs et al., 2010). The second is that sensitive individuals may be more aware of health symptoms and are more likely to report minor physiological sensations that others exposed to the same stimuli may not notice. In separate studies (albeit from the same research group), annoyance has been correlated with sound levels and visual perception of wind turbines, but ill health has not (Pedersen & Persson Waye, 2004; Pedersen & Persson Waye, 2007).

Infrasound, or low frequency sound, is another potential risk factor from wind turbines that may help to explain symptoms associated with balance and nausea. Pierpont (2009) reports a clustering of symptoms in families living in close proximity to wind turbines; this symptom cluster has been termed “wind turbine syndrome” and includes effects such as sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, and nausea. Low frequency noise creates vibrational energy that may disturb vestibular function and disrupt the internal mechanism for balance and position recognition (Pierpont, 2009). Although annoyance from background noise exposure seems to be one of the major contributors to the potential health issues associated with industrial wind turbines, there are also reports of potentially more serious physiological responses such as recurring (cluster and migraine-type) headaches and nausea (McMurtry, 2011).

1.2.2 Scientific Evidence on Wind Turbines and Health

The health impact of wind energy installations has become a widely debated and contentious political issue in Canada (Knopper & Ollson 2011; Watson 2012) and in Northern European countries, including Sweden and the Netherlands (Pedersen, 2011). In response to

public concern of wind turbines as a potential health risk, a review was conducted by the Ontario Chief Medical Officer of Health in 2010. This report concluded that the current scientific literature does not demonstrate a causal link between exposure and direct health effects (CMOH, 2010). Additionally, the scientists at the National Collaborating Centre for Environmental Health in Canada acknowledge that some individuals may be concerned about adverse stimuli such as noise and low frequency sound, electromagnetic fields, shadow flicker, ice throw and structural failure. Although these stimuli may lead to annoyance and sleep disturbance, they are not sufficient to cause adverse health effects (Rideout et al., 2010). A scientific advisory panel established by the Canadian and American Wind Energy Associations in 2009 conducted an extensive review of the literature on sound and health effects, and on sound produced specifically by wind turbines. The panel's conclusions were that audible or sub-audible sounds, or vibrations, emitted by wind turbines are not different than audible (sub-audible) exposures in other occupational settings, and do not have any direct physiological health effects (Colby et al., 2009).

To summarize the key points from the literature on the health effects of wind turbines: (1) there is a potential dose-response relationship between noise exposure from wind turbines and annoyance, but this relationship is mediated by attitudes (positive or negative) towards wind turbines, (2) though ill health has not been directly correlated with exposure to wind turbines, anecdotal reports indicate that some individuals may suffer symptoms such as headaches, nausea, sleep disturbance, and tinnitus, and (3) the potential health effects from wind turbines are a widely debated political issue and has become a point of concern for many members of the public.

1.3 Media and Health Communication

Despite the emergence of other information technologies, such as the internet, newspapers boast high readership levels in Ontario. Each week 73% of Ontarians over the age of 18 years read a printed edition of a daily paper and 83% read their community paper (Canadian Community Newspaper Database, 2010; Newspaper Audience Databank [NAD], 2011). In areas where daily papers are available, more than half of adult Ontarians read the paper every day (NAD, 2011). Therefore, it seems reasonable to suggest that the Ontario public is highly exposed on a regular basis to the information that appears in printed newspapers.

Newspapers are a highly trusted and often primary source of health information for the public, particularly among health-conscious individuals (Atkin, Smith, McFeters, & Ferguson, 2008; Dutta-Bergman, 2004; Johnson, 1998; Meischke et al., 2002). For example, in an older study from the U.S. National Cancer Institute determining where patients get information on cancer screening and prevention, newspapers ranked fourth behind (in order) doctors, magazines, and television (Meissner, Potosky, & Convisser 1992). Other studies report newspaper media as the most frequently reported source of health information although this may vary by cultural and literacy preferences. For example, a study of Vietnamese American men found that Vietnamese newspapers/magazines were the most commonly used health information source, followed by Vietnamese and English language television and Vietnamese radio (Woodall et al., 2006). Not only do newspapers play an important role in the dissemination of public health information, but they often translate medical and scientific findings into more understandable terms (Salmon & Atkin, 2003; Viswanath et al., 2008). However, many

newspaper editors consider stories for publication because of economic, political, or cultural relevance rather than to benefit public health (Hillier, 2006; McCarthy et al., 2008). Therefore, although newspapers can promote awareness of health information by the public, it is often not in a public health frame nor delivered as part of social marketing of health.

Public perceptions of health risk can be influenced by the way the media frames and covers a risk story, especially how and what elements are reported (Rowe et al., 2000). Several factors including message content, tone of delivery, expert sources, and information accuracy influence whether the public attends to, understands, and acts on risk information (McCarthy et al., 2008). The quality of health information in daily newspapers serving Ontario is often poorly related to empirical scientific evidence, and has been demonstrated to include misleading titles, contain erroneous information or omit important results, or treat speculation as fact (MacDonald & Hoffman-Goetz, 2002). Additionally, a larger percentage of small compared to large newspapers (based on circulation numbers) had misleading titles, omitted important results, or omitted qualifications (MacDonald & Hoffman-Goetz, 2002). Context, accuracy, and regional differences in health information can be highly influential for public acceptance or resistance to wind energy developments.

Agenda-setting refers to the ability of the media to influence the salience of topics in the public space (McCombs, 2004). This is accomplished by daily coverage, presentation, and framing of various issues (Dearing & Rogers, 1996; McCombs, 2004). Manipulating any of these variables can have a considerable influence on the decision process of members of the public or policymakers (Dearing & Rogers, 1996). Framing refers to the selection of some aspects of a perceived reality and make them more salient in

communicated text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation (Entman, 1993). Case studies of nuclear power, tobacco, and pesticides have shown that major shifts in public policy and opinion are often the result of a change in the salient or framing aspects of specific issues among the public (Baumgartner & Jones, 1993). Therefore, the mass media, including newspapers, has the power to potentially influence public attitudes and opinions by using agenda-setting and framing (McCombs, 2004).

Characteristics of newspapers, including the ability to attend to articles repeatedly and at no fixed pace, have made them the primary choice of media agenda analysis (Soroka, 2002). In addition to message-level variables, such as framing, content, and accuracy, the frequency of newspaper coverage on the topic of wind turbines and health can influence the decisions of policymakers and various public groups with respect to renewable energy technologies. This is because the frequency of newspaper coverage increases the salience of the issue on the public agenda (Dearing & Rogers, 1996). In other words, an increase in newspaper reporting on any specific issue corresponds with an increase in public awareness and perceived importance. For example, this trend has occurred in newspaper coverage of issues such as global warming and climate change, obesity, tobacco, and physical activity (Liu, Vedlitz, & Alston, 2008; Chau, Bonfiglioli, Chey, & Bauman, 2009).

1.4 Health Literacy and Readability of Health Risk Information in Newspapers

Health literacy has been defined by the Expert Panel on Health Literacy, which was founded by the Canadian Public Health Association and the Canadian Council on Learning, as “the ability to access, understand, evaluate and communicate information as a way to promote, maintain and improve health in a variety of settings across the life course (Rootman & Gordon-El-Bihbety, 2008). Measures of reading and word comprehension, such as the Rapid Estimate of Adult Literacy in Medicine (REALM) and Test of Health Literacy in Adults (TOFHLA) have been developed to assess health literacy in medical settings (Chinn, 2011). Patients with low scores on these tests have lower health knowledge, worse health outcomes related to their condition, and higher overall mortality (Chinn, 2011; Gazmararian, Williams, Peel, & Baker, 2003; Sudore et al., 2006). However, not all health literacy occurs in a clinical setting, and expanded definitions of health literacy go beyond the individual health behaviours and include social determinants of health such as income, education, and social organization (Nutbeam, 2000). As previously mentioned, newspaper articles represent a prominent health risk information source, and have broadly been demonstrated to reflect the public discourse of an issue. Measures of reading comprehension for written text, such as newspapers, include measures for readability.

Readability of health risk information is an important factor in the public understanding of an issue and the ability of individuals and collective groups to make informed decisions (Lunin, 1987). Low science literacy levels, coupled with health information written at a higher reading grade level (RGL), are associated with lower levels of health knowledge (Edwards, Elwyn, Covey, Matthews, & Pill, 2001; Williams, Baker, Parker, & Nurss, 1998). Poor comprehension of science and health information has

negative effects on health and well-being (Berkman, Davis, & McCormack, 2010; Bernhardt & Cameron, 2003; Rudd, Rosenfeld, & Simonds, 2012). In a clinical setting, low literacy can result in a patient being less likely to seek preventive care, understand discharge or medication instructions, or attend follow-up appointments (Sellors et al., 1997; Smith & Haggerty, 2003). In an environmental setting, low literacy may be associated with an inability to appropriately assess the risk of certain exposures to an individual (LePrevost, Blanchard, & Cope, 2012). The International Adult Literacy Survey (IALS) (2005) found that four out of ten adult Canadians had a reading ability below 3 on a 5 level literacy scale and that nearly 3.1 million adult Canadians were at a proficiency level of 1. A proficiency level of 1 on IALS means that a significant percentage of adult Canadians have serious difficulty with printed materials (including newspaper articles about health) and can deal with simple reading tasks only.

Readability formulas are devices that provide quantitative estimates of text reading difficulty and complexity. Generally, these formulas calculate a reading grade level (RGL) of written material, which indicates the education level or grade at which an individual would be expected to fully comprehend the text (McLaughlin, 1969). There are a number of formulas that can be used to measure the reading difficulty of text including the Simple Measure of Gobbledygook (SMOG), the Gunning Fog Index Readability Formula (FOG), the Flesch Reading Ease Formula (FRE), and the Fry Graph Readability Formula (FRY). When evaluating health-based information, each of these formulas demonstrate a very high positive correlation with one another ($r = 0.93 - 0.99$) (Meade & Smith, 1991). The FOG, FRE, and FRY formulas each are time-consuming and cumbersome to calculate manually, and computer scores for each typically underestimate reading difficulty (Friedman &

Hoffman-Goetz, 2006). The SMOG formula is widely used in health studies because of its reputation for accuracy, simplicity, and short length of time needed for manual administration, which is especially important when computerized formulas are not available (Meade & Smith, 1991).

Although IALS scores and RGL have not been directly correlated, individuals at Level 1 of IALS likely have a RGL of 3 or less (Hoffman-Goetz, Donelle, & Ahmed, 2014). For most people to read and understand health material, it must be written at a RGL of 8 or lower (Doak, Doak, & Root, 1996; Rootman & Gordon-El-Bihbety, 2008). Despite the recommendations of readability (RGL) at 8th grade or lower, newspaper content is often written at much higher readability levels. For example, a sample of periodicals, newspapers, newsletters and pamphlets from a health information database (InfoTrac), containing information on a variety of health-related topics (ranging from stroke to cancer), had an average reading grade level of 12, with a range from 10 to 14 (Baker, Kars, & Wilson, 1997). Another study examined the differences in cancer coverage between ethnic and mainstream newspapers in Canada and the United States and found that mean SMOG readability scores were well above a grade 12 level (Hoffman-Goetz & Friedman, 2005). Therefore, newspapers often present health information at a reading difficulty that is too high for the majority of the adult population to understand.

1.5 Factors Influencing Public Reaction towards Wind Turbines

1.5.1 Health Risk Communication and Fright Factors

Risk is the likelihood of a specific event occurring, multiplied by the magnitude of consequences associated with that event. Risk communication refers to the “interactive process of exchange of information and opinions among individuals, groups, and institutions concerning a risk to human health or the environment” (NRC, 1989). Fear is often used in risk communication as a strategy to motivate public action (Witte, Meyer, & Martell, 2001). Additionally, the underlying theoretical construct for using fear messages to elicit behaviour change has been developed by Witte (1992) as the Extended Parallel Processing Model (see Chapter 7 for further details). Messages that are perceived as threatening or fearful can evoke high anxiety or negativity for individuals and lead to a counterproductive response (Johnson, Henderson, Pedersen, & Stonecipher, 2011). Often, the counterproductive behaviour is avoidance. This is common in studies that range from the fear of falling in the elderly (Zijlstra et al., 2006), to the fear or stigma associated with HIV testing in a non-clinical setting (Joseph et al., 2011). The renewable energy goals in Ontario, and subsequent increase in the number of wind energy projects located throughout the province, may hinder the ability of people who perceive risk from wind turbines to use avoidance as a coping mechanism; however, this possible behavioural effect has not been tested with wind turbine exposure.

Several studies have identified characteristics of risk messages that can shape individual risk judgements. The psychometric paradigm is a theoretical framework which asserts that risk is subjectively defined by individuals based on a variety of social, psychological, institutional, and cultural factors. This theory identifies dread, catastrophic potential, perceived controllability, familiarity, and uncertainty as major determinants of public risk perception (Slovic, 1992).

Expanding on these risk components, a diagnostic checklist of fright factors has helped to explain why some environmental health risks are more likely to trigger fear, anxiety, or outrage than others, independent of scientific estimates of their seriousness (Bennett, 1999). The complete list of fright factors can be found in Table 1.

Table 1: Fright Factors Adapted from Risk Communication in Public Health

Fright Factor*	Definition Risks are generally more worrying if perceived:
Involuntary	To be involuntary rather than voluntary
Inequitably distributed	As inequitable distributed (e.g., greater exposure in some populations compared to others)
Inescapable	As inescapable by taking personal precautions
Hidden or irreversible damage	To cause hidden and irreversible damage (e.g., onset of illness years after exposure)
Damage to future generations	To pose particular danger to small children or pregnant women, or more generally to future generations
Dread	To threaten a form of death (or illness/injury) arousing particular dread
Identifiable victims	To damage identifiable rather than anonymous victims
Poorly understood by science	To be poorly understood by science
Contradictory statements	As subject to contradictory statements from responsible sources
Novel source	To arise from an unfamiliar or novel source
Man-made source	To result from man-made, rather than natural sources

Note: *Based on Peter Bennett's fright factors (Bennett, 1999, 2010)

These fright factors provide a detailed framework from which public risk perceptions related to environmental health may be predicted (Bennett, 1999). Accordingly, these fright factors have been shown in newspaper coverage of HPV vaccination, avian flu, biosolids, and genetically modified crops (Burke, 2011; Abdelmutti & Hoffman-Goetz, 2009; Fung, Namkoong & Brossard, 2011; Goodman, & Goodman, 2006). As a result of their ability to elicit fear, anxiety, or other negative emotional responses, media that contain a large number of fright factors can provoke a strong public reaction and upstream policy action (Bennett, 2010).

1.5.2 Emotional Tone

Sensationalism refers to the potential for media to distort or exaggerate information about risk through the use of emotionally provocative language (Allan, 2002; Dudo, Dahlstrom, & Brossard, 2007). Emotional tone, whether negative, positive, or neutral, can have important consequences for how people interpret, understand, and act on health information (Abdelmutti & Hoffman-Goetz, 2009, 2010). Repeated presentation of an issue through a particular frame can change the discourse of the public and policymakers regarding that issue (Finnegan & Viswanath, 2002; Salmon & Atkin, 2003). On an individual level, the influence of framing on risk perception can ultimately lead to changes in behaviour, such as avoidance, which may then affect health outcomes (Edwards et al., 2001). For example, strong emotional responses to environmental risks may trigger an overreaction and excessive preventative measures (Sunstein & Zeckhauser, 2011). The quality and accuracy of media reporting of health and environmental risks are often biased towards sensational and dramatic news, which can elicit fear for the reader (Hillier, 2006).

Chapter 2: Research Gaps, Objectives and Rationale

Existing research on public perceptions of wind turbines is limited. A review of the literature on perceptions of wind turbines identifies a lack of research on public perceptions of wind turbines across different socio-economic and socio-cultural contexts as well as a comparison between urban and rural areas (Devine-Wright, 2005). Although the issue of wind turbines and health has received widespread attention from the Ontario newspaper media, there has not been any empirical analysis of the frequency and content of these health messages. Content analyses are a convenient, low-cost, and non-intrusive technique used to build understanding of how the public interprets health risk when risk perception surveys are not available (Driedger, 2007). Given the influence of the media on health risk perceptions, understanding the newspaper coverage of wind turbines and health may increase the effectiveness of future health communication initiatives.

This study was comprised of four synergistic components, each with specific research questions and testable hypotheses. The relationship between each component of this study is shown in Figure 2. The overall goal this research was to provide insight into how health and risk communication in the newspaper media can influence public attitudes, opinions and behaviours. As a case study, the newspaper discourse about health risks from exposure to wind turbines in select Ontario communities was examined. The following sections detail the research gaps, questions and hypotheses from each component of this thesis.

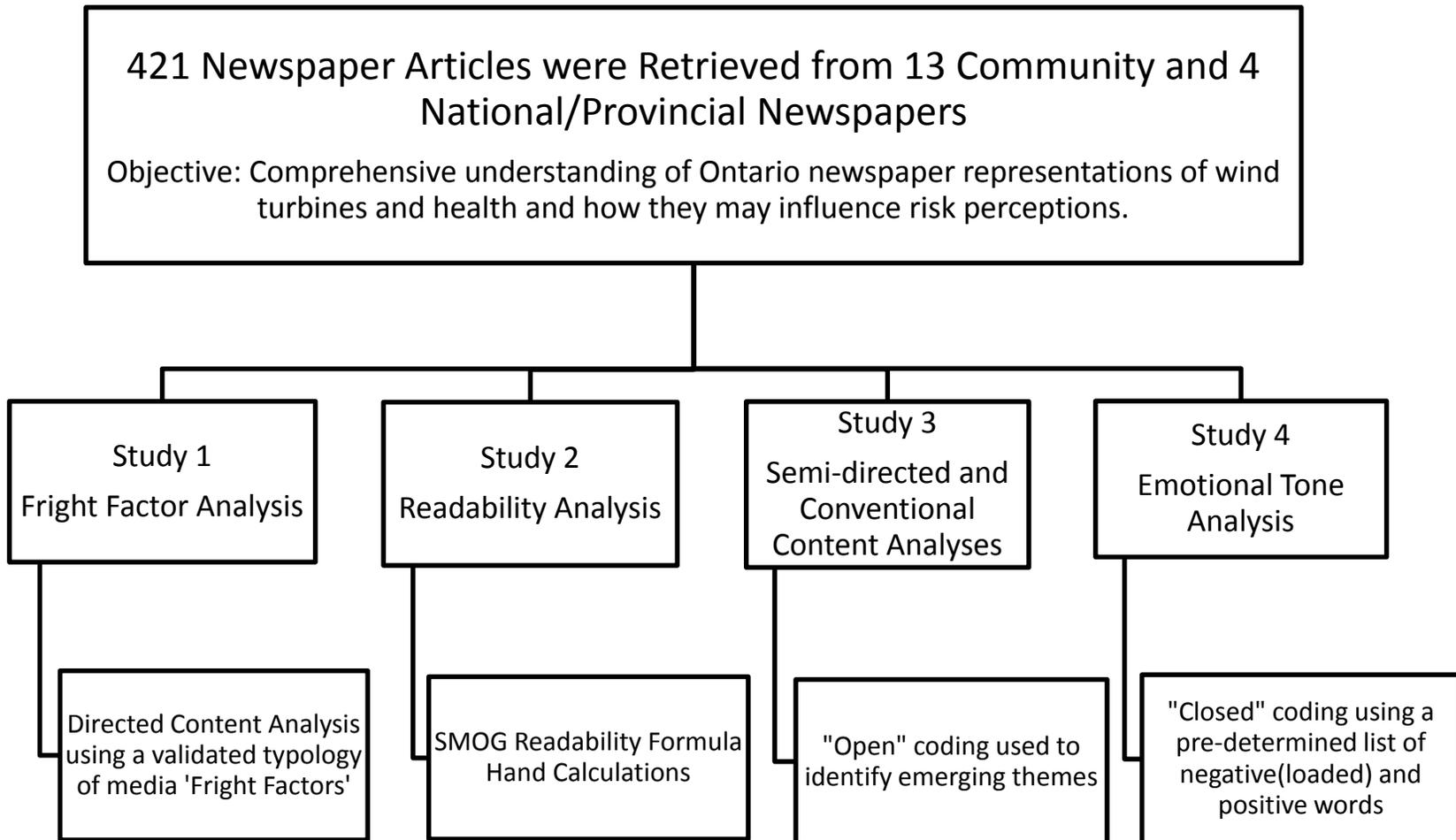


Figure 2: Brief Description of Each Component of the Study and their Relation to the Overall Research Question

Study #1

As previously noted, there exists a variety of anecdotal evidence linking wind turbines with adverse health effects (McMurtry, 2011; Rideout et al., 2010). These safety concerns have prompted a large amount newspaper coverage. To date, no previous analysis of the newspaper media's coverage, especially in Ontario, of wind turbines and health has been conducted. Therefore, there is limited knowledge of how the content of newspaper media may influence or amplify risk perceptions. The first component of this thesis research focused on analyzing newspaper coverage of the health effects of wind turbines in Ontario newspapers using a published and validated typology of fright factors (Bennett, 1999). The specific research questions examined were: (A) What are the most prevalent fright factors in Ontario newspaper coverage of wind turbines and health? (B) Does the presence of these fright factors change relative to newspaper type (community vs. national/provincial)? (C) Does the presence of fright factors change relative to the implementation of a major policy legislation, the Green Energy Act? and (D) Is there a difference in number of or type of fright factors about wind turbines and health in newspaper articles based on community-specific demographic variables, such as population density, median income, and education level?

Although industrial wind energy has existed in a small capacity for a couple of decades, the recent and rapid expansion this technological sector has made it difficult to characterize and study exposure to wind turbines prospectively. This has potentially led to a knowledge deficit in both scientific and lay communities, which can have an inflammatory effect on public risk perceptions (Slovic, 1987). The abundance of reported symptoms included in anecdotal reports, such as headaches, dizziness, tinnitus, nausea, and sleep disturbance (McMurtry, 2011; Pierpont, 2009), may trigger fear or dread in populations exposed to wind turbines. Therefore, the

hypothesis for research question (A) was that the fright factor “threatens a form of death (or illness/injury) arousing particular dread (‘dread’ for short)” would be the most prominent fright factor in Ontario newspaper articles on wind turbines and health.

A logical assumption is that the readership of community newspapers is predominantly local. Most community newspapers are published in rural areas where wind turbines feature prominently. Small media organizations (such as community newspapers) pursue human interest angles in stories while large media organizations (such as national/provincial newspapers) use an economic angle when reporting (Wallington, Blake, Taylor-Clark, & Viswanath, 2010). The limited staff resources of smaller media markets often results in localization of health stories (Caburnay et al., 2003). As a result, community newspapers may be more likely to publish reports that reflect local (and proximal) rather than national/provincial (and distal) concerns. The hypothesis for research question (B) is that articles in community newspapers would have a greater prevalence of most fright factors than articles in national/provincial counterparts. Furthermore, the province of Ontario has recently introduced policy legislation on alternative energies, including wind turbines, known as the GEA. By implementing the GEA in 2009, the province streamlined the approval process for many renewable energy technologies. This removed the ability of municipal governments to control the location of renewable energy sources in their communities. As a result, the hypothesis for research question (C) was that newspaper articles published after the GEA would focus on inequitable distribution and involuntary exposure.

Knowledge and awareness of health issues has been correlated with socioeconomic status (SES). Generally, lower SES correlates with the slower acquisition and inaccurate use of health information (Viswanath et al., 2006). This may influence the ability of people and patients to

make informed and rational choices about medical decisions and lifestyle (Rimer, Briss, Zeller, Chan, & Woolf, 2004). Individuals with lower SES (i.e., lower income and education levels) may be more likely to hold myths and fatalistic views about potential hazards than their higher SES counterparts. This SES-fatalism perspective has been demonstrated in studies of cancer risks (Scroggins & Bartley, 1999). It is also documented that as media organizations become smaller, the focus of their stories turns from economic to predominantly health and human interest-based (Wallington et al., 2010). Communities with individuals at a lower average SES are likely served by a newspaper with reduced resources. Therefore, news stories would tend to be localized and reflective of community public opinion. The hypothesis for research question (D) was that the prevalence of some fright factors (e.g., ‘involuntary exposure’) in newspaper articles would fluctuate based on demographic characteristics (e.g., education and income) of the surrounding community in which they were published.

Study #2

Health information that is written at a complexity that does not match with the literacy level of the population can lead to lower levels of health knowledge and, consequentially, poorer health outcomes (Bernhardt & Cameron, 2003). Previous studies on other health issues in the media, including cancer coverage in newspapers, have found that health information is presented at a reading grade level that is too high for the majority of the population to understand (Hoffman-Goetz & Friedman, 2006). However, there is no previous analysis of the reading complexity of information regarding wind turbines and health in Ontario. Improving our understanding of the health information related to wind turbines could inform future health communication initiatives. Therefore, the second research component was undertaken to determine the readability level of Ontario newspaper articles on wind turbines and health. The specific

research question was whether the average reading grade level (readability score) of newspaper articles on wind turbines and health differed by type of newspaper (community, provincial, national).

There exists both an education and income gap between urban and rural Canadian communities (Alasio, 2003). These differences can be illustrated using two census subdivisions (CSD) from the 2006 Canadian Census, Hanover (rural) and Hamilton (urban), that were included in this study. One measure of educational attainment, “Total population 15 years and over: No certificate, diploma, or degree”, described 35% of the Hanover CSD population compared to 25% of the Hamilton CSD population. Additionally, the “Median income in 2005 – All private households” was \$44771 in the Hanover CSD compared to \$55312 in the Hamilton CSD. Although these descriptions only represent a small amount of the census data, they demonstrate that the average individual from the Hamilton CSD (urban) has a higher education and income than the average individual from the Hanover CSD (rural). Therefore, this data suggests the existence of education and income gaps between rural and urban Ontario communities.

Previous studies have noted that national newspapers are written at a higher RGL than community newspapers (Meyer, 2009). From this evidence, it may be that the audience of provincial and national newspapers may generally be more affluent, with higher SES, than the audience served by community newspapers. Therefore, provincial and national newspapers will compose newspaper articles that reflect the reading ability of the majority of its readership.

Study #3

As a complement to Study #1, the third component of this study was designed to provide more substantial and descriptive qualitative interpretation of the underlying themes that support the fright factor typology. To accomplish this, text was coded inductively using “open” coding, emerging themes in the same dataset of newspaper articles on wind turbines and health. This technique captured data that the previous “closed” coding methods may have overlooked. Again, the intention was to discover the emerging themes in the newspaper discourse on wind turbines and health in Ontario newspapers, and whether themes varied relative to newspaper type or the Green Energy Act.

A priori hypotheses are a sensitive subject among qualitative researchers. Many believe that generating hypotheses prior to beginning the reading and coding process may sacrifice the objectivity of the researcher (Hesse-Biber & Leavy, 2011). However, in the case of wind turbines and health, predictions can still be made about potential framing topics or themes that may occur while remaining objective. For example, the energy industry as a whole is viewed by the public as extremely politically sensitive. Therefore, perceptions of wind turbines and resultant newspaper reporting of the issue may change in regions with different political viewpoints. These differences may be exacerbated in community newspapers, as local reporters have closer ties to their community than their provincial counterparts, and are more likely to be influenced by cultural, political, and geographical factors (Kitzinger, 1999). As a result, there may be differences in editorial agendas. The differences in reporting between community and national/provincial newspapers could translate into subtle effects on health risk messages aimed at readers. Therefore, the hypothesis was that community newspapers articles would be more focused

on the direct impact from wind turbines, such as aesthetic and financial concerns. National/provincial newspaper articles, on the other hand, would be more focused on the indirect impact from wind turbines, such as environmental damage.

Study #4

In the fourth and final component of the thesis research, health messages about wind turbines in Ontario newspapers were studied in relation to the emotional valence of the message (positive, negative or neutral), which in turn can influence public perception of risk. The purpose of this research was to determine how the issue of wind turbines and health was presented in Ontario newspapers, and whether this changed relative to newspaper type or the Green Energy Act (GEA).

Although the majority (89%) of the Ontario population supports wind energy, there is greater opposition in several smaller regions of the province (Ipsos Reid, 2010). The greater resistance towards wind energy in small communities is likely because the majority of wind turbines in Ontario are located in rural areas (CANWEA, 2013). Additionally, living in a rural environment, in comparison to a suburban area, increases the perception and risk of being annoyed by sound from a nearby wind turbine (Pedersen & Persson Waye, 2007). Close ties between local reporters and their community could also influence editorial agendas as cultural, political, and geographical factors shape reporting (Kaniss, 1991; Kitzinger, 1999). Therefore, in the case of wind turbines and health, community newspapers may be more likely to report the issue negatively because of their residents' increased exposure to wind energy developments. In addition, the Green Energy Act removed municipal control over the placement of wind turbines. Therefore, it is likely that community newspapers will not only publish more negative articles about health risks and

wind turbines than provincial and national ones but the number of articles in community newspapers will be greater after the GEA legislation.

Chapter 3: Presence of Fright Factors about Wind Turbines and Health in Ontario Newspapers

The work presented in this chapter has been published as:

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3.1 Introduction

The Government of Ontario, Canada has established goals for reducing greenhouse gas emissions through the Climate Change Action Plan (MOE 2010). Part of this plan involves phasing out coal-fired power plants and supporting renewable energy technologies, such as wind, solar, hydro, biomass, and biogas. The objective of this programme is to double the amount of electricity from renewable sources by 2025, positioning Ontario as one of the top energy producers in North America. By implementing the Green Energy Act in 2009, the province streamlined the approval process for many renewable energy technologies, notably wind energy installations. As a result, the number of wind turbines in Ontario increased from 10 in 2003 to almost 700 currently in place or planned (MOE 2010). The rapid and substantial increase in the number of wind turbines has caused concerns among individuals and community organisations, in part due to potential health effects.

The health impact of wind energy installations has become a widely debated political issue in Canada (Knopper and Ollson 2011, Watson *et al.* 2012) and elsewhere (Pedersen 2011). In 2010, the Ontario Chief Medical Officer of Health concluded that the current scientific literature does not demonstrate a causal link between exposure and direct health effects (CMOH 2010). However, there are anecdotal reports which indicate a possible relationship between

exposure and health effects such as dizziness, headaches, and sleep disturbance (Pierpont 2009, Knopper and Ollson 2011). People living near wind turbines have reported prolonged annoyance and psychosocial stress, which may physically manifest as adverse health effects (Pedersen and Waye 2004). Media triggers, including conflicting opinions, high exposure, and human interest through identification of victims, have made the potential public health risk of wind turbines a newsworthy story (Bennett, 2010).

The public often gathers information relating to health consequences of environmental exposures from news reports, rather than more science-based sources such as healthcare practitioners (Lundgren & McMakin, 2009; Riesch & Spiegelhalter, 2011). However, many newspaper editors consider stories for publication in terms of economic, political, or cultural relevance rather than providing information about public health (Hillier, 2006; McCarthy *et al.*, 2008). Public perceptions of health risk can be influenced by the way the media frames and covers a risk story, especially how and what elements are reported (Rowe *et al.*, 2000). Several factors including message content, tone of delivery, expert sources, and information accuracy influence whether the public attends to, understands, and acts on risk information (McCarthy *et al.*, 2008). A diagnostic checklist of fright factors has helped to explain why some environmental health risks are more likely to trigger alarm, anxiety, or outrage than others, independently of scientific estimates of their seriousness (Bennett, 1999). Media stories that contain a large number of these fright factors provoke a strong public reaction (Bennett, 2010). These fright factors have been shown in newspaper coverage of Human papillomavirus (HPV) vaccination, avian flu, bio solids, and genetically modified crops (Burke, 2004; Goodman and Goodman, 2006; Abdelmutti and Hoffman-Goetz, 2009; Fung *et al.*, 2011).

In the present study we analysed newspaper coverage of the health effects of wind turbines in Ontario newspapers using a published typology of fright factors (Bennett, 1999). Our aim was to provide insights into the public newspaper discourse about health risks from exposure to wind turbines using select Ontario communities. We chose Ontario, Canada as a case study because of recent major policy legislation on alternative energies, including wind turbines, known as the Green Energy Act. We did not evaluate the biological evidence for or against health effects of wind turbines but rather the occurrence of fright factors linked to possible health effects of wind installations.

3.2 Methods

We identified thirty-seven wind turbine installations prior to September 2011 in Ontario using the CANWEA database (CANWEA, 2011). From this list, three large and two small wind energy installations, which began operation between 2006 and 2009, were selected: large installations were Melancton Phase II, Ontario Wind Power Farm, and Prince Wind Farm with 88, 110 and 126 turbines, respectively; small installations were Dunnville Wind Turbine and Proof Line Wind Turbine with one and four turbines, respectively. We selected these turbines because they were geographically discrete, represented a diverse set of communities in Ontario and reflected differing magnitudes of installations throughout the province. Maps identifying the location of each of these wind energy developments can be found on the CANWEA database (http://www.canwea.ca/farms/index_e.php). We generated a list of communities within a 50 km radius of each installation using 2006 Canadian Census subdivisions maps. In addition, large urban centres (Toronto and Hamilton), which were located just beyond the 50 km radius, were included because of their potentially high influence on the public agenda about wind turbines and health. The approximate population of census subdivisions for Melancton Phase II was

2,600,000 (including Toronto), for Ontario Wind Power Farm was 85,000, for Prince Wind Farm was 95,000, for Dunnville Wind Turbine was 750,000 (including Hamilton), and for Proof Line Wind Farm was 460,000. We identified the newspapers distributed in each census subdivision through the Canadian Newspaper Association database (CCNA, 2011). Seventeen newspapers were included, with four considered national/provincial and thirteen considered community based on geographic reach, circulation size, and frequency of publication (Table 1). The four national/provincial newspapers included the *Globe and Mail*, *National Post*, *Toronto Star*, and *Hamilton Spectator*. The *Globe and Mail*, and *National Post* are generally considered to be national newspaper sources because several editions are published across Canada. However, we used only ‘Ontario’ editions for this study. The *Toronto Star* and *Hamilton Spectator* are considered provincial newspapers, with the majority of their readership based in Toronto and Hamilton, respectively, and the remainder spread throughout neighbouring major cities.

Table 2: Summary of newspapers included in study

Newspaper Name	Category	Geographical Distribution (census subdivisions)	Circulation Size (Canadian Newspaper Association annual circulation for 2010)
Globe and Mail	National/Provincial	All	317 781 (daily)
Toronto Star	National/Provincial	All	292 003 (daily)
National Post	National/Provincial	All	158 250 (daily)
Hamilton Spectator	National/Provincial	All	91 716 (daily)
Orangeville Banner	Community	Melancthon, Shelburne, Southgate, Orangeville, Grey Highlands, Amaranth, Mulmur, Caledon	42 508 (twice weekly)
Orangeville Citizen	Community	Melancthon, Shelburne, Southgate, Orangeville, Grey Highlands, Amaranth, Mulmur, Caledon	14 412 (weekly)
Hanover Post	Community	Hanover, Brockton	14 868 (weekly)
Kincardine News	Community	Kincardine	2 838 (weekly)
Lucknow Sentinel	Community	Huron-Kinloss	1 412 (weekly)
Owen Sound Sun Times	Community	Owen Sound	12 505 (daily)
Shoreline Beacon	Community	Arran-Elderslie, Saugeen Shores	3 765 (weekly)
Lakeshore Advance	Community	Lambton Shores, South Huron, North Middlesex	1 254 (weekly)
Sault Star	Community	Prince, Sault Ste. Marie, Rankin 15D, Garden River 14, Elliot Lake, Algoma	13 851 (daily)
Londoner	Community	London	145 200 (weekly)
Sarnia Observer	Community	Sarnia, Plympton-Wyoming	13 029 (daily)
Sarnia and Lambton this Week	Community	Sarnia, Plympton-Wyoming	39 296 (weekly)
St. Catharines Standard	Community	St. Catharines	19 388 (daily)

Newspapers were searched using the LexisNexis database and individual newspaper websites from May 2007 to April 2011 (2 years before to approximately 2 years after the introduction of the Green Energy Act in May 2009). The following search terms alone and in combination were used to identify articles: (wind turbine* OR wind farm* OR wind energy OR wind power OR windmill* OR green energy OR renewable energy OR turbine* OR alternative power) AND (health* OR noise OR vibration* OR stress* OR sleep* OR flicker* OR mood* OR illness* OR mental* OR joint pain). Articles were excluded if they were duplicates, outside of date range, did not contain the terms ‘health’ and ‘wind turbine’ or ‘wind farm’, or contained ‘health’ not related to humans (such as economic health).

We undertook a directed content analysis to develop the coding instrument based on the fright factors that affect the public’s perception of risk (Hsieh & Shannon, 2005). This approach is guided by a structured process in which existing theory is used to identify key concepts or variables as coding categories. We developed operational definitions for each of the fright factors used in this study, and examples of their application to newspaper articles on wind turbines and health can be found in Table 2. We also coded articles by newspaper name, newspaper type (national/provincial, local), article date, article type (article, letter to editor, editorial/column), article main focus (human health, other), and number of references to health. We classified the main focus of an article as ‘human health’ if the article made a reference to health three or more times and as ‘other’ if human health was mentioned fewer than three times in the article. The ‘other’ category included topics such as the economy, politics, and the environment.

Table 3: Diagnostic fright factors and application to wind turbine news media

Fright Factor (Bennett 1999, 2010)	Example of Application to Wind Turbine Media Coverage
Involuntary exposure	Location of wind turbine not under influence of community or nearby residents
Inequitably distributed	Wind turbines present in certain communities and absent in others
Inescapable by taking personal precautions	Unable to avoid vibration/noise/flicker unless physically distant from wind turbine
Cause hidden or irreversible damage	Some effects of low frequency vibration and noise (such as infrasound) cannot be seen or heard
Pose particular danger to small children or pregnant women	Potential effect of wind turbines on learning and behaviour of children, long-term fertility unknown
Arousing dread due to death, illness or injury	Threat of long-term illness unknown. Chronic migraines may increase risk of other health problems
Damage to identifiable victims	Specific cases of residents leaving homes within close proximity to turbine
Poorly understood by science	Lack of studies on health effects relating to wind turbine exposure
Subject to contradictory statements from responsible sources	Municipal governments/councils conflict with provincial governments (such as moratoriums)
Arises from unfamiliar or novel source	Not applicable
Result from man-made sources	Not applicable

One author coded all of the articles. However, to ensure reliability of data extraction, a randomly selected subset of 100 articles was coded by two independent readers, and inter-rater reliability calculated. Cohen's kappa ranged from 0.813 to 1.00, with an average of 0.920, indicating excellent agreement for each variable. The readers/coders resolved discrepancies through discussions which informed the coding process.

We generated descriptive statistics (frequencies, means, and percentages) on the fright factors mentioned in the articles (SPSS v20, SPSS Inc., Chicago, IL) and analysed differences in the frequency of fright factors across newspaper type and relative to the Green Energy Act using chi-square. We used Student's t test to analyse the number of mentions of health in each article by newspaper type and accepted a p value of <0.05 to indicate that differences were not the product of chance.

We used a cluster analysis (SAS v9.2, SAS Institute Inc., Cary, NC) to identify distinct community subgroups based on demographic variables from the 2006 Canadian Census; these variables were population density, population with post-secondary education, house value, and median income, which broadly reflected 'urban' and 'rural' community characteristics. The cluster technique groups communities that share similar socioeconomic and demographic characteristics. Classifying communities into various subgroups allowed us to determine whether the content of newspaper articles on wind turbines and health varied based on characteristics of the readership.

3.3 Findings

Coverage by Newspaper and Region

There were 421 newspaper articles retrieved from 17 newspapers. Of these, 150 articles were from four national/provincial newspapers and 271 articles were from thirteen community newspapers. The number of newspaper articles about wind turbines and health published from each newspaper type increased substantially over time. In the national/provincial newspapers for full years of coverage, the number of articles were 13 in 2008, 52 in 2009, and 40 in 2010 ($X^2=22.8$, $df=2$, $p<0.001$). Also of note is that for the four months of data collection in 2011

(January-April) there were 34 articles on wind turbines and health appearing in the national/provincial newspapers. In the local newspapers, the number of articles on wind turbines and health also increased: 15 in 2008, 90 in 2009, and 107 in 2010 ($X^2=67.83$ $df=2$, $p<0.001$). For the four month period of January-April 2011, there were 49 articles on wind turbines and health in the local newspapers. The increase in newspaper articles over time was greater in community newspapers compared to national/provincial newspapers ($X^2=9.63$, $df=4$, $p<0.05$).

There were differences in news coverage based on wind energy development size. The small wind energy developments included in this study, Dunnville and Proof Line, accounted for 15 % ($n=42$) of the community newspaper coverage collected on wind turbines and health. The large wind energy developments, in contrast, contributed 85 % ($n=229$) of the community newspaper coverage on wind turbines and health.

Prevalence of Fright Factors

The most common fright factors linking wind turbine exposure to human health were ‘dread’, ‘poorly understood by science’, ‘involuntary exposure’, and ‘inequitable distribution’ occurring in 94% ($n=394$), 58% ($n=242$), 45% ($n=188$), and 42% ($n=177$) of articles, respectively. In the following extracts we present illustrative examples of newspaper coverage highlighting the four most prominent fright factors.

Dread:

We identified the fright factor ‘dread’ as a negative, loaded or fear-evoking description of health-related signs, symptoms or adverse effects of wind turbine exposure.

Extract from *Lucknow Sentinel* (community newspaper), May 2009: In a recent interview...all made it clear that the [family's] environments had two changes occur simultaneously in November of 2007 [when the Ripley industrial wind turbine project was installed]. First there was a change in the hydro configuration to their homes enabling electrical pollution to enter via a cross contamination from the wind turbine high voltage collection lines. The second change was the repetitive sound, both low frequency and audible from the blades of the industrial turbines that began rotating close to and above the height of their homes. Since these two changes, all began experiencing sleep deprivation, humming in the head and ears, stress, anxiety, heart palpitations, increased blood pressure, vibrations in the chest, earaches, headaches, an increased sensitivity to noise and sore eyes. It gets worse when the winds increase.

Extract from *Hanover Post* (community newspaper), Jan 2011: Stelling's comments, and a two-page letter he read to council outlining results of studies about adverse health issues resulting from the low frequency noise emitted by the turbines and suggestions that turbines have setbacks from 1 to 4.3 km from any residences, drew loud applause from those in attendance.

Poorly Understood by Science:

We identified the fright factor 'poorly understood by science' as the need for a health study, the unknown effects or outcomes on health, or the implementation of a moratorium until health effects are better studied.

Extract from *Sarnia & Lambton County this Week* (community newspaper), Oct 2008:

The residents, 180 of [whom] signed a petition presented to council, are hoping the municipality will do a health study before making a decision about the project.

Extract from *Lucknow Sentinel* (community newspaper), Feb 2011: ‘We haven’t had the opportunity to do a lot of scientific research around the large-scale, very large-sized turbines that are generally the type most projects are installing,’ Gillespie said.

Involuntary Exposure:

We operationalised the fright factor ‘involuntary exposure’ as a stated or implied statement that wind turbine placement was beyond the control of an individual or municipality, or that the Green Energy Act removed municipal rights over land development:

Extract from *Lakeshore Advance* (community newspaper), Mar 2009: They are just being whipped into place without due diligence, and now our Premier has decided to take out the role of the municipalities. Instead of working with them to solve issues, he is rolling over them.

Extract from *Kincardine News* (community newspaper), Aug 2010: The lakeshore community of Point Clark does not want to see this project move forward, but instead of the company demonstrating why it should be allowed to build, or recommending where the best place would be, the decisions have already been made and the public’s opinion isn’t a factor in determining where the turbines are erected, at all.

Inequitable Distribution:

We determined the fright factor ‘inequitable distribution’ was present if the newspaper article mentioned (directly or indirectly) the risk of health effects from wind turbines increased with proximity or was higher in one group compared to another.

Extract from *Kincardine News* (community newspaper), Aug 2010: In the Ripley area, Lynn said 10%, or about 35 people living within the wind development area, have said they suffer as a result of proximity to the turbines.

Extract from *Lakeshore Advance* (community newspaper), Sept 2010: During a question-and-answer period, McMurtry agreed with one participant's assertion the projects are going up in rural Ontario, because urban residents are supporting the Green Energy Act without understanding its long-term impacts. ‘Make no mistake about it. This is a targeting of rural Ontario.’

The other five fright factors occurred less frequently in the newspaper articles: ‘identifiable victims’ in 19% of articles (n=80), ‘inescapable’ in 15 % (n=64), ‘contradictory statements from reliable sources’ in 9% (n=39), ‘damage to future generations’ in 6% (n=23), and ‘hidden or irreversible damage’ in 3% (n=12). In the following extracts we present illustrative examples newspaper coverage highlighting these less common fright factors linking wind turbines and human health:

Identifiable Victims:

We identified the fright factor ‘identifiable victims’ as occurring in newspaper articles if there was a reference to a named individual who was affected by wind turbines.

Extract from Kincardine News (community newspaper), Apr 2009 ‘I consider myself a green person, but there's controversy on how green (wind turbines) actually are,’ said Norma Schmidt of Bruce Twp. who lives west of Underwood and came to protest because of the perceived health impacts it has had on her and her family. With wind turbines erected around her property, she and her husband Ron have experienced sleeping problems and headaches since the commissioning of the project.

Extract from *Owen Sound Sun Times* (community newspaper), July 2009: ‘We can’t live in our house anymore. We bought a house and moved to Kincardine. My son and daughter-in-law and two-year-old who live on a different farm . . . the wind company is paying for them to stay in Kincardine,’ said Glen Wild, one of a half-dozen speakers at a public information session on the dangers of living too close to wind turbines.

Inescapable:

The fright factor ‘inescapable’ was identified by us if a newspaper article stated that an individual or family was unable to modify their exposure to the health risk or were forced to leave their home.

Extract from the *Londoner* (community newspaper), Dec 2010: As more wind farms are built, more stories are emerging of farmers having to leave their homes because of health issues attributed to wind turbines.

Extract from *Toronto Star* (national/provincial newspaper), Jan 2011: Too many Ontario families have already been made ill and forced to flee from their homes as a result of hastily developed wind energy projects with inadequate setbacks.

Contradictory Statements:

We identified the fright factor ‘contradictory statements’ as occurring in newspaper articles which emphasized that experts (such as medical health officers and government officials) were on opposite sides of the issue.

Extract from *Globe and Mail* (national/provincial newspaper), Jan 2011: To support his client's case in court, Mr. Gillespie will present evidence from three physicians who say turbine noise and vibration can cause high stress, sleep deprivation and headaches among people who live near them. The government argues, in a document filed with the court, that the doctors' conclusions are suspect, and that it reviewed all the literature available on the issue, and held public consultations before creating the guidelines.

Extract from *Toronto Star* (national/provincial newspaper), Jan 2011: Their case was bolstered last May after the provincial medical officer of health, Dr. Arlene King, issued a report saying no scientific evidence exists to show that wind turbines harm human

health. (Dr.) McMurtry countered that this is because no one has ever conducted a proper study - which is why he wants one.

Damage to Future Generations:

Newspaper articles that contained the fright factor ‘damage to future generations’ had statements which identified the health of pregnant women, infants, children, or teenagers as being adversely influenced by wind turbine exposure.

Extract from *Lucknow Sentinel* (community newspaper), May 2009: ‘We have taken three-year-old Keiara to the emergency room 10 times with problems and Dr. McMurtry said my daughter shouldn’t be there (at their home in the Ripley Wind Project). Melissa as well because she is pregnant,’ said Kent Wylde.

Extract from *Toronto Star* (national/provincial newspaper), Apr 2010: They claim the turbines cause low-frequency noise and have sickened 106 Ontario residents, causing a variety of health ailments ranging from hypertension to sleeplessness and nosebleeds in children

Hidden or Irreversible Damage:

We recognized the fright factor ‘hidden or irreversible damage’ as being present in newspaper articles which stated that individuals did not know the source of their symptoms or that exposure to wind turbines may result in lasting health effects.

Extract from *Lucknow Sentinel* (community newspaper), June 2009: Krogh compared the situation to discovering the harmful effects of tobacco adding that there is no long-term investigation into the effects of wind turbines in 10 to 20 years.

Extract from *Kincardine News* (community newspaper), Feb 2011: Remember thalidomide and second-hand smoke, both perceived as acceptable at one time until science proved otherwise. Unfortunately this approach is being taken again with the blind acceptance of wind farms in close proximity to humans.

The fright factors of ‘dread’, ‘poorly understood by science’, ‘inequitable distribution’, and ‘inescapable’ occurred more frequently in community newspapers than in national/provincial ones ($X^2=12.11$, $df=1$, $p<0.001$; $X^2=36.19$, $df=1$, $p<0.001$; $X^2=15.45$, $df=1$, $p<0.001$; $X^2=17.61$, $df=1$, $p<0.001$, respectively). National/provincial and community differences in the occurrence of the four most common fright factors are shown in Figure 3. The remaining, less prevalent fright factors are shown in Figure 4. Article focus (human health vs. other) differed between newspapers, with community newspapers focused more on human health than national/provincial newspapers ($X^2=36.193$, $df=1$, $p<0.001$). There was an average of 5.01 ± 3.9 (SD) mentions of health per article from community newspapers and 2.53 ± 2.4 (SD) mentions per article from national/provincial newspapers ($t= 8.0$, $df=416$, $p<0.001$).

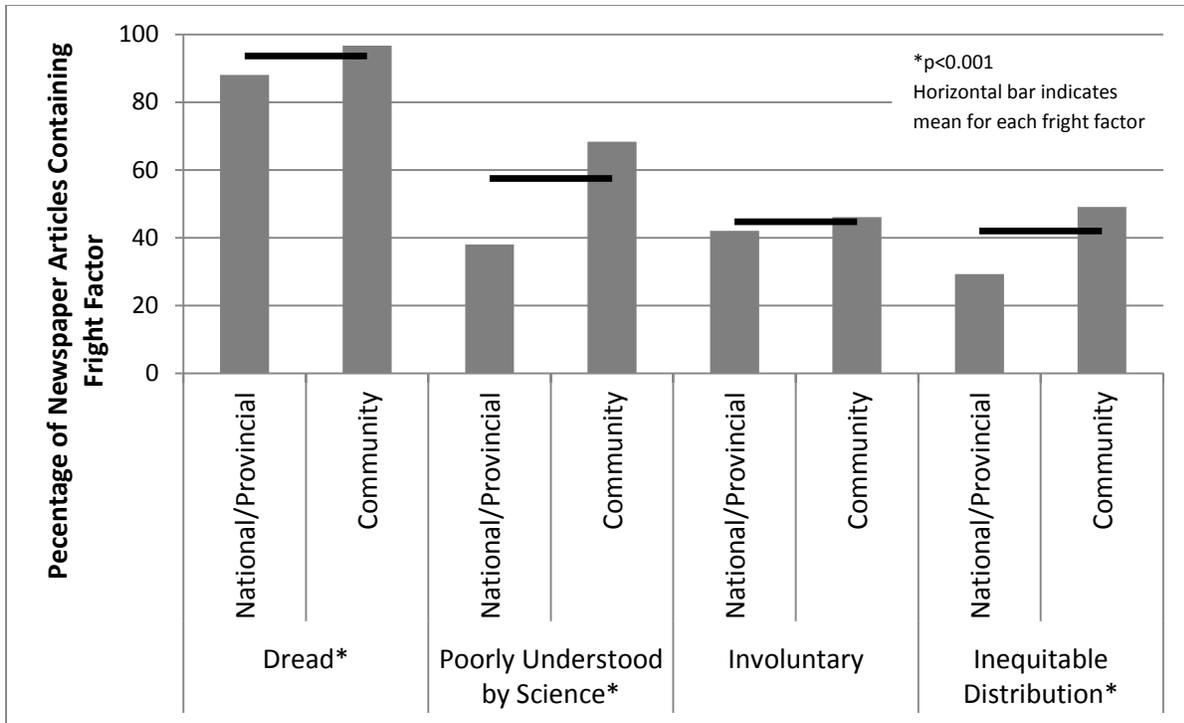


Figure 3: Presence of most commonly mentioned fright factors in Ontario newspaper articles

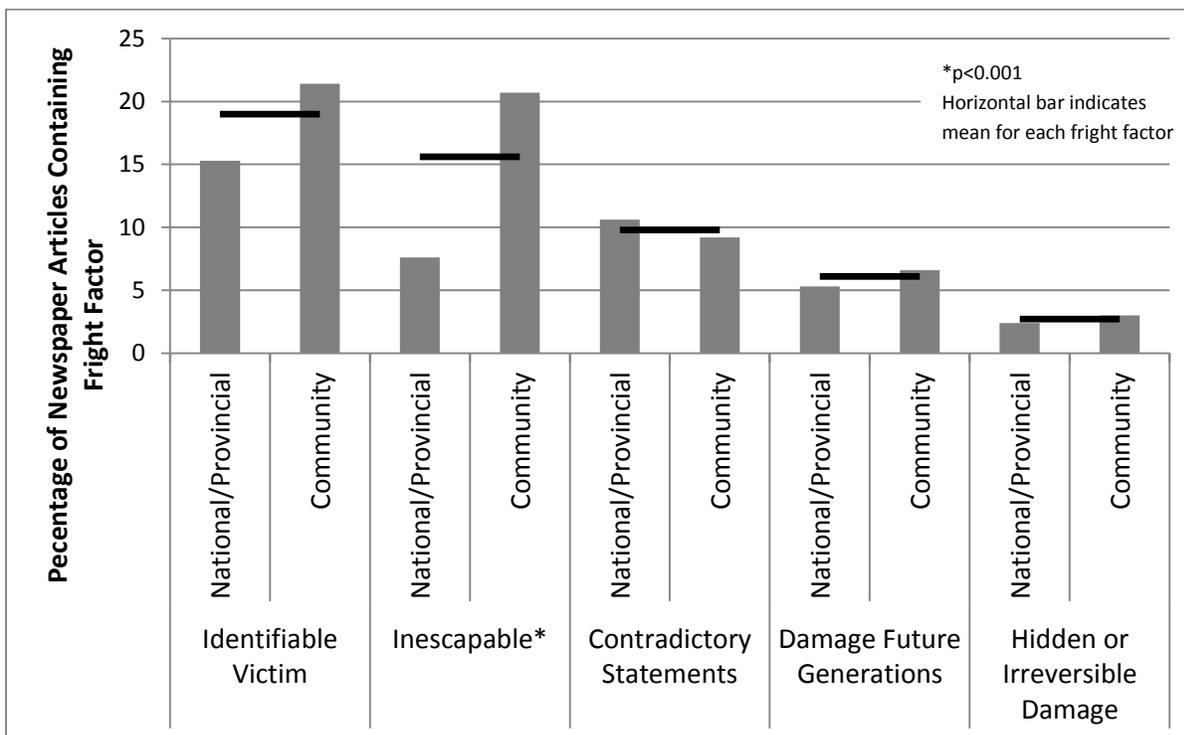


Figure 4: Presence of less commonly mentioned fright factors in Ontario newspaper articles

Influence of the Green Energy Act

The number of occurrences of each fright factor increased after the Green Energy Act, with dread and poorly understood by science increasing significantly ($X^2=4.76$, $df=1$, $p<0.05$ and $X^2=7.66$, $df=1$, $p<0.01$, respectively). The fright factor identifiable victims occurred less often after the Green Energy Act ($X^2=25.35$, $df=1$, $p<0.001$) (Table 4). Both community and national/provincial newspapers were more likely to focus on human health following compared to before the Green Energy Act ($X^2=19.36$, $df=1$, $p<0.001$).

Table 4: Presence of Fright Factors Before vs. After the Green Energy Act in Ontario

Fright Factor	Before Green Energy Act (Total Number of Articles= 99)		Following Green Energy Act (Total Number of Articles=322)		Chi- square	P-value
	Number of Articles With Fright Factor	Percent of Articles With Fright Factor	Number of Articles With Fright Factor	Percent of Articles With Fright Factor		
Arousing Dread	88	88.9	306	95.0	4.759	0.029
Poorly Understood by Science	45	45.5	197	61.2	7.662	0.006
Involuntary Exposure	46	46.5	142	44.1	0.171	0.679
Inequitable Distribution	38	38.4	139	43.2	0.711	0.399
Identifiable Victim	36	36.4	44	13.7	25.348	0.001
Inescapable	14	14.1	50	15.5	0.113	0.737
Contradictory Statements	8	8.1	31	9.6	0.215	0.643
Damage to Future Generations	8	8.1	15	4.7	1.717	0.190
Hidden or Irreversible Damage	2	2.0	10	3.1	0.322	0.570

Cluster Analysis

To explore whether community characteristics influenced the occurrence of fright factors in newspaper articles about wind turbines and health, we conducted a cluster analysis based on demographic census characteristics. Three subgroups were identified: Cluster 1 characteristics included communities with higher population density (>400 persons per square km), education levels above the provincial mean, average house values between \$300,000 and \$400,000 and a

median income of \$61,000; examples of communities in Cluster 1 included Toronto, Hamilton, Sarnia, Orangeville and Kincardine. Cluster 2 included communities with a lower population density (<400 people per square km), education levels below the provincial average, average house values between \$100,000 and \$200,000 and a median income of \$30,000. Examples of communities in Cluster 2 included Hanover, Owen Sound, Arran-Elderslie, Elliot Lake, and Algoma. Together, these two clusters accounted for almost 60% of the variation in demographic characteristics of census subdivisions. A third cluster capturing four communities did not have a distinct census profile, explained only 20% of the variation in demographic characteristics, and was excluded from further analysis. Within the two clusters, we identified the community newspaper with the largest number of articles compared these for type and prevalence of fright factors. The representative community newspaper for Cluster 1 was the Kincardine News (n=53), and the representative community newspaper for Cluster 2 was the Owen Sound Sun Times (n=72).

None of the fright factors occurred significantly more often in the representative community newspapers as a function of the community cluster characteristics. However, ‘involuntary exposure’ was mentioned more often in articles from Cluster 2 (n=34) compared with Cluster 1 (n=16) ($X^2=3.69$, $df=1$, $p=0.055$). With respect to timing relative to the Green Energy Act, newspaper articles from Cluster 2 had a significantly greater number of occurrences of the fright factor ‘involuntary exposure’ after vs. before the Green Energy Act (n=30 vs. n=4) ($X^2=5.26$, $df=1$, $p<0.05$). In the following extracts we present illustrative examples newspaper coverage highlighting ‘involuntary exposure’ in Cluster 2 both before and after the Green Energy Act:

Before the Green Energy Act:

Extract from *Owen Sound Sun Times*, Mar 2009: The primary issues of concern for Grey Highlands are that the act will remove local planning control over renewable energy projects as well as concerns over health issues and loss of property values.

Extract from *Owen Sound Sun Times*, Apr 2009: Protesters questioned how much wind generation is actually reducing greenhouse gas emissions and raised concerns about the visual impact on the landscape and the loss of local control over projects if the provincial Green Energy Act is made law.

After the Green Energy Act:

Extract from *the Owen Sound Sun Times*, Oct 2009: Municipalities with projects in their areas know, firsthand, how much trouble they are. When they tried to stop existing projects from expanding, they were taken to the Ontario Municipal Board where they were told they had to allow turbines because the provincial government said so.

Extract from *Owen Sound Sun Times*, Mar 2011: The minister addressed concerns raised by critics of the government's renewable energy policies contained in the Green Energy and Green Economy Act which takes away planning approval powers by local and county councils and replaces it with a poorly-defined consultation process.

3.4 Discussion

A content analysis of newspaper media is a convenient, low-cost, and non-intrusive technique used to build understanding of how the public interprets health risk when risk perception surveys are not available (Driedger, 2007; Mistry & Driedger, 2012). In the study on which this article is based, we used systematic counting and recording to produce a quantitative description of fright factor content on wind turbines and health in Ontario newspaper articles relative to a major policy initiative. To our knowledge, no previous media analysis has documented the issue of wind turbines and health. These results study may help to fill gaps in the literature regarding newspaper media framing of wind energy and health.

Of the fright factors associated with environmental risks and human health (Bennett, 1999), we found the most commonly reported were ‘dread’, ‘poorly understood by science’, ‘involuntary exposure’, and ‘inequitable distribution’. The high number of citations for ‘dread’ and ‘poorly understood by science’ which we identified is consistent with the literature on perceived risk associated with other technologies - electromagnetic (EMF) fields, power lines, cell phone radiofrequencies and cell phone base towers (Slovic, 2000; Frick *et al.*, 2002; Cousin & Siegrist, 2011; Khiefets *et al.*, 2010). The rapid rate of change in many technological sectors has made it difficult to characterise and study exposures prospectively, resulting in a knowledge deficit in both scientific and lay communities (Slovic, 1987). The combination of dread and unknown consequences, when associated with technology, may lead to greater risk perceptions and result in stigmatisation and avoidance (Finucane *et al.* 2000). This effect may be exaggerated when coupled with frequent and dramatic news media coverage.

Local conditions, and their consequences, are experienced more directly by local media than national media (Viswanath *et al.* 2008). Therefore, our finding that both fright factors of

‘dread’ and ‘poorly understood by science’ were identified more frequently in community compared with national/provincial newspaper articles is not surprising. The audience for community newspapers generally have closer ties with local reporters, and expect information that affects their daily quality of life (Kaniss, 1991). Subscribers to community newspapers are more likely to be local residents who live in a closer proximity to wind turbines. Thus, there may be an association between how often the fright factors ‘dread’ and ‘poorly understood by science’ were mentioned in the articles and the physical proximity of community residents to the actual wind energy installations; these fright factors were increasingly likely to occur in newspaper articles when the risk of exposure to wind turbines was greater. This potential relationship between locality of wind turbines, resident responses, and public media discourse is an area for future research.

The fright factors of ‘involuntary exposure’ and ‘inequitable distribution’ were present in about half of the articles, with community newspapers emphasising inequitable distribution more often than national/provincial newspapers. This finding may reflect wind turbine locations in rural areas where community newspapers feature prominently. National/provincial newspapers, in contrast, are generally published in cities more distant from wind energy installations. Therefore, residents of rural areas might have a higher exposure than urban populations to the potential health risk of wind turbines. This represents an inequitable distribution of risk and may enhance and reinforce perceived risk among Ontario residents located near wind energy developments. Whether the perception of inequitable risk by local residents parallels the occurrence of this fright factor in the community newspaper reports remains to be determined.

A major function of the Green Energy Act was to streamline the approval process for wind energy installations in Ontario. This removed the ability of municipal governments to

control the location of renewable energy sources in their communities. We expected to see an increase in the reporting of the fright factors ‘involuntary exposure’ and ‘inequitable distribution’. However, only ‘dread’ and ‘poorly understood by science’ were reported more often after the Green Energy Act. Although our data do not indicate why the newspaper reporting of the fright factor ‘poorly understood by science’ increased after the Green Energy Act, this may reflect public dissatisfaction with the level of scientific evidence regarding wind turbines and potential health effects. Of note is that public calls for scientific study have been successful in altering behaviours towards other environmental and technological health risks, such as cell phones on airplanes, pesticides in schools, and polyvinyl chloride children’s toys (Kriebel *et al.*, 2001). We also found a decreased prevalence in newspaper articles of the fright factor ‘identifiable victims’ following the Green Energy Act. The drop in the occurrence of this fright factor may be due to a greater collective voice and mobilisation of community groups, rather than concerns expressed by individuals. For example, the largest wind turbine opposition group in Ontario was established in late 2008, and has since grown to about 60 grassroots organisations (WCO, 2011).

We used cluster analysis to study geographic variations in public health (Pedigo *et al.*, 2011). Our intention was to contrast the prevalence of fright factors in newspaper articles in different communities. Following the Green Energy Act and extrapolating from a representative newspaper in each cluster with the greatest number of articles, Cluster 2 (‘rural communities’) had more articles linked to the fright factor of ‘involuntary exposure’ than did Cluster 1 (‘urban communities’). The excerpts from the representative Cluster 2 newspaper showed that ‘involuntary exposure’ almost exclusively refers to the loss of municipal control over the placement of wind energy developments after the implementation of the Green Energy Act.

Residents of rural communities may also feel disproportionately affected by legislation that removes municipal control, leading to feelings of powerlessness and a decreased ability to regain this control compared to urban communities.

The significant increase in news articles on wind turbines and potential health effects over time suggests that this topic is newsworthy. An increase in news coverage of an issue can result in audience negativism independent of the nature of the risk itself, and repeated public reactions to media can itself induce health consequences (Mazur & Lee, 1993; Young et al., 2008). This is especially true of public exposure to new health information, which has been shown to increase health concerns for up to two weeks after the receipt of the information (Cousin & Siegrist, 2011). Alternatively, an increase in newspaper coverage of an issue can lead to positive health behaviours, such as reporting on the H1N1 outbreak and increased demand for diagnostic testing (Olowokure et al., 2012). The increased frequency of newspaper coverage that focuses on human health reflects not only greater public discourse about health effects of wind turbines but a growing influence of the media in this debate.

The study on which this article is based had limitations. Our results and conclusions were restricted to a select number of Ontario newspapers, a handful of wind energy installations in the province, and did not reflect risk information presented in other important media outlets such as television or the internet. Newspaper articles were also retrieved through an online database, and manually searching newspaper websites and archives, which could potentially have biased their collection. The search string used to collect articles from the online database included terms such as illness and stress, which may have biased our results to over represent negative news articles. However, the inclusion of these terms was necessary to capture the complete public discourse on health effects of wind turbines for the time period studied. A potential bias in this study is that

more than half of the newspapers were owned by a single publisher. Although there is a variety of evidence to suggest that collective media ownership does not result in concentration of media content (Soroka, 2002), there was still the possibility that newspaper coverage might reflect specific editorial agendas and selection bias rather than community concerns. We excluded duplicate articles from our analysis, which eliminated the potential syndication of stories across newspapers from the same publisher. Moreover, although each newspaper included in the study was publically available, they were generally sold individually or by subscription. Only those residents with the financial ability to purchase newspapers would have consistent exposure to fright factors embedded within news articles. We also recognize that there is the potential to miss relevant themes in the public discourse about wind turbines and health in Ontario because of the closed coding methods used. Although outside of the scope of this study, a qualitative analysis of these newspaper articles may identify several important emergent themes and contribute to building theory for future risk perception research. For example, the theme of political lobbying may be identified in a preliminary reading of the text, and further examined to reveal subthemes (Crabtree & Miller, 1999).

3.6 Conclusion

Ontario newspaper articles on wind turbines and health contained a large number of fright factors, especially ‘dread’ and ‘poorly understood by science’, which both increased in frequency after the introduction of a major policy initiative, and occurred more often in community relative to national/provincial newspapers. The information presented in mass media can affect public opinion related to wind turbines and influence the acceptance or resistance to renewable energy technology programmes in Ontario and potentially elsewhere (Dearing & Rogers, 1996). Newspapers reporting of health concerns have widespread influence on the

uptake of health campaigns, such as the HPV vaccination programme (Abdelmutti & Hoffman-Goetz, 2009) and on consumer behaviours, such as purchasing genetically modified foods (Frewer et al., 2002). Findings from this content analysis represent a first step in documenting possible effects of newspaper reporting on the issue of wind turbines and health effects on individual, social, or cultural norms (Riffe et al., 1998). Similar quantitative content analyses have contributed to understanding the public discourse about health risks in Canadian newspapers (Holton et al., 2012; Rachul et al., 2011). We suggest that other methodological approaches (for example surveys or interviews) will be necessary to make inferences and predications about the effects of exposure to fright factors in the media on public perceptions on health risks from wind turbines.

Chapter 4: Readability of Health Information on Wind Turbines in Ontario Newspapers

The work presented in the remainder of this chapter has been accepted for publication as:

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4.1 Introduction

Newspapers are often an initial source of health information for the general public, particularly among health-conscious individuals (Dutta-Bergman, 2004; Meischke et al., 2002), and play an important role in the dissemination, translation, and interpretation of public health information into understandable terms (Viswanath et al., 2008; Salmon & Atkin, 2003). Although the reading difficulty of printed health information does not always account for a reader's knowledge, motivation, or comprehension (Bailin & Grafstein, 2001), it represents an important marker for health professionals because of close connections with health literacy (Friedman & Hoffman-Goetz, 2006; Peerson & Saunders, 2009). In fact, recent literature suggests a direct relationship between health literacy and the comprehension of written health information (Needham et al., 2010). Health literacy, described by Nutbeam (1998) and adopted by the World Health Organization (WHO, 1998), is defined as:

“...the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health...By improving people’s access to health information and their capacity to use it effectively, health literacy is critical to empowerment.” (Nutbeam, 1998, p. 357)

A fundamental requirement for health literacy is the understanding of basic health information; this in turn depends on functional literacy skills. Functional literacy is the ability of an individual to read, understand, and make decisions in response to factual information about health, or indeed, about any topic (Nutbeam, 2000). An individual who has low functional literacy will likely have low health literacy as well. Low literacy has been associated with direct effects on health and well-being including difficulty finding and understanding health information, having a greater number of health problems, making more mistakes with medication use, and having a greater number of workplace accidents; indirect effects on health have also been observed such as being under- or unemployed, feeling of stress and vulnerability, and engaging in unhealthy or risk-taking behaviours (Rootman & Ronson, 2003).

Matching the difficulty of the health information that individuals read with their specific functional literacy levels empowers them to self-manage their health by making informed decisions. Although the mass media can promote awareness of health information by the public, newspapers often frame stories according to economic, political, or cultural relevance instead of public health (McCarthy et al. 2008). Additionally, the reading

complexity of newspaper articles is typically much higher than the average literacy level of the population (Hoffman-Goetz & Friedman, 2005). For example, Baker, Kars, & Wilson (1997) have shown that the average readability score of articles in U.S. newspapers containing medical information is at a grade 14 level, whereas the average prose literacy (ability to read and understand text) score for Americans is estimated to be between the 8th and 9th grade (Winslow & Jacobsen, 1998).

A large body of research in the field of literacy and health outcomes confirms that the level of comprehension and understanding of health information is closely linked with morbidity and mortality (Wolf et al., 2010). The association between literacy and physical functioning is thought to be continuous, graded, and dose-dependent: an incremental increase in reading fluency (or prose literacy) leads to a progressively better understanding of how to stay healthy, better use of the healthcare system, and greater ability to follow medication or rehabilitation instructions (Wolf et al., 2010). However, information with high readability is more difficult to understand, and poor comprehension of health information can have negative effects on well-being (Bernhardt & Cameron, 2003; Rudd, Rosenfeld, & Simonds, 2012). In a clinical setting, low (health) literacy can result in a patient being less likely to seek preventive care, understand discharge or medication instructions, attend follow-up appointments, or manage chronic diseases such as diabetes, heart disease and stroke (Smith & Haggerty, 2003; Adams et al., 2009). In an environmental setting, low functional literacy may be associated with the inability of an individual to appropriately assess the risk of certain exposures which contribute to disease development (LeProvost, Blanchard, & Cope, 2012). For example, the inability to understand written or graphic information on pesticide product labels can result in certain

farming populations being exposed to dangerous environmental toxins (Waichman, Eve, & Nina, 2007). Another example is the increased risk of exposure to mercury and polychlorinated biphenyls (PCBs) from over-consumption of fish in some immigrant populations which is, in part, due to inadequate comprehension of health awareness materials and health warning labels (Ratnapradipa et al., 2010). Health information campaigns are most successful in decreasing morbidity and mortality when they consider the functional literacy levels of the target population during program development.

The public is often exposed to emerging science and new technology issues through the mass print media, including newspapers (Scheufele & Lewenstein, 2005). Consequently, information presented through newspaper coverage can have a strong influence on how people develop opinions and attitudes about emerging technologies (Scheufele & Lewenstein, 2005). Emotional responses, such as fear and anxiety towards new technology, can result from improper education (Amin et al., 2011) or from emphasis on fright factors in the newspaper presentation of the issue (Deignan, Harvey & Hoffman-Goetz, 2013). For example, the misunderstanding of some early information about bio and nanotechnology by the public led to stigmatization and amplification of public concern (Pidgeon, Harthorn, & Satterfield, 2011). Literacy of the population is a factor that can affect risk communication and must be taken into consideration when formulating effective communication strategies (Hartigan-Go, 2012). Therefore, from a practical public health orientation, it is important to study the content and the complexity of newspaper media messages, how they may influence people's acceptance and perception of science and technology, and the implications for health.

Globally, the response to climate change has positioned wind power as an increasingly important energy source (European Wind Energy Association, 2012; Global Wind Energy Council, 2012). In Canada, energy production by wind is expanding faster than energy production by other sources, with a 21 % increase in capacity for 2010 (NEB, 2011). The Ontario government in 2009 introduced major legislation to encourage the development of renewable energy technologies (solar, biofuel, wind) known as the Green Energy Act (GEA). The GEA simplified the approval process for wind energy developers, resulting in a dramatic increase in the number of wind turbines in Ontario (MOE, 2010). The increase in wind energy production has, however, been controversial both in Canada (Knopper & Ollson, 2011; Watson, Betts, & Rapaport, 2012) and worldwide (Pedersen, 2011). Opponents to wind energy cite issues such as visual and environmental impacts, as well as possible health effects (such as migraines and sleep disturbances) as barriers to future development of wind energy (Knopper & Ollson, 2011). Numerous characteristics, including controversy, conflict, a human angle, and the potential for public impact make the issue of wind turbines and potential health effects newsworthy (Finnegan & Viswanath, 2002; Viswanath et al. 2008).

In this research chapter, we present original findings on the readability of health information related to green energy technologies in a sample of national, provincial, and community newspapers published in Ontario, Canada. Newspapers were selected to sample health risk messages relating to wind turbines because of high readership levels. It has been estimated that on a weekly basis about 73 % of Ontarians over the age of 18 read a printed edition of a daily newspaper and 83 % read their community newspaper (Canadian Community Newspaper Database, 2010; Newspaper Audience Databank, 2011). The

selection of wind turbines as a case study was due to the extensive public discourse regarding potential health effects. We focused on Ontario because it is the most populous province in Canada and is a geographical jurisdiction where recent government policy (the Green Energy Act) has allowed fast-tracking of new wind installations. We hypothesized that articles in community newspapers would be written at a lower reading grade level (RGL) than those in provincial and national newspapers based on reported education gaps between urban and rural Canadian communities (Alasio, 2003). Previous studies also indicated that national newspapers are written at a higher RGL than community newspapers (Meyer, 2009).

4.2 Methods

Using the Canadian Wind Energy Association (2011) database, three large and two small wind energy installations in the province of Ontario were selected from a list of thirty-seven that were built prior to September 2011. Each site began operation between 2006 and 2009, was geographically discrete, and reflected differing magnitudes of wind energy generation throughout the province (Table 5).

Table 5: Wind energy developments included in the study

Name	Location	Number of Wind Turbines	Energy Capacity (MW)	Year Completed
Prince Wind Farm	Sault Ste. Marie, ON	126	189.00	2006
Ontario Wind Power Wind Farm	Kincardine, ON	110	181.50	2009
Melancthon Phase II	Melancthon Township, ON	88	132.00	2008
Proof Line Wind Farm	Lambton Shores, ON	4	6.60	2009
Dunnville Wind Turbine	Dunnville, ON	1	0.65	2006

*Statistics and location of each wind energy development retrieved from CANWEA (2011)

A list of communities within a 50 km radius of each installation was compiled using 2006 Canadian Census subdivisions maps. Newspapers distributed within each census subdivision were identified using the Canadian Community Newspaper Association Database (2009). Seventeen newspapers were included with two classified as national (available across Canada), two provincial (available only in Ontario), and thirteen community (available only within the community catchment area), based on geographic reach, circulation size, and frequency of publication (Table 6). The *Globe and Mail* and *National Post* were considered national newspapers because several editions are published across Canada. Although only the “Ontario” editions of these national newspapers were collected for this study, they were classified separately because their larger scope and

available resources compared to provincial and local newspapers may result in content differences (Caburnay et al., 2003). The *Toronto Star* and *Hamilton Spectator* are considered provincial newspapers, as the majority of their readership is based in greater Toronto and Hamilton, two of the largest urban centres in Ontario, with populations of 5 113 149 and 692 911, respectively, using 2006 Canadian census data. Newspapers such as the *Owen Sound Sun Times*, and the *Kincardine News*, were classified as community newspapers because their readership is predominantly local, their catchment area is limited geographically, they are published less frequently (weekly or biweekly) compared with national or provincial newspapers, and have a total circulation size considerably smaller than national or provincial newspapers.

Table 6: Newspapers included in study

Newspaper Name	Category	Geographical Distribution (census subdivisions)	Circulation Size*
<i>Globe and Mail</i>	National	All	317 781
<i>National Post</i>	National	All	158 250
<i>Toronto Star</i>	Provincial	All	292 003
<i>Hamilton Spectator</i>	Provincial	All	91 716
<i>Orangeville Banner</i>	Community	Melancthon, Shelburne, Southgate, Orangeville, Grey Highlands, Amaranth, Mulmur, Caledon	42 508
<i>Orangeville Citizen</i>	Community	Melancthon, Shelburne, Southgate, Orangeville, Grey Highlands, Amaranth, Mulmur, Caledon	14 412
<i>Hanover Post</i>	Community	Hanover, Brockton	14 868
<i>Kincardine News</i>	Community	Kincardine	2 838
<i>Lucknow Sentinel</i>	Community	Huron-Kinloss	1 412
<i>Owen Sound Sun Times</i>	Community	Owen Sound	12 505
<i>Shoreline Beacon</i>	Community	Arran-Elderslie, Saugeen Shores	3 765
<i>Lakeshore Advance</i>	Community	Lambton Shores, South Huron, North Middlesex	1 254
<i>Sault Star</i>	Community	Prince, Sault Ste. Marie, Rankin 15D, Garden River 14, Elliot Lake, Algoma	13 851
<i>Londoner</i>	Community	London	145 200
<i>Sarnia Observer</i>	Community	Sarnia, Plympton-Wyoming	13 029
<i>Sarnia and Lambton this Week</i>	Community	Sarnia, Plympton-Wyoming	39 296
<i>St. Catharines Standard</i>	Community	St. Catharines	19 388

* Annual circulation size for 2010 (Canadian Newspaper Association).

Newspapers were searched using the LexisNexis database and individual newspaper websites from May 2007 to April 2011 (2 years before to approximately 2 years after introduction of the Green Energy Act in May 2009). The search string included terms to describe wind energy developments (*wind turbines, wind farms, wind energy, wind power, windmill*). Search terms related to common complaints of health problems due to wind turbine exposure were also included (*health, noise, vibration, stress, sleep disturbance, illness*) and linked to wind energy terms with Boolean operators. Articles were excluded if they were duplicates, outside the date range, did not contain the terms “health” relating to wind turbines or only contained the term “health” when not related to humans (e.g., financial health).

Readability of newspaper articles was assessed using the “Simple Measure of Gobbledygook” (SMOG) formula, based on the criterion of 100% text comprehension, which uses an approximate number of polysyllabic words per sentence to indicate semantic difficulty (McLaughlin, 1969). The formula we used for the SMOG calculation is shown in Figure 5. The SMOG formula is a widely accepted measure of text readability. It is commonly used in the health risk communication literature because of its accuracy, simplicity, short length of time needed for administration, and easy availability with online calculators (Abdelmutti & Hoffman-Goetz, 2009; Meade & Smith, 1991).

$$\text{Reading Grade Level} = \sqrt{PSW} + 3$$

Where PSW refers to the number of polysyllabic words counted in 30 total sentences; 10 sentences from each of the beginning, middle, and end of a newspaper article. When the number of sentences in an article was below 30, the total number of polysyllabic words was counted and divided by the total number of sentences. This number was then multiplied by 30 to give the approximate number of polysyllabic words had the article been 30 sentences in length (McLaughlin, 1969; NCI, 2001).

Figure 5: SMOG Readability Formula

SMOG analysis provides an estimate of the attained education level or school grade at which an individual would be expected to fully comprehend the text, known as a reading grade level (RGL) (McLaughlin, 1969). A RGL of 8.9 or lower indicates primary school education is necessary for comprehension, a RGL of 9.0-12.9 indicates a secondary (high) school education is required, a RGL of 13.0–16.9 indicates a post-secondary (university/college) education is required, and RGL of 17.0 or above indicates a graduate education level or higher professional qualification is needed for full text comprehension.

One author calculated a SMOG readability score for all newspaper articles. To ensure reliability of the results, a second author independently calculated SMOG RGL for a

random sample of 20 % of the articles. The inter-rater reliability for the SMOG readability scores was very high (Cronbach's alpha = 0.982).

Articles were coded for newspaper name, newspaper type (national, provincial, or community), article date, and article type (news article, letter to the editor, or editorial). All articles were coded using NVivo 9 (QSR International Pty Ltd., Melbourne, Australia). Descriptive statistics, analysis of variance, Tukey's post hoc tests, and chi-square analyses were conducted using SPSS (SPSS v20, SPSS Inc., Chicago, IL). Values presented are means \pm 1 SEM unless otherwise noted. A p value of <0.05 was accepted as being significantly different from chance alone.

4.3 Results

A total of 421 newspaper articles were collected from 17 newspapers. The number of articles on wind turbines and health for community, provincial, and national newspapers was 271, 83, and 67, respectively. The number of wind turbines and health articles appearing in each newspaper type depended on the year in which they were published ($X^2=24.8$, $df=8$, $p<0.01$). Closer examination revealed that the number of articles increased with each subsequent full year of collection (from 28 articles in 2008 to 147 articles in 2010).

There was a statistically significant difference between the type of newspaper (national, provincial, community) and the SMOG reading grade level (RGL) ($F(2,418)=4.09$, $p<0.05$). Articles published in national newspapers were written at a higher average RGL of 13.9 ± 0.2 compared to articles in community and provincial newspapers. The average reading grade levels of community and provincial newspaper articles were

almost one grade lower at 13.2 ± 0.2 and 13.1 ± 0.2 , respectively. Table 7 contains representative quotes from articles that demonstrate the variety of RGLs for each newspaper type.

Table 7: Examples of sentences from articles reflecting different RGL by newspaper type

Type of Newspaper	Representative Excerpts From Newspaper Articles Written at Different Reading Grade Levels	Reading Grade Level by SMOG of the Full Newspaper Article
Community	“To the people of this province reading this, please do your research. Please stand up for your rights.” (Lakeshore Advance, 2009)	8.2
	“Do I like wind turbines? Yep. Do I want them everywhere? Nope.” (Shoreline Beacon, 2011)	8.5
	“On confidentiality, Mr. Granger likened the process to pre-trial conferences for criminal cases, held routinely in judges’ Chambers, or to preliminary hearings in which publication of evidence is usually prohibited.” (Orangeville Citizen, 2007)	13.9
	“Van Geel left a two-inch binder with council, filled with information ‘to give a positive perspective’ and asked if he could be appointed as a member on the recently created municipal wind energy committee, which involves representatives from Arran-Elderslie and about eight of its neighbouring municipalities.” (Owen Sound Sun Times, 2010)	14.2
	“Dedicate resources to the necessary scientific research to consider the impact of low frequency noise; electrical and electromagnetic disturbances in areas of industrial wind turbines with the intent to confirm/deny public health implications; and technology and infrastructure being used.” (Kincardine News, 2011)	18.1
Provincial	“Wind farms are not green, they are not good for the environment. If they were, they would be out in the lake.” (Hamilton Spectator, 2011)	8.9
	“No original research was conducted. But based on review of the literature a clean bill of health has been awarded.” (Toronto Star, 2009)	10.5
	“Wind turbines have been used for decades to generate electricity without any serious health	13.2

	implications so Ontario won't postpone or delay new projects, said McGuinty." (Hamilton Spectator, 2010)	
	"They claim the turbines cause low-frequency noise and have sickened 106 Ontario residents, causing a variety of health ailments ranging from hypertension to sleeplessness and nosebleeds in children." (Toronto Star, 2010)	13.8
	"That you can build a 900 megawatt plant, which burns thousands of cubic meters per minute of flammable gas close to schools and people's homes, and emits carbon dioxide, particular matter, and acid gases, all of which have known environmental and health impacts, in a location where you would not be allowed to build a solitary 1 megawatt wind turbine is absurd." (Toronto Star, 2009)	18.0
National	"People across the country are fiercely divided over wind power. They like the idea of it, so long as it is somewhere else." (Globe & Mail, 2009)	9.6
	"So who is telling the truth? The company trying to sell wind turbines? Or the woman who had to leave her home?" (National Post, 2008)	10.3
	"And while Canada obfuscates, China and the rest of the world build. By the end of 2008, China's wind turbines will exceed the capacity of Ontario's fossil-fuelled power stations." (National Post, 2008)	13.6
	"Ontario's Environment Ministry correctly followed the process outlined in the environmental bill of rights, and conducted sufficient consultation before coming up with its regulations, the ruling said." (Globe & Mail, 2011)	14.0
	"Until multiple, carefully controlled experimental studies are completed that accommodate individual differences in sensitivities and their synergistic effects with these amplitude fluctuations in sound pressure, the statement they are 'not harmful' is premature." (National Post, 2009)	19.1

Note: The sentences provided are for illustration of range of article - text complexity, and the Reading Grade Level presented is for the article from which the excerpt was found.

There was a significant difference in text readability depending on article type and authorship. Post hoc comparisons indicated that the mean reading grade level for news articles (13.5 ± 0.1) was significantly higher than for editorials (12.7 ± 0.2) ($F(1, 419) = 5.02$, $p < 0.01$) but not significantly different from letters to the editor (13.2 ± 0.2). However, when editorials and letters to the editor were collectively evaluated as opinion pieces, they had an average RGL of 13.0 ± 0.2 which differed significantly from news articles ($F(1, 419) = 7.61$, $p < 0.01$). The RGL of letters to the editor, regardless of newspaper type, varied by authorship, with letters authored by residents written at a lower average RGL (12.8 ± 0.2) than those authored by non-residents, such as political figures and expert authorities ($RGL = 14.3 \pm 0.5$) ($F(1, 86) = 5.74$, $p < 0.01$).

4.4 Discussion

4.4.1 (Health) Literacy in Canada

The findings from this study outlines a potential gap between the text readability levels of health information about wind turbines presented in Ontario newspapers and the literacy level of the population. The 1994 International Adult Literacy Skills (IALS) Survey identified that four out of ten adult Canadians between the ages of 16-65 years had a reading ability (prose competency) below 3 on a 5 level literacy scale and that nearly 3.1 million adult Canadians were at the lowest proficiency level of 1 (Corbeil, 2006). Therefore, a significant percentage of adult Canadians have serious difficulties reading and understanding all but the simplest printed materials. Additionally, the Adult Literacy and Life Skills (ALLS) survey, conducted in 2003, concluded that more than half (55%) of working age Canadians (aged 16-65) had inadequate levels of health literacy (below level 3), which can make it challenging for them to participate fully in society and puts them at

risk of negative social and health outcomes (CCL, 2007). Taken together, the findings from the IALS and the ALLS surveys suggest that not only do some Canadians have inadequate literacy skills to function in a knowledge-based economy, but that an even higher proportion of Canadians have low health literacy skill. Health literacy involves the simultaneous use of a range of literacy competencies and individuals who are weak in any of the prose, numeracy, or document literacy domains may struggle with interpreting health information (Rootman & Gordon-El-Bihbety, 2008). Lower levels of health literacy put individuals at an increased likelihood of negative social outcomes such as being on income support, and not participating in community activities or volunteering (CCL, 2008). Inadequate health literacy has also been linked with negative health outcomes such as arthritis, alcohol use, high blood pressure, injuries, stress, asthma, and diabetes (CCL, 2008). Although there are multiple and interacting factors which lead to poor health outcomes, the discrepancy between the written difficulty of mass media messages and health decisions that people make based on those messages is another potential contributory factor.

4.4.2 Complexity of Newspaper Articles on Wind Turbines and Health

For most people to read and understand health information it should be written at a RGL of 8 or lower (Doak, Doak, & Root, 1996; Williams, Baker, Parker, & Nurss, 1998). For example, the Canadian Council on Learning (2008) suggests that industry and governments can use plain-language principles and various text formats (e.g., large print) when communicating health issues and health information to the public. With an average RGL of 13.3 (range: 8.2-19.1), the newspaper articles in this sample would present readability difficulties for many people. Moreover, we found that articles from community

and provincial papers were written at post-high school text readability levels of 13.2 and 13.1, respectively. Although articles from community and provincial newspapers were slightly easier to read than national ones (RGL of 13.9), articles across all newspaper types pose challenges for understanding. The finding that Ontario newspapers typically present health information at a reading difficulty that is quite high for the majority of the adult population to understand is consistent with other studies conducted in North America (Hoffman-Goetz & Friedman, 2005; Baker, Kars, & Wilson, 1997). Amplifying the difference between the literacy level of the population and the reading difficulty of newspaper material is the fact that Ontario ranks lower than the Canadian average for both overall literacy and health literacy (CCL, 2007). Given that almost three-quarters of the adult population of Ontario read newspapers on a daily basis for news (including health) content (Canadian Community Newspaper Database, 2011), the impact of information written at high RGL is potentially large. Low literacy levels, coupled with health information written at a higher reading grade level (RGL), are associated with lower levels of health knowledge (Williams et al. 1998; Edwards *et al.*, 2001). As a result, the discordance between the high prevalence of low literacy levels among Ontarians and the high readability levels of health information related to wind turbines in this case study indicates a potential challenge for health communicators. If drawing on content from newspaper articles alone, the average Ontarian may not be able to understand health issues well enough to make informed behavioural changes to self-manage their health. In the case of wind turbines and their potential health effects, misunderstanding or the misinterpretation of health information could have a host of implications such as not

understanding proper (safe) setback distances, not participating in community wind energy development planning committees, and an amplified perceived risk of health implications.

Another important finding was that opinion pieces, specifically editorials, may be easier to read than news articles. This suggests that the most “readable” information in newspapers about wind energy and health is subjective or opinion-based. Conversely, news articles which tend to be objective and present factual content (Schudson, 1978) were more difficult to read. Letters to the editor, when authored by community residents, were written at a RGL that was 1.5 grades lower than letters from other sources including expert authorities or political figures. For example, the difference between a newspaper article of 30 sentences with a RGL of 11.5 and another with a RGL of 10 is approximately 23 additional polysyllabic words. These extra polysyllabic words could potentially present comprehension difficulties, especially in an unfamiliar context (wind energy) where reading difficulty of the medium already exceeds the literacy level of the readership. Our results indicate a potential for the opinions of local residents and editorial perspectives offered in community newspapers to be more readily accessible to readers.

From an emerging technology perspective, these findings are important because of the well-established relationship between people’s understanding of science and their perceptions about science and technology (Ceccoli & Hixon, 2011). Previous studies have shown that low science literacy can contribute to individuals’ distrust of science and scientists (Einsiedel, 1994). Additionally, improper education about new technology often heightens the development of fear in a population (Pidgeon *et al.*, 2011). The relatively recent proliferation of wind energy in Ontario has preceded rigorous prospective study of exposures, and hindered the proper communication of health risk to the general public.

Together, this has created a knowledge gap between scientific and lay communities, which can lead to greater risk perceptions, stigmatization, and avoidance (Slovic, 1987). Therefore, poor understanding of the issue of wind turbines and potential health effects may make the public more resistant to their implementation, as demonstrated in other studies of emerging technologies (Ceccoli & Hixon, 2011).

This study has limitations. First, the study objectives required that “health” be used in the search terms, which may contribute to failure to identify potentially relevant articles (e.g., included descriptions about health but without using the actual term ‘health’). A second limitation was the exclusion of non-print media, such as television or radio, and internet postings from this study. Other media outlets provide additional health information regarding wind turbines to individuals and communities, which affects public understanding of the issue. Moreover, readability formulas, such as the SMOG, do not measure other key elements of reading ease such as text coherence, the size and style of fonts or white space. Readability formulas measure the difficulty of individual word and sentences and not the actual comprehension of text by the reader. Although highly correlated, different readability formulas (SMOG, Flesch Reading Ease and Fry, for example) can produce different results, either over or under-estimating text difficulty (Meade & Smith, 1991). We measured RGL of text and not the actual comprehension of the information by the readers of the newspapers. Further research will be needed to determine if the high text readability poses a real barrier to readers’ understanding of newspaper content on wind turbines and health. Finally, we evaluated readability of newspaper articles but not the tone or frame of the message. Gain or loss framing of the messages and the use of words that trigger alarm or dread can influence what readers

perceive and understand about the health risks of wind turbines. Nevertheless, in order for readers to attend to the message, the prose must be written at a reading grade level that is easily accessed and understood.

4.5 Conclusion

In this pilot analysis of the readability of newspaper articles on the potential health effects of wind turbines in Ontario, the majority of articles were written at a higher RGL than what is normally recommended by health educators for the general public for understanding. On average community newspapers were more readable in terms of text difficulty than national newspapers. While increasing exposure to health information relating to new energy technologies can foster a scientifically aware and civically engaged public, the most text friendly information was in editorials and letters to the editor—formats which represent the interactive public forum and tend to be more subjective and less fact-based than ‘news articles’ (Westwood & Westwood, 1999). Our novel findings show the topic of wind turbines (as a case study) and its potential health effects are presented in newspapers at a reading grade level that is much higher than the average literacy level of the target population. This presents a potential barrier to educating the public about the potential health risks due to exposure to wind turbines (and potentially to other science and medical topics). Whether newspaper reading difficulty influences public understanding of and response to wind turbines and health remains to be investigated in future studies.

Chapter 5: Emergent Themes Analysis of Health Information from Wind Turbines in Ontario Newspapers

The work presented in this chapter is currently under review as:

Deignan, B., Hoffman-Goetz, L. (2013). A content analysis of health risks and wind turbines in Canadian Newspapers, 2007-2011. *Health, Risk & Society*, submitted.

5.1 Introduction

The public often adopts or modifies health behaviours using information obtained from the mass media, including causes, symptoms and signs of sickness, and how policies affect health care providers and consumers (Seale, 2003). Although newspapers often serve as primary sources of health information (Dutta-Bergman, 2004) coverage may fall short of providing comprehensive information about health risks (Johnson et al., 2011). For example, the quality of health information about breast cancer in Ontario (Canada) daily newspapers often includes misleading titles, contains erroneous information, omits important results, or treats speculation as fact (MacDonald & Hoffman-Goetz, 2002). Newspaper coverage can influence how people develop their opinions and attitudes about the risks (and benefits) of emerging technologies (Scheufele & Lewenstein, 2005). Incomplete or inaccurate information on emerging technologies can lead to misunderstanding, stigmatization, and amplified public concern (Pidgeon et al., 2011), as well as a failure to appreciate potential health threats (Charbonneau, 2013). Understanding the contribution of health information in newspapers on the public's risk perception is important because of subsequent changes in health behaviours and, ultimately, health outcomes (Edwards et al., 2001).

There are conflicting claims about the potential health impacts of wind energy installations in the scientific literature. In response to concerns from the Canadian public about wind turbines as a potential threat to health, the Ontario Chief Medical Officer of Health concluded that the current scientific literature does not demonstrate an unequivocal causal link between exposure and direct health effects (CMOH, 2010). This position was adopted by the Ontario provincial government, as well as organisations such as the National Collaborating Centre for Environmental Health in Canada, and an international scientific advisory panel (Colby et al., 2009; Rideout et al., 2010). However, there is also evidence, albeit anecdotal, which links adverse health effects to wind turbine exposure. Pierpont (2009) reported a clustering of symptoms in families living in close proximity to wind turbines, termed “wind turbine syndrome”, which included sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, and nausea. However, scientists have not reached consensus on whether or not wind turbines directly or indirectly cause health effects, as evidenced by recent commentary appearing in two prominent peer-reviewed British and Australian journals: British Medical Journal (Chapman, 2012; Hanning & Evans, 2012a, 2012b) and the Medical Journal of Australia (Chapman, 2011; Shepherd, 2012). This debate also exists in Canada (Knopper & Ollson 2011), and elsewhere, including Sweden and the Netherlands (Pedersen, 2011). The lack of agreement between expert authorities in the fields of environmental and public health suggests a potential knowledge gap and presents challenges for risk communication with the public.

It has been shown (Deignan et al., 2013) that Ontario newspaper articles on wind turbines and health emphasize a well-documented typology of fright factors (Bennett, 1999); these fright factors, such as dread, vary by newspaper type and proximity of the newspaper catchment area to the wind energy installation. As a further exploration of the media ‘risk discourse’ on the

relationship between wind turbines and potential health effects, we analyzed underlying themes and messages in newspapers. We wanted to address the following questions: (1) How are health risks of wind turbines described in Ontario newspapers? (2) What other concerns presented in newspaper articles support, amplify, or weaken the description of health risk from wind turbines? (3) Do these health and other concerns differ among Ontario newspapers that serve local compared with larger geographic regions?

5.2 Methods

The thirteen community newspapers included in this study were *Orangeville Banner*, *Orangeville Citizen*, *Hanover Post*, *Owen Sound Sun Times*, *Kincardine News*, *Lucknow Sentinel*, *Shoreline Beacon*, *Lakeshore Advance*, *Sault Star*, *Londoner*, *Sarnia Observer*, *Sarnia and Lambton this Week*, and *St. Catharines Standard*, and the four national/provincial newspapers were the *Globe and Mail*, the *National Post*, the *Toronto Star* and the *Hamilton Spectator*. Further details on the identification of geographically discrete wind energy installations in Ontario, and the rationale for selection of newspaper sources, have been published (Deignan et al. 2013).

Newspapers were searched using the LexisNexis database and individual newspaper websites from May 2007 to April 2011 (2 years before to approximately 2 years after introduction of a major policy legislation, the Green Energy Act, in May 2009). The search included terms to describe wind energy developments: wind turbine, wind farm, wind energy, wind power, and windmill. Additionally, search terms related to common complaints of health problems due to wind turbine exposure, including health, noise, vibration, stress, sleep disturbance, and illness, were used. Articles were excluded if they were duplicates or only contained the term “health” when not related to humans (e.g., financial health). All retrieved

newspaper articles were imported, categorized and analysed using NVivo 9 software (QSR International Pty Ltd., Melbourne, Australia).

Articles were categorized by newspaper name and coded in chronological order of publication. Initial data analysis involved a directed content analysis (Hsieh & Shannon 2005) in which the coding categories were generated from the research literature on health effects from wind turbine exposure (CMOH, 2010; Knopper & Ollson, 2011) as well as on new technologies and risk perception (Slovic et al., 2000). Preliminary categories were: description of health effect, not in my backyard concerns, distrust of information source, and scientific uncertainty. This was followed with a conventional content analysis using open coding, a process whereby data were examined line by line to gather specific descriptions of concepts and actions reported in the newspaper articles (Hsieh & Shannon, 2005). All newspaper articles were read iteratively at least four times for emerging themes and subthemes within the initial coding categories (Bengs et al., 2008). This process of theme identification and refinement continued until saturation was reached and no new themes were evident. The initial coding categories (n=4), emergent themes (n=7) and subthemes (n=22) are shown in Table 8.

Table 8: Coding Categories and Themes about Health Effects in Ontario Newspapers

Initial Category	Theme	Subtheme
Description of Health Effects	Cause of Health Problem	Inadequate setbacks or proximity issues
		Noise issues
		Shadow flicker and vibration problems
		Electrical problems or sensitivity
		Other Concerns (e.g., icing)
	Specificity of Health Complaint	General effects
		Specific effects
Not in my Backyard Concerns	Auxiliary Concerns	Property Values
		Financial Burden
		Aesthetic Concerns
		Environmental Damage
Distrust	Government	Centralization of planning decisions
		Politically driven decision making/implications
		Lack of Compassion or Response to Citizens
	Industry	Lack of Consideration for Public
		Secrecy with Contract Owners
Scientific Uncertainty	Conflicting Evidence	Expert Sources on Opposite Side of Issue
		Confusion
		Scientific Evidence for Moratorium
		Scientific Evidence Against Moratorium
	Insufficient Quantity and Quality of Health Information	Inaccurate or Untrustworthy Information
		Overall Lack of Evidence

One author coded all of the articles. To address potential threats to validity of the coding categories, inter-rater reliability tests were performed by two independent coders on a randomly selected subset of 20% of the articles (n=80), using the initial codebook categories and themes. The average Cohen's kappa score was 0.871 (range: 0.8-1.0) indicating excellent agreement. All coding inconsistencies were thoroughly discussed until agreement was reached.

The coding categories and themes relevant to the research questions were analysed using SPSS (SPSS v20, SPSS Inc., Chicago, IL). Descriptive statistics, including frequencies, means, and percentages were generated, and chi-square analysis was used to compare the presence of themes in community vs. national/provincial newspapers. A *p*-value of <0.05 was accepted as statistically significant.

5.3 Results

5.3.1 Health Effects of Wind Turbines and their Causes

All newspaper articles collected for this analysis mentioned health related to wind turbines. However, there was significant variation in three key elements of the health messages: symptom detail, the underlying exposure from wind turbines that was associated with health problems, and auxiliary concerns.

Newspaper descriptions of the health effects from wind turbines were organised into one of two categories - general or specific concerns. General health concerns appeared in 71% (n=298/421) of the articles, and included broad terms such as “ill”, “adverse”, “concern”, or “problem” related to health, illustrated below::

‘We in the trenches know, without a shadow of doubt, that perfectly healthy people become seriously ill after turbines start up nearby and that the numbers of people getting ill is significant’ (Kincardine News, March 2011).

Specific health complaints were present in 29% (n=123/421) of the articles, and included a description of one or more symptoms attributed to wind turbine exposure. There were more than 60 unique symptoms to describe these health effects from wind turbines in Ontario newspapers, ranging from mild (e.g., sleep problems, nausea) to severe (e.g., heart palpitations, incidence of breast cancer). The most common specific symptoms were headache, insomnia and sleep disorders, nausea, and tinnitus. When mentioning specific health effects, several symptoms were often listed together:

‘They want to find out whether, as many suspect, the turbines rob people of sleep and hearing, or cause stress, skin rashes, headaches, high blood pressure or a host of other ailments.’ (Toronto Star, June 2009).

Although general health concerns occurred more often than specific concerns, there were no differences in the frequency of general or specific health effects between community and national/provincial newspapers ($X^2=1.69$, $df=1$, $p>0.05$).

Health complaints were often attributed to specific types of exposure from wind turbines with the most commonly cited being inadequate setbacks (n=114/421, 27%), noise issues (n=90/421, 21%), electrical exposure (n=49/421, 12%), and shadow flicker or vibrations (n=27/421, 6%). Other suspected causes of health problems, such as ice throw, were described in <5% of the articles. To be coded in one of these five exposure categories, statements must have

contained both the exposure type along with a reference to either general health concerns or specific symptoms. Illustrated in Table 9, two of the four commonly cited causes of health complaints from wind turbines (“Inadequate Setbacks” and “Electrical Exposure”) were significantly more likely to appear in community compared to national/provincial newspaper articles ($X^2=4.85$, $df=1$, $p<0.05$; $X^2=10.02$, $df=1$, $p<0.01$, respectively). The following sections provide a brief description of how each exposure type and health effect was developed in the newspaper articles.

Table 9: Cited Causes of Health Concerns in Community vs. National/Provincial Newspapers

Cause of Health Concern	Community Newspapers (total articles = 271)		National/Provincial Newspapers (total articles = 150)		Chi-square	p-value
	Number of Articles Citing Cause	Percentage of Articles Citing Cause	Number of Articles Citing Cause	Percentage of Articles Citing Cause		
Inadequate setbacks	83	30.6	31	20.7	4.85	0.028
Noise issues	50	18.5	40	26.7	3.88	0.049
Vibration or flicker	37	13.7	12	8.0	3.00	0.083
Electrical exposure	25	9.2	2	1.3	10.02	0.002

Inadequate Setbacks

The proximity of a home to the base of a wind turbine, known as a setback distance, was commonly cited as the cause of health problems. There were several accounts of symptoms disappearing when residents were away from home, and reappearing shortly after returning.

‘At a setback of only 550 metres, far too many people complain about adverse health effects. Many people living near wind turbines are unable to sleep, experience continuing stress and increasing health problems’ (Lucknow Sentinel, Oct. 2010).

Noise Issues

Noise, both audible and sub-audible, was the second most common exposure linked to a health effect amongst those living near wind turbines. Noise was often described in newspaper articles as an annoyance by property owners living near wind turbines. Symptoms related to sleep quality and hearing problems were often attributed to noise emissions:

‘Wind turbines emit noise and some rural residents have complained the massive machines are disrupting sleep and making people sick’ (Toronto Star, June 2009).

Shadow Flicker and Vibrations

The third most commonly cited cause of health complaints was shadow flicker and vibrations from the wind turbines. Statements which cited health issues with the flicker of light caused by rotating wind turbine blades or health complaints attributed to vibrations, whether structural (e.g, inside the home) or as a physical symptom (e.g., within chest cavity) were coded. Though often coupled with noise exposure, health concerns were also uniquely attributed to vibrations or shadow flicker from wind turbines:

“I experienced vibration in my body. My head was painful and intense and I was queasy and dizzy. I can't hear them [turbines] but I was sensitive to the effects," she said.’ (Lucknow Sentinel, June 2009).

Electrical Exposure

The final category of commonly cited causes of health problems linked to wind turbine exposure was electrical or electromagnetic pollution from power lines and transformers associated with wind energy installations. Typically, complaints about “dirty electricity” and “electrical hypersensitivity” were reported by residents who lived close to power lines or transformers that were introduced to transmit power from wind turbines into the power grid.

‘Many people experience difficulty breathing and a pressure in their chest...caused by stray electricity, citing numerous research sources linking illness to electrical hypersensitivity. Symptoms at some Ripley [a large wind energy development in Ontario] homes can arrive within 15 minutes...’ (Owen Sound Sun Times, Oct. 2010).

5.3.2 Auxiliary Concerns to Health

In addition to health concerns, newspapers often associated auxiliary non-health concerns with wind turbines. The number of times each of these categories was cited in Ontario newspapers is shown in Table 10.

Table 10: Auxiliary (Non-Health) Concerns about Wind Turbines in Community and National/Provincial Newspapers

Auxiliary Concern	Community Newspapers (total articles = 271)		National/Provincial Newspapers (total articles = 150)		Chi-square (df=1)	p-value
	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern		
Environmental damage	65	23.9	52	34.7	5.49	0.019
Property Values	60	22.1	26	17.3	1.37	0.241
Aesthetic	29	10.7	49	32.7	29.31	0.0001
Financial	54	19.9	20	13.3	2.90	0.089

The most common auxiliary concerns to health were environmental effects (n= 117/421, 28%), property values (n=86/421, 20%), aesthetic concerns (n=77/421, 18%), and financial issues (n=74/421, 18%). These themes were often grouped together, as illustrated below:

‘Stop and consider the hundreds of independent published reports... which confirm that wind turbines are ineffective, unreliable, cause serious health problems, damage our environment, devalue property values and are a waste of tax payers money’ (Owen Sound Sun Times, Nov. 2009).

The most common auxiliary, non-health concern about wind turbines was adverse environmental effects, which were mentioned more often in national/provincial compared to community newspapers ($X^2=5.49$, $df=1$, $p<0.05$). Statements on environmental health impacts of

wind turbines focused primarily on wildlife assessments, including the migration patterns of birds and bats. Statements about the efficiency of wind energy, decommissioning issues, and the amount of environmentally unfriendly materials used during construction were also present, although less often. These statements presented the position that wind turbines were dangerous to wildlife and inefficient or “not green”.

‘...during their annual migration, 7,000 to 9,000 birds cross those wetlands at night. With the arrival of the turbines, they would be flying into a stand of whirring, blinking, 135-metre-high towers with 45-metre blades fearsomely rotating 90 metres in diameter’ (Globe and Mail, Nov. 2007).

Slightly less frequent were reports in newspaper articles of the negative effects of wind turbines on property values (n=86/421, 20%). Although a greater percentage of articles from community compared with national/provincial newspapers mentioned property value issues, the difference was not statistically significant ($X^2=1.37$, $df=1$, $p>0.05$). Statements emphasized a decrease in property values due to proximity to wind turbines.

‘Developers say wind turbines have no effect on property values. Common sense suggests otherwise. A three-year study of 600 property sales near the wind turbine developments north of Shelburne shows values declining by 20% to 25%, with one reassessed at 50% of its market value. Some homes can't be sold at any price so developers buy them and bulldoze the homes.’ (Owen Sound Sun Times, April 2009).

Aesthetic concerns were a common non-health issue in newspaper articles on wind turbines and health. Statements often contained descriptors such as “blight”,

“intrusive”, “ugly”, “eyesore”, and “unsightly”, and included comparisons to airport runways and visually damaging effects on iconic landscapes. Newspaper articles from national/provincial newspapers were more likely to contain statements about aesthetic concerns than articles from community newspapers ($X^2=29.31$, $df=1$, $p<0.001$).

‘The blinking lights and the huge [wind turbine] towers visually pollute our once tranquil scenic countryside’ (Kincardine News, Feb. 2009).

Newspaper articles cited various financial barriers due to the implementation of wind energy. The most common financial barriers were a lack of economic return, inequitable distribution of wind energy subsidies, and low annual reimbursement.

‘As an income support program wind energy has extremely uneven coverage. Some municipalities will never see wind farms....The lease payments are not enough to save the family farm...to think that a measly \$6-8,000 annual payment will solve a farm's profitability problem is just plain wrong.’ (Londoner, Dec. 2010).

An important finding was that each auxiliary concern was often juxtaposed with a statement about health effects. Statements were coded as juxtaposed if health was mentioned in the same sentence, or in the sentence immediately before or immediately following, an auxiliary concern. The auxiliary concern most often juxtaposed with health was property values (60.5%), followed by environmental damage (48.7%), aesthetic concerns (41.0%), and financial barriers (32.4%). Of the 86 newspaper articles that mentioned property values as an auxiliary concern, 52 (60.5%) included a juxtaposed sentence about health. Table 11 illustrates that property value and environmental concerns were equally likely to be juxtaposed with health in community and

national/provincial newspaper articles. In contrast, aesthetic concerns were significantly more likely to be juxtaposed with health in national/provincial compared to community newspapers ($X^2=13.59$, $df=1$, $p<0.001$). Financial burden was more likely to be juxtaposed with health in community compared to national/provincial newspapers ($X^2=3.99$, $df=1$, $p<0.05$).

Table 11: Auxiliary Concerns Juxtaposed with Health Statements

Type of Auxiliary Concern Linked with Health Statement	Number of Occurrences in Community Newspapers (n=271)	Number of Occurrences in National/Provincial Articles (n=150)	Chi- square (df=1)	p-value
Environmental damage	32	25	1.94	0.163
Property Values	35	17	0.223	0.637
Aesthetic	11	21	13.6	0.0001
Financial	20	4	3.99	0.046

5.3.3 Conflicting Expert Opinions and Lack of Scientific Evidence

Expert sources, such as academics, physicians, and provincial Medical Officers of Health, were presented by the newspaper articles as divided on the issue of whether wind turbines produced health effects. For example, in 2010 the Chief Medical Officer of Health for Ontario, Dr. Arlene King, reported insufficient scientific literature to suggest a causal relationship between wind turbines and health. Other provincial Medical Officers of Health, notably Dr. Hazel Lynn, indicated concern for current setback distances, and called for further study. Expert sources on the wind turbines and potential health effects debate appear in 15.9%

(n=67/241) of the newspaper articles. The following are typical statements from expert sources on seemingly opposite sides of the issue:

“But several reports from government agencies worldwide, including one last spring from Ontario's chief medical officer of health, say there is no direct link between wind turbine noise and the health of people living nearby” (Globe and Mail, News Article, Aug. 2010).

“Dr. Lynn has stated that after looking into the situation she believes the current setback of industrial wind turbines from people's homes "certainly appears to have a very negative effect on some of the people's health and that a third party independent study must be done” (Hanover Post, News Article, Jan. 2011).

A small but not insignificant number of newspaper articles (7.6%, n=32) contained statements from expert authorities on both sides of the wind turbines and health issue within the same article. These articles were equally distributed between community and national/provincial newspapers.

‘To no surprise, there are arguments from both directions, Dr. Pierpont and others claiming scientific proof of illness, others stepping forward to claim they live near them with no ill effects at all.’ (Globe and Mail, Opinion Piece, June 2009).

Newspaper articles containing only one position about the scientific evidence were common. A large proportion of articles (24.5%, n=103/421) presented evidence, or indicated lack of evidence, to justify a moratorium on building additional wind turbines in Ontario. This theme appeared more often in community (28.8%, n=78/271) compared to national/provincial newspapers (16.7%, n=25/150) ($X^2=7.67$, $df=1$, $p<0.01$).

‘More than 30 gallery members braved unfavourably snow covered roads in order to attend the meet and add their names to the list of residents who want to stop wind development without comprehensive review of the growing number of reported negative health effects’ (Lucknow Sentinel, Dec. 2010).

On the other hand, 16% (n=69) of articles cited evidence against imposing a moratorium on building wind installations in Ontario. These statements were more likely to appear in national/provincial (22.0%, n=33/150) compared to community newspapers (13.3%, n=36/271) ($X^2=5.35$, $df=1$, $p<0.05$). Generally, these articles either directly quoted, or referred to, a report produced by the Chief Medical Officer of Health in Ontario:

‘Ontario Chief Medical Officer of Health Dr. Arlene King issued a report on May 20, entitled The Potential Health Impact of Wind Turbines. On the day it was released, she stated: “According to the scientific evidence, there isn't any direct causal link between wind turbine noise and adverse health effects”’ (Kincardine News, July 2010).

Another prominent theme was an overall lack of scientific evidence regarding potential health effects from wind turbine exposure. Statements in newspaper articles suggested the need for an increase in overall scientific evidence. Over one third of the newspaper articles in this sample feature this theme. However, a significantly greater proportion of community newspapers mention a lack of general scientific evidence (38.0%, n=103/271) compared to national/provincial newspapers (26.7%, n=40/150) ($X^2=5.54$, $df=1$, $p<0.05$).

‘...there has been little independent, credible research on the specific issue of wind turbine noise and what, if any, impact it has on human health. That research should be undertaken immediately...’ (Kincardine News, June 2009).

5.3.4 Distrust of Government and Industry

Distrust of the provincial government was a consistent category throughout the newspaper articles sampled. Common themes included the centralization of planning authority, politically driven decision-making, and a lack of compassion about (or complete dismissal of) residents' health complaints.

One political event that had a significant impact on the newspaper reporting of the wind turbine and health issue was the introduction of the Green Energy Act in May 2009, which streamlined the approval process for renewable energy installations by removing municipal control over planning. This received a significant amount of negative newspaper coverage in community newspapers, with a greater proportion of community newspaper articles mentioning centralization of planning authority as a concern (31.4%, n=85/271) compared to national/provincial newspapers (20.0%, n=30/150) ($X^2=6.28$, $df=1$, $p<0.05$).

‘Ontario planning policies do not apply to wind development under the new Green Energy Act, Davis said. The government is "showing down our throats something the majority of our people don't want."’ (Owen Sound Sun Times, Oct. 2009).

The second most common theme for government distrust was a lack of compassion, response, or due diligence, towards citizens of communities with wind turbines present. Although the proportion of community versus national/provincial newspaper articles that contained this subtheme did not differ statistically, it was present in about one-fifth (21%) of articles.

‘Critics of the premier's ambitious schemes were dismissed as cranks and nutters infected with a not-in-my-backyard syndrome.’ (Toronto Star, Jan. 2011)

Finally, the occurrence of statements that emphasized purely political motives behind decision-making for the wind energy industry was frequent in the articles. Partisan politics and election-oriented decisions were often mentioned in the articles on wind turbines and health effects. Although not significantly different, there was a trend towards this theme being more prevalent in national/provincial compared to community newspapers ($X^2=3.29$, $df=1$, $p=0.07$).

‘He said he thinks Ontario's decision [to place a moratorium on offshore wind turbines] was purely political, designed to appease voters concerned about wind power ahead of a provincial election, and had nothing to do with environmental concerns’ (Globe and Mail, Feb. 2011).

Distrust of the wind turbine industry was prevalent in the news articles. The wind turbine industry was mentioned as being untrustworthy, showing a lack of consideration for the Ontario public, or operating with a lack of transparency. The lack of consideration theme occurred significantly more often in community (19.6%, $n=53/271$) compared to national/provincial newspapers (12.0%, $n=18/150$) ($X^2=3.93$, $df=1$, $p<0.05$). An excerpt which illustrates lack of trust in the wind turbine industry in relation to potential health effects is illustrated below:

‘The wind industry will have you believe a direct link hasn’t been drawn between health symptoms and turbines, and therefore there isn’t one.’ (Orangeville Banner, Nov. 2009).

Secrecy of contracts for residents with wind turbines on their properties ($n=18/421$; 4.3%) was another source of distrust mentioned in the articles. Reference to neighbours who had been “bought out” or “silenced” by the wind energy companies to conceal adverse health effects from wind turbine exposure, is illustrated by the following statement.

‘Residents should know that the wind companies here have such strict confidentiality agreements that people who are sick cannot talk about it. Thankfully, some risk it all and do it anyway’
(Kincardine News, April 2010).

5.4 Discussion

Given the increase in the renewable energy technology industry in Ontario, Canada, the purpose of this study was to examine newspaper coverage in several Ontario newspapers for the description of health risks related to wind turbine exposure. Although every article, by design, contained some discussion on health related to wind turbines, the emphasis and presentation of this topic varied considerably.

Non-specific statements, such as “adverse health effects”, were prevalent in the discussion of direct health effects from wind turbines. This finding is consistent with media analyses of electromagnetic fields from mobile telecommunication, a somewhat comparable environmental health risk, where authors found that generalized terms such as “risk” and “burden” were intentionally used by newspapers to present vague health risk information (Claassen et al., 2012). Conversely, specific symptoms were reported less often in the sample of newspapers included in this study. Although symptoms of headache, sleep disturbance, nausea, and tinnitus were common, more than 60 unique health complaints were mentioned in the articles. The variety of specific health symptoms attributed to wind turbine exposure has been noted elsewhere (Chapman, 2012) and is not unlike the multiple symptoms reported by individuals living or working near mobile phone towers (Rööslü, 2008). This finding suggests that either wind turbines exposure causes a large spectrum of health problems, or that there are potential confounding factors in the relationship between adverse health effects and exposure to

wind turbines. For example, one expert panel review suggests that a ‘nocebo effect’ (negative placebo effect) may contribute to the variety of health effects from wind turbine exposure (Colby et al., 2009). Other studies suggest that visual interference and negative attitudes towards wind turbines increase noise annoyance levels (Pedersen & Persson Waye, 2004). The lack of a significant difference between general and specific health effects between community and national/provincial newspapers indicates that health concerns are comparable across Ontario and may reflect a common concern about the lack of scientific evidence.

Reported causes of health effects arising from wind turbine exposure occurred due to inadequate setbacks, noise issues, vibration or shadow flicker, and electromagnetic disturbance. However, these exposure types were not mutually exclusive: each can be linked to inadequate setbacks. For example, noise may be perceived to be louder by those living closer to a wind turbine (Pedersen, 2011). Three of these cited etiologic causes of health effects were reported more often by community compared to national/provincial newspapers. This finding suggests a possible difference in the risk agenda or emphasis between newspaper media outlets. Not only are community newspapers more likely to be published in locations that are closer in proximity to wind turbines than their national/provincial counterparts, but under the Green Energy Act, people directly affected (and the presumed readership of the newspapers serving the affected municipalities) have less control over the placement of wind turbines in their respective municipalities. Inadequate setbacks were an important, and relevant, issue in the Ontario communities examined in this study.

A large percentage of newspaper reports mentioned auxiliary concerns, such as environmental damage, reductions in property values, financial burden, and aesthetic concerns, because of wind energy developments. About half of auxiliary concern statements were

juxtaposed (within one sentence) of a health concern about wind turbines. There are at least two potential consequences of juxtaposing health issues with auxiliary concerns for readers of the information. First, linking health effects with other concerns may provide greater weight for the health issue argument. Each of the auxiliary concerns in this analysis has been previously noted in the literature. One survey of a community in close proximity to a wind farm in the United States had a large percentage of respondents disagree that property values would increase, agree that wind turbines are unattractive features on the landscape, and agree that they are a danger to wildlife and are unreliable (Swofford & Slattery, 2010). Additionally, a study of wind energy in Ontario raises questions about financial sustainability (Holburn et al., 2010). Combining health issues with those that have significant evidence in the scientific literature may help to strengthen the argument for health impacts arising from wind turbines (an associative or halo effect). A second potential effect of juxtaposing health effects is that some auxiliary concerns may overshadow health concerns. For example, coverage of individual suicides in the mainstream media often overshadows larger public health issues such as mental health, homelessness, and other social determinants of health (Zarghami, 2011). National/provincial newspapers were more likely to report auxiliary aesthetic concerns with the environment whereas community newspapers trended towards reporting more financial issues. Additionally, aesthetic concerns were more likely to be juxtaposed with health in national/provincial newspaper articles and financial burden was significantly more likely to be juxtaposed with health in community newspapers. The emphasis on financial burden (and link to health) in community newspapers represents a direct and immediate impact on individuals; the national/provincial newspapers emphasize a more remote, abstract effect (loss of a bucolic, rural landscape). The relative differences in the reporting of auxiliary concerns between community and national/provincial

newspapers reflect subtle differences in the public agenda and may supersede the issue of health effects.

Newspaper reporting of the lack of scientific consensus and inconsistent statements from prominent medical figures in Ontario may amplify uncertainty about wind turbines and health effects in the general population. The controversial nature of scientific uncertainty often attracts media attention (Eldridge & Reilly, 2003). Themes categorized in this analysis as scientific uncertainty, such as confusion, contradictory information from expert sources, and a lack of scientific evidence, mirror those reported for other technologies, such as electromagnetic fields, mobile phones, and nanotechnology (Friedman & Egolf, 2011; Claassen et al., 2012). The disagreement in the mass media between two prominent public health figures in Ontario emphasizes this uncertainty and supports the theory that contradictory health information is a newsworthy story. Public understanding of science may be limited and subject to a variety of influences, including personal predisposition to risk aversion, and trust in government and industry (Johnson & Slovic, 1995). The rapid proliferation of wind turbine technology in Ontario preceded rigorous prospective studies of exposures and health risks. This may also have reduced the communication of health risk to the general public. Therefore, public understanding of science could be even more limited and risk perception potentially more likely to be influenced by incomplete, controversial, and contradictory health information in the media (Pidgeon et al., 2011).

Newspaper articles often portrayed the wind energy industry and the Ontario government in a frame that exacerbates public distrust. Developing public trust is a multidimensional endeavour, including perceived competence, objectivity, fairness and consistency from individuals and organisations (Bennett, 1999). In a seminal paper on risk perception, Slovic

(1993) identified an “asymmetry principle” in which negative, or trust-destroying, events are much more influential than positive or trust-building events. During the time period studied, some policies implemented by the Ontario government, such as the Green Energy Act, and imposing a moratorium on offshore, but not onshore, wind energy development may be viewed as negative, trust-destroying, events. The removal of municipal control over the placement of wind turbines through the Green Energy Act could have also contributed to public distrust by increasing the inequity amongst Ontario communities. Only specific, and predominantly rural areas with high wind speed patterns were eligible for helping the province meet renewable energy goals (MNR, 2011). Additionally, the lack of control over exposure to potential health risks is commonly known to amplify public risk perceptions (Fishhoff et al., 2000). Although the majority of environmental and health research on wind turbines exists for onshore wind turbines (Knopper & Ollson, 2011), the public may interpret the moratorium on offshore wind turbines as being inconsistent or irrelevant. Newspaper articles on wind turbines and health consistently contained statements that amplified distrust in the provincial government.

Pervasive in the media messages was distrust in the wind energy industry. A large proportion of newspaper articles suggested that the wind energy industry is primarily interested in financial profit rather than public health concerns. The mass media has promoted similar messages of distrust in other energy industries, such as the disposal of nuclear waste (Slovic, 1993), and in the pharmaceutical industry, such as the Cox-2 inhibitor controversy (Lofstedt, 2007). Secrecy amongst contract owners was another prominent subtheme relating to the distrust of the wind energy industry. The public often makes risk management decisions based on unscientific information (Lofstedt, 2007) which could include the unexpected, quiet and prompt relocation of a neighbour. Transparency brings about trust by making information, such as

underlying data, regulatory procedures, and conflicts, available to empower individuals to make their own decisions (Papadopoulos et al., 2012). Newspaper articles containing statements about the suppression of contract details between residents and wind energy companies likely contributes to public distrust of the industry

The theme of distrust in both the provincial government and the wind energy industry may reflect the erosion of social capital, especially in rural Ontario where many wind turbine installations are located. Social capital is as the combination of social trust, networks, and values that individuals can use to improve their lives (Putnam, 2000). In rural populations, social capital plays an important role in increasing access to information (Mills et al., 2011). However, high levels of distrust can raise doubt about the importance or usefulness of information or advice provided by the government (Fisher, 2013). Some rural populations may distrust individuals if they consider their level of knowledge insufficient (Fisher, 2013). Furthermore, the ‘distribution’ of economic benefits from wind energy developments between neighbours and communities is related to perceived noise annoyance (Pedersen, 2011). Taken together, the messages of distrust toward government and industry, coupled with a lack of scientific evidence about wind turbines, may reflect an erosion of traditional social networks in rural communities.

Ontario newspapers sampled in this study describe health effects from wind turbines with ambiguous and inconsistent detail that often is linked to environmental, financial, or aesthetic complaints. Although much of the published scientific evidence suggests that there are no direct adverse health effects from wind turbines (CMOH, 2010; Knopper & Ollson, 2011; Pedersen, 2011), newspaper articles consistently emphasized scientific uncertainty about the issue. The uneven distribution of wind energy installations, risk of exposure to wind turbines, and public distrust of risk communication from industry, government, and scientific experts can trigger

public protest (Slovic, 1993), and likely contribute to the growing and vocal grassroots opposition to wind energy in Ontario. The impact of these news media reports on health risk perception by the readership remains to be evaluated.

5.5 Additional Results from Emergent Themes Analysis

The analysis in earlier sections of this chapter did not include comparisons to before and after the GEA. However, this information is still important because it can help illustrate the potential influence major policy change on the way newspapers report the issue of wind turbines and health.

The cited causes of health concerns were relatively consistent before vs. after the GEA, as demonstrated in Table 12. The only statistically significant difference was an increase in the ‘vibration or flicker’ exposure being cited before compared to after the GEA ($X^2=3.85$, $df=1$, $p<0.05$). There were also trends towards a decrease in newspaper articles which cite ‘electrical exposure’ as a cause of health problems after the GEA. However, ‘inadequate setbacks’ show an increasing trend after the GEA.

Table 12: Cited Causes of Health Concerns Before vs. After the GEA

Cause of Health Concern	Before the GEA (total articles = 99)		Following the GEA (total articles = 322)		Chi-square	p-value
	Number of Articles Citing Cause	Percentage of Articles Citing Cause	Number of Articles Citing Cause	Percentage of Articles Citing Cause		
Inadequate setbacks	21	21.2	93	28.9	2.26	0.133
Noise issues	24	24.2	66	20.5	0.632	0.427
Vibration or flicker	17	17.2	32	9.9	3.85	0.050
Electrical exposure	10	10.1	17	5.3	2.93	0.087

Like the cited causes of health problems, auxiliary concerns remained relatively consistent before vs. after the GEA, as demonstrated in Table 13. However, the auxiliary concern ‘environmental damage’ was significantly less likely to occur in newspaper articles after compared to before the GEA ($X^2=10.26$, $df=1$, $p<0.01$).

Table 13: Auxiliary Concerns Before vs. After the GEA

Auxiliary Concern	Before the GEA (total articles = 99)		Following the GEA (total articles = 322)		Chi-square (df=1)	p-value
	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern		
Environmental damage	40	40.4	77	23.9	10.26	0.001
Property Values	23	23.2	63	19.6	0.626	0.429
Aesthetic	24	24.2	53	16.5	3.07	0.080
Financial	22	22.2	52	16.1	1.93	0.165

Distrust from both the provincial government and the wind energy industry was often cited in Ontario newspaper articles, and is elaborated on in Chapter 5. However, there are subtle differences in the newspaper representations of the trust issue before vs. after the GEA, especially in the provincial government, as illustrated in Table 14. For example, newspapers were significantly more likely to express the concept of centralization after vs. before the GEA ($X^2=4.30$, $df=1$, $p<0.05$). Given the stipulations of the GEA, such as the streamlining approval process which essentially bypasses municipal governments, this finding is not very surprising. Additionally, the code for ‘political implications’ which occurs when a newspaper article implies that the provincial government is manipulating the wind energy industry for purely political means, was significantly more common after vs. before the GEA ($X^2= 13.26$, $df=1$, $p<0.001$). Again, this finding was expected.

Table 14: Distrust Before vs. After the GEA

Code for Distrust	Before the GEA (total articles = 99)		Following the GEA (total articles = 322)		Chi-square (df=1)	p-value
	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern		
Government - Centralization	19	19.2	96	29.8	4.30	0.038
Government – Political Implications	4	4.0	62	19.3	13.26	0.001
Government – Lack of consideration	21	21.2	70	21.7	0.012	0.911
Industry – Lack of consideration	15	15.2	56	17.4	0.271	0.603
Industry - Secrecy	3	3.0	15	4.7	0.490	0.484

Finally, the availability of scientific evidence regarding wind turbines and health changed after the implementation of the GEA, as shown in Table 15. Both evidence for and against moratoriums on wind energy in the province were significantly more likely to appear after the GEA ($X^2=10.26$, $df=1$, $p<0.01$, and $X^2=12.15$, $df=1$, $p<0.001$, respectively). Rather than speaking to the quality of scientific evidence, this finding illustrates that the issue of scientific evidence in the wind turbine and health debate has increased substantially since May 2009. Whether the GEA is directly responsible is uncertain. Additionally, and likely related to the previous finding, the code for ‘lack of scientific evidence’ appeared significantly more often

after vs. before the GEA. Therefore, the debate about the science of wind turbines and health has gained momentum in Ontario newspapers since the introduction of the GEA.

Table 15: Scientific Evidence Before vs. After GEA

Lack of Scientific Evidence Code	Before the GEA (total articles = 99)		Following the GEA (total articles = 322)		Chi-square (df=1)	<i>p</i> -value
	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern	Number of Articles With Auxiliary Concern	Percentage of Articles with Auxiliary Concern		
For Moratorium	13	13.1	90	28.0	10.26	0.003
Against Moratorium	5	5.1	64	19.9	12.15	0.001
Lack of scientific evidence	24	24.2	119	37.0	5.46	0.019

Chapter 6: Emotional Tone in Ontario Newspaper Articles on Wind Turbines and Health

The work presented in this chapter is currently under review as:

Deignan, B., & Hoffman-Goetz, L. (2013). Tilting at Windmills: Emotional tone of Ontario newspaper articles on the health effects of industrial wind turbines. *Journal of Health Communication*, submitted.

6.1 Introduction

Newspapers are a principal source of health information for the public, particularly among health-conscious individuals (Atkin, Smith, McFeters & Ferguson, 2008; Dutta-Bergman, 2004; Johnson, 1998; Meischke et al., 2002). While print media is useful in promoting awareness of health information, it can also influence the public's perception of an issue's importance and priority by presenting defined points of view or by changing the framing of the issue (McCombs & Shaw, 1972; Scheufele, 1999; Weaver, 2007). Journalists use different perspectives to highlight specific details of an issue (Weaver, 2007). Framing refers to the promotion and interpretation of an issue by emphasizing or downplaying particular information (Entman, 1993). This may involve an ethical assessment, a definition of the issue, or the identification of a cause or solution (Entman, 1993; Nelkins, 1987). One important aspect of framing is the presentation of an issue in a negative or positive tone using, for example, trigger words and phrases (Edwards et al., 2001).

Media reporting is more likely to gain attention and public interest if it provides opinions to or evokes sympathy from readers (Taylor & Sorensen, 2002). Sensationalism refers to the potential for media to distort or exaggerate information about risk through the use of emotionally provocative language (Allan, 2002; Dudo, Dahlstrom, & Brossard, 2007). Emotional tone,

whether negative, positive, or neutral, can have important consequences for how people interpret, understand, and act on health information (Abdelmutti & Hoffman-Goetz, 2009). Repeated presentation of an issue through a particular frame can change the discourse of the publics and policymakers regarding that issue (Finnegan & Viswanath, 2002; Salmon & Atkin, 2003). On an individual level, the influence of emotional tone on risk perception can potentially lead to changes in behaviour, such as avoidance, which may then affect health outcomes (Edwards et al., 2001).

6.2 Wind Energy in Ontario

In response to a global concern over climate change, wind power has become an increasingly important energy source, supplementing or replacing other sources such as fossil fuels and nuclear power (European Wind Energy Association, 2012; Global Wind Energy Council, 2012). The Canadian wind energy industry is expanding faster than other sources of power. In 2010, there was a nationwide increase in wind energy capacity of 21% (NEB, 2011). The province of Ontario is a leader in Canada with wind energy projected to provide 10% of all power in Ontario by 2030 (MOE, 2010). In 2009, the Ontario government introduced the Green Energy Act (GEA) to encourage the development of renewable energy technologies by removing barriers to and promoting opportunities for solar, biofuel, and wind energy generation and capture projects (Bill 150, 2009). The GEA simplified the approval process for wind energy developers resulting in an exponential increase in the number of industrial wind turbines in Ontario (MOE, 2010).

The increase in the number of industrial wind energy installations has not been without controversy in Canada (Watson, Betts, & Rapaport 2012) and elsewhere (Pedersen, 2011). Opponents cite issues such as visual impact on the landscape, impact on wildlife and the

environment, intermittent and weather-dependent energy production, annoyance from noise pollution, shadow flicker, and possible health effects as barriers to the development of wind energy (Gray, Haggett, & Bell, 2005; Phadke, 2010; Todt, González, & Estévez, 2011; Warren & Birnie, 2009). In Ontario, opponents of wind energy installations have mobilized to form several grassroots organizations, some of which have been successful in influencing the political agenda of local municipal offices. Numerous characteristics, including controversy, conflict, a human angle, and the potential for public impact make the issue of industrial wind turbines and potential health effects newsworthy (Finnegan & Viswanath, 2002; Viswanath et al., 2008). Indeed, we have shown previously that the news media reported extensively on these concerns over the past few years (Deignan, Harvey, & Hoffman-Goetz, 2013).

Seventy three percent of Ontarians over 18 read a printed edition of a daily paper and 83% read their community paper (Canadian Community Newspaper Database, 2010; Newspaper Audience Databank [NAD], 2011). In areas where daily papers are available, more than half of adult Ontarians read the paper every day (NAD, 2011). Therefore, the Ontario public has potentially high exposure to health risk messages through newspaper media.

The purpose of this study was to describe how health messages about wind turbines are reported in Ontario newspapers. We wanted to determine the emotional tone or valence of the message (positive, negative or neutral) which can potentially influence public perception of health risk associated with industrial wind turbines. Exposure to industrial wind turbines in Ontario is generally higher for rural compared to urban populations (Pedersen & Persson Waye, 2004). Local reporters tend to write stories that are culturally and geographically relevant (Kitzinger, 1999) which may result in more articles on wind turbines and health in community newspapers. In addition, the Green Energy Act removed municipal control over the placement of

wind turbines. We hypothesized that community newspapers would publish more negative articles about health risks and industrial wind turbines than provincial or national ones, and as well, the number of negatively framed articles in community newspapers would be greater after the GEA legislation.

6.3 Methods

Using the Canada Wind Energy Association database (CANWEA, 2012), three large and two small industrial wind energy installations in the province of Ontario (Canada) were selected from a list of thirty-seven that were built prior to September 2011. Each site began operation between 2006 and 2009, and included Melancthon Phase II, Ontario Wind Power Farm, and Prince Wind Farm as large installations with 88, 110 and 126 turbines, respectively, and Dunnville Wind Turbine and Proof Line Wind Turbine as small installations with 1 and 4 turbines, respectively. These turbines were selected because they are geographically discrete, represent a diverse set of communities in Ontario, and reflect differing magnitudes of installations throughout the province. A list of communities within a 50 km radius of each wind energy installation was generated using 2006 Canadian Census subdivision maps. Newspapers distributed in each census subdivision were identified using the Canadian Newspaper Association database (CCNAD, 2010). Seventeen newspapers were included with two classified as national (available across Canada), two provincial (available across the province), and thirteen community (available only within the community catchment), based on geographic reach, circulation size, and frequency of publication. The complete list of newspaper included in this study is illustrated in Table 16.

Table 16: Newspapers included in emotional tone study

Newspaper Type	Newspaper Name	Frequency of Publication	Circulation Size*
National	Globe and Mail	Daily	317 781
	National Post	Daily	158 250
Provincial	Toronto Star	Daily	292 003
	Hamilton Spectator	Daily	91 716
Community	Owen Sound Sun Times	Daily	12 505
	Sault Star	Daily	13 851
	Sarnia Observer	Daily	13 029
	St. Catharines Standard	Daily	19 388
	Orangeville Banner	Twice Weekly	42 508
	Orangeville Citizen	Weekly	14 412
	Hanover Post	Weekly	14 868
	Kincardine News	Weekly	2 838
	Lucknow Sentinel	Weekly	1 412
	Shoreline Beacon	Weekly	3 765
	Lakeshore Advance	Weekly	1 254
	Londoner	Weekly	145 200
	Sarnia and Lambton this Week	Weekly	39 296

*Annual circulation size for 2010 (Canadian Newspaper Association)

Two search strategies were used for newspaper article retrieval. National and provincial newspapers were searched using the LexisNexis database using a search string which included terms to describe wind energy developments such as *wind turbines*, *wind farms*, *wind energy*, *wind power*, and *windmill*. Additionally, search terms related to common complaints of health problems due to wind turbine exposure, including *health*, *noise*, *vibration*, *stress*, *sleep disturbance*, and *illness*, were used. Community newspapers were not searchable using the

LexisNexis database and articles were retrieved using searchable individual newspaper websites. Articles were included if they were published between May 2007 and April 2011 (2 years before to approximately 2 years after introduction of the GEA in May 2009). Articles were excluded if they were duplicates, outside of the date range, did not contain the terms “health” relating to wind turbines or only contained the term “health” when not related to humans (e.g., economic health).

Emotional tone (negative, positive, neutral) was determined by identifying the number of negative (loaded) and positive words in each article. The frequency of negative words in each newspaper article was used as a quantitative measure of sensationalism (Dahlstrom, Dudo & Brossard, 2012; Dudo et al., 2007). Loaded words are emotionally charged, inflammatory language that would not otherwise influence content (Dudo et al., 2007; Fung, Namkoong & Brossard, 2011). Relative to the topic of industrial wind turbines and health, loaded words would present scientific information about wind turbines in a negative emotional aspect. Positive words also elicit emotional responses. However, unlike their negative counterparts, positive words are not inflammatory or fear inducing (Johnson, Henderson, Pedersen & Stonecipher, 2011). The coding instrument included a list of negative and positive words that were informed by previous studies in the risk communication literature (Abdelmutti & Hoffman-Goetz, 2009; Dudo et al., 2007; Fung et al., 2011) and by induction from a random sample of 10% of the articles from this study using a grounded theory approach. The authors generated lists of loaded and positive words independently and resolved discrepancies in what constituted coded words (negative and positive) through iterative discussion. The initial list of negative/loaded and positive words identified for the tone analysis is given in Table 17. To avoid creating an extensive list of each

word variation, only the root words are included in Table 17. For example, the positive-valence word “success” appears but “successful” would also have been coded.

Table 17: Initial list of negative (loaded) and positive words

Emotional Valence	Coded Words
Negative (Loaded)	Abandon, adverse, alarm, against, anger, annoy, battle, blunder, catastrophe, catastrophic, complain, concern, consequence, controversy, critical, criticize, damage, danger, deadly, destroy, difficult, disappoint, disrupt, disturb, eyesore, fail, fear, ferocious, fiasco, fight, giant, guinea pig, harm, hazard, ill, industrial, inefficient, inflict, intrude, issue, killing, massive, negative, nightmare, oppose, pain, problem, protest, resist, risk, ruin, scary, serious, severe, sick, slaughter, suffer, threat, unhealthy, unfortunate, unwelcome, victim, worry, worst, wrong
Positive	Achieve, approve, attractive, awe, beautiful, benefit, best, better, clean (energy), confidence, eager, eco-friendly, efficient, embrace, excite, favour, good, great, happy, healthy, help, magnificent, opportunity, pleased, reduce emissions, right, save, success, support, triumph, tremendous

Each occurrence of a coded word in an article was counted as an independent event. The rationale for this was that our focus was on the total number of exposures of the reader to negative and positive words rather than the “weight” of the coded words (i.e., are some words more “negative” than others). An article was determined to be negative if it contained a greater number of loaded words than positive words. Likewise, an article was determined to be positive if it contained a greater number of positive words than loaded words. Articles with equal numbers of loaded and positive words were considered neutral.

One team member coded for emotional tone (positive, neutral, or negative) in all newspaper articles. To ensure reliability of the results, another researcher coded for emotional

tone in a random sample of 20% (n=84) of the articles. The inter-rater reliability score for emotional tone was very high, with a Cohen's Kappa score of 0.940. Additional valence words were added as the articles were read iteratively.

Articles were also coded for newspaper name, newspaper type (national, provincial, or community), article date, article type (news article, letter to the editor, editorial/column), article focus (human health or other), and type of health effect (general or specific). Article focus was classified as human health if it made reference to human health three or more times. Articles were classified as focusing on the "other" category, which included topics such as the economy, politics, and the environment, if human health was mentioned fewer than three times. Articles were classified as general health effects when non-specific statements such as "adverse health effects" or "ill health" were stated in an article, or as specific health effects when a symptom such as headaches, nausea, fatigue, or sleeplessness was mentioned.

All articles were coded using NVivo9 (QSR International Pty Ltd., Melbourne, Australia). Descriptive statistics (frequencies, means, percentages) as well as analysis of variance and two-tailed independent t tests were generated using SPSS (SPSS v20, SPSS Inc., Chicago, IL). Differences in the frequency of emotional tone by newspaper type and relative to the GEA were analyzed by chi-square. A p value of <0.05 was accepted as being significantly different from chance alone.

6.4 Results

A total of 421 newspaper articles were collected from 17 newspapers. When classified by newspaper type, the number of articles for community, provincial, and national newspapers was 271, 83, and 67, respectively. The number of newspaper articles on industrial wind turbines and

health appearing in each newspaper type was dependant on the year published ($X^2=24.8$, $df=8$, $p<0.01$). Further examination showed that the number of articles on this issue increased with each subsequent full year of collection (2008-2010).

Fewer than 5% ($n=18/421$) of articles were neutral in tone; this category was collapsed into a group named positive/neutral tone for subsequent analyses. All newspaper articles on industrial wind turbines and human health had a greater emphasis on negative rather than positive/neutral tone (total negative: 89.3%, $n=376$; total positive/neutral: 10.7%, $n=45$). The emotional tone of an article was dependant on newspaper type ($X^2=6.11$, $df=1$, $p<0.05$). Community newspapers published a greater number and percentage of articles with negative tone (92%, $n=249$) than did provincial (87%, $n=72$) or national (82%, $n=55$) ones. National newspapers were more likely to include articles with positive/neutral tone (12%) than community (5%) or provincial (7%) ones. Representative excerpts from articles with negative and positive/neutral tone from each newspaper type are presented in Table 18.

Table 18: Examples of negative and positive tone in articles by newspaper type

Newspaper Type	Example of Negative Tone	Example of Positive Tone
Community	<p>“Despite the new setback regulations from the MOE, their <u>suffering</u> is being ‘grandfathered’, so they are basically being <u>abandoned</u>.” (Orangeville Citizen, 2009)</p>	<p>“The foresight of this Ontario government has provided an <u>opportunity</u> for Canadian Hydro and other companies like Canadian Hydro, local townships and landowners to all prosper in a sustainable manner for many years to come. ‘That will <u>benefit</u> not only our generation but the next generation and the generation after that. Wind will always be there.” (Orangeville Banner, 2008)</p>
	<p>“These <u>monstrosities</u> will be 50 stories high and 550 metres from our homes. This is one of the <u>worst</u> invasions into a populated area as these are being placed way too close to homes... The wind turbines will not only <u>destroy</u> our health, wildlife including birds. They will also <u>destroy</u> tourism and the environment as a whole.” (Kincardine News, 2010)</p>	<p>Wind energy is steadily providing a <u>solution</u> as Canadian communities look to improve the environmental performance of their electricity systems while also creating new manufacturing/employment <u>opportunities</u>. Ontario has a tremendous wind energy <u>opportunity</u> and it stands to gain enormously from it. (Kincardine News, 2010)</p>
Provincial	<p>“Enbridge Inc. will start construction this summer on a major wind power project in Bruce County after the Ontario Municipal Board overruled resident <u>objections</u> arising from <u>fears</u> of noise and <u>unsightliness</u>.” (Hamilton Spectator, 2007)</p>	<p>“Wind power is <u>abundant</u>, renewable and relatively <u>affordable</u>. Wind produces <u>no emissions</u> and poses only minimal threats to ecosystems, making it one of the most <u>environmentally-friendly</u> forms of energy.” (Hamilton Spectator, 2011)</p>
	<p>“Wind turbines <u>sicken</u> us, protestors say [Headline] ...your article betrays a solely urban view and ignores the many real, <u>negative</u> effects of these turbines on people in Ontario. These are <u>industrial</u> structures; they are not ‘windmills’ and</p>	<p>”There are three things we need to do,’ said Hornung. ‘The first is more <u>effectively</u> engaging communities, more <u>effectively</u> engaging municipal leaders, and</p>

	they are not located on ‘farms’.” (Toronto Star, 2010)	working toward making sure discussions at the community level are full, frank and well informed.’ The association ran a survey last year that showed broad <u>support</u> for wind energy.” (Toronto Star, 2011)
National	“It clearly also affects those of us who are <u>concerned</u> about the protection of wildlife and wildlife habitat, who <u>worry</u> that living too close to turbines will affect our health, who see a <u>threat</u> to usable farmland...When the government talks of cutting red tape, it seems to mean <u>destroying</u> legal safeguards and ending transparency.” (Globe & Mail, 2009)	“He suggests the real <u>benefit</u> lies in the image it projects. ‘Every company spends a block of money - whether it's \$10,000 or \$20,000 or \$50,000 per year - in advertising. You take the <u>goodwill</u> that you get out of it and add it to the cost of the windmill and, yes, it is a <u>positive</u> .’” (Globe & Mail, 2007)
	“Regardless of one’s views of the merits of wind power, the process the Ontario government has put in place is <u>sickening</u> . I recently attended a municipal council meeting in Grey Highlands, where the <u>damage</u> being <u>inflicted</u> by the Machiavellian scheme dreamt up by the Ontario Liberals is <u>painful</u> to observe.” (National Post, 2011)	“Nowhere can it be shown that industrial wind energy will: 1 close down coal-powered plants; 2 create new long-term jobs without atrophying jobs in other sectors because of redirected funding for wind initiatives; 3 <u>reduce</u> <u>greenhouse-gas emissions</u> in amounts that would justify the funding that Big Wind will received from taxpayers' pockets” (National Post, 2009)

Note: Negative and positive words and phrases are underlined.

The number of articles with negative tone was higher in the two years after the major legislative GEA compared with the two years before ($X^2=12.5$, $df=3$, $p<0.01$). This is shown in Figure 6, which demonstrates that the negative article count increases more rapidly than the positive/neutral article count.

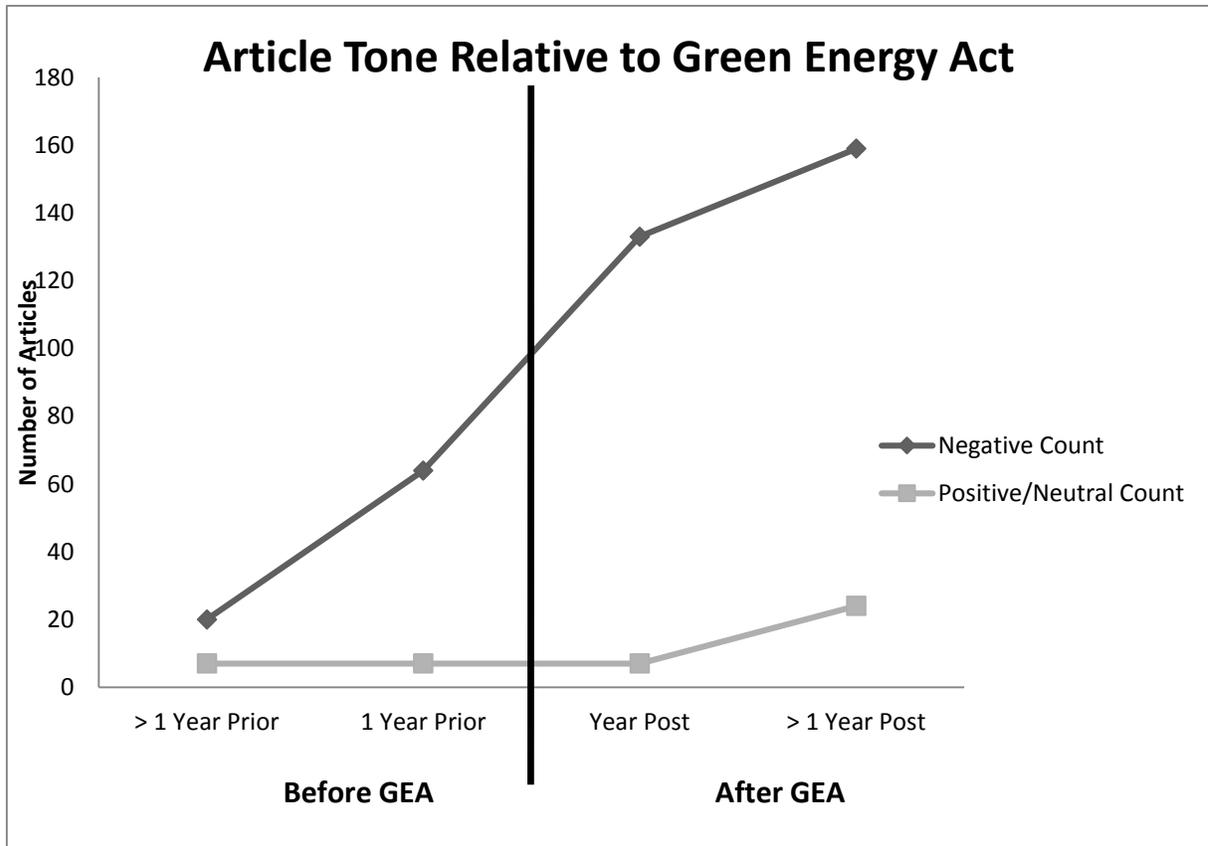


Figure 6: Article tone relative to the introduction of major legislation in Ontario known as the Green Energy Act (GEA)

Of the newspaper articles examined, 56% primarily focused on human health (n=233). Although the remainder mentioned human health, the focus was largely on another topic (politics, economy, environment). News articles were more likely to emphasize human health compared to letters to the editor or editorials/columns ($X^2=8.4$, $df=1$, $p<0.05$). Community newspaper articles were more likely to emphasize human health than articles in provincial or national newspapers ($X^2=41.7$, $df=2$, $p<0.001$).

Newspaper articles that focused on human health were also more likely to have a negative tone than those that only mentioned human health but focused on another topic ($X^2=19.8$, $df=1$, $p<0.001$). In total, 95% of all articles that focused on human health were negative in tone.

Newspaper articles on industrial wind turbines and health were more likely to describe human health effects following the GEA compared to before the GEA ($X^2=19.4$, $df=1$, $p<0.001$). In fact, 85% ($n=198$) of the articles that focused on human health were published after the introduction of the GEA; of those, 96% ($n=190$) were negatively framed. Therefore, newspaper articles published after the GEA were more likely to focus on human health, and these articles on health were significantly more negative than those published before the introduction of the GEA ($X^2=19.1$, $df=1$, $p<0.001$).

A higher number of newspaper articles that focused on human health mentioned general health effects (56%, $n=132$) than specific health issues (44%, $n=102$), with each newspaper type (community, provincial, national) publishing a similar proportion of articles describing general or specific health effects. The following excerpt, appearing in a community newspaper, is representative of how general health effects were presented in each newspaper type:

"[there is] indisputable evidence that industrial wind turbines are having a very negative effect on the health and well-being of a number of people living around existing wind farms in Ontario." (Hanover Post, 2010)

Newspaper articles that focused on human health and mentioned specific health effects were also more likely to be negative than articles that mentioned general health effects ($X^2=8.92$, $df=1$, $p<0.001$). The following is an excerpt from a provincial newspaper, which mentions some symptoms that commonly appeared in articles citing specific health effects:

“They claim the turbines cause low-frequency noise and have sickened 106 Ontario residents, causing a variety of health ailments ranging from hypertension to sleeplessness and nosebleeds in children. People are suffering and their concerns are being dismissed...”(Toronto Star, 2010)

6.5 Discussion

The media can have considerable influence on the public agenda, shaping what is viewed as important and influencing public perceptions of issues, often based on how information is presented (McCombs & Shaw, 1972; Viswanath et al., 2008; Weaver, 2007). Our findings show the majority of newspaper articles on industrial wind turbines and health were negative in tone. This potentially translates into public exposure to a high volume of emotionally charged, inflammatory, and anxiety-inducing loaded words juxtaposed with information on wind turbines and health. These findings are consistent with previous findings that Ontario newspaper media publish newspaper articles on wind turbines and health that contain a large amount of fright factors that are known to increase fear and anxiety in the readership independently of the risk itself (Deignan et al., 2013). Messages that are perceived as threatening or fearful can evoke high anxiety or negativity for individuals and lead to a counterproductive response (Johnson et al., 2011). Strong emotional responses to environmental risks may trigger an overreaction and excessive preventive and avoidance measures (Sunstein & Zeckhauser, 2011). The predominantly negative frame found in this sample of newspaper articles could have an adverse influence on public perception of and reaction to the development of industrial wind turbines across the province of Ontario.

Articles published in community newspapers were more often negative in tone than those published in provincial or national newspapers. Differences in the frequency of media reporting correlate with changes in health risk perception. This association has been found in the area of emerging biotechnology; an increase in media coverage of an issue tends to result in a steady decline in public optimism, and vice versa (Guteling et al., 2002; Villela-Vila & Costa-Font, 2008). Therefore, we suggest that a greater proportion of negative tone articles in community papers could lead to regional differences in the perception of health risks attributed to industrial wind turbines. This may explain, in part, why overall 89% of the Ontario population supports wind energy while there has been greater resistance from smaller regional communities in the province (Ipsos Reid, 2010). Close ties between local reporters and their community could influence editorial agendas as cultural, political, and geographical factors shape reporting (Kaniss, 1991; Kitzinger, 1999). For example, in the case of industrial wind turbines and health, community newspapers may frame the issue negatively because of residents' increased exposure to wind energy developments, and concerns about long term consequences for the community.

Community newspapers were not only publishing a greater proportion of negative articles than provincial and national newspapers, they were also more likely to focus on human health. This is consistent with the finding that small and local media organizations (such as community newspapers) pursue human interest angles in stories while large media organizations (such as provincial and national newspapers) use an economic angle when reporting newsworthy items (Wallington, Blake, Taylor-Clark, & Viswanath, 2010). The limited staff resources of smaller media markets often result in localization of health stories (Caburnay et al., 2003). As a result, community newspapers are likely to publish reports that reflect local rather than provincial or national concerns.

The newspaper articles included in this study suggest sensationalizing coverage of industrial wind turbines and health, as articles with a human health focus were more often negative than articles without a human health focus. Articles that did not focus on human health emphasized political, economic, or environmental impacts of wind energy. These topics are less likely to inspire the same level of negative emotional response as stories about human health issues; this was shown by the lower percentage of negative tone in articles that focused on “other” topics. Sensational information has been shown to elicit fear, evoke overreactions, and unreasonably amplify the public’s risk perception, especially when imprecise risk information is available (Dahlstrom et al., 2012). The controversial nature of the topic of industrial wind turbines and health, coupled with potentially sensational newspaper coverage, may contribute to negative attitudes towards wind energy in some Ontario jurisdictions.

Following the introduction of the Green Energy Act (GEA) in May 2009, our results show an increase in the frequency of overall newspaper coverage, proportion of negative newspaper articles, and articles that focus mainly on human health. If newspaper coverage is reflective of the larger public discourse about a topic, our study suggests increasing public awareness or concerns of potential health risks due to industrial wind turbines. With the implementation of the GEA, the provincial government adopted a position that wind turbines are economically viable and environmentally friendly. Recent studies suggest that wind energy is becoming more financially sustainable without government incentives (Welch & Venkateswaran, 2009). Therefore, debates about the economic and environmental sustainability of wind energy developments, which were prominent before the GEA, may have less readership saliency. Anecdotal evidence of health risks from wind turbines (Knopper & Ollson, 2011) may take on

greater relevance after the GEA, contributing to a greater focus on human health in newspaper articles.

This study has limitations. Non-print media channels, such as television or radio, and internet postings (reports, blogs etc.) were excluded from this study. Other media outlets provide additional health information regarding industrial wind turbines to individuals and communities, which can influence public perception of the issue. Article prominence (length, location, layout), an indicator of media exposure, was also not measured and should be considered in future analysis. We generated a reasonably complete and independently validated list of emotional tone words for analysis. However, this list was not exhaustive and we may have inadvertently excluded some terms. This would lead to potentially under reporting of emotional tone (in one or both directions), and could have affected the results. Additionally, this analysis compared total numbers of loaded and positive terms to determine emotional valence. Therefore, an article with four more loaded terms than positive terms was treated the same as an article with two more loaded terms than positive terms. Rather than focus on each individual article, the important finding from this study is that the majority of articles contain a larger number of loaded compared to positive terms. Finally, media reporting on potential human health effects and risks associated with wind turbines cannot capture the direct impact that risk messages have on individuals' perceptions or actions. Further research will be necessary to identify the potential influence that industrial wind turbine and health risk messages in newspapers may have on behavior.

6.6 Conclusion

In this analysis of emotional tone (valence) of newspaper coverage of the potential health effects of wind turbines in Ontario, the majority of articles were found to be negative. Consistent exposure to sensationalized newspaper articles may foster a negative attitude by the public about the acceptability of industrial wind turbines as a green energy source. Our results suggest that the potential negative influence may be stronger in smaller communities; community newspapers published a larger absolute number and a greater proportion of negative framed articles than national and provincial newspapers. Community newspapers also tended to publish the more emotionally evocative health-focused stories, which were exclusively negative when describing specific health effects. Overall, our novel findings show the topic of industrial wind turbines and potential health effects are presented in newspapers with a largely negative slant. Whether negative article tone and repeated exposure to such articles influence the public's perception of health risks from wind turbines, their response to industrial wind turbine developments, and ultimately their civic engagement in policy discussions about green energies technologies and health remain to be investigated.

Chapter 7: General Discussion

7.1 Key Findings

The majority of the results from this thesis research have been presented and discussed in Chapters 3, 4, 5 and 6. The relationship between the four main study components will be detailed in the following section, including: Figure 7 which summarizes the key findings from each of the four study components. This chapter also presents a comparison based on newspaper type and date of publication relative to the Green Energy Act, how newspaper reporting can play an important role in communicating information about emerging technologies, and more broadly how the news media can shape public opinion about wind energy.

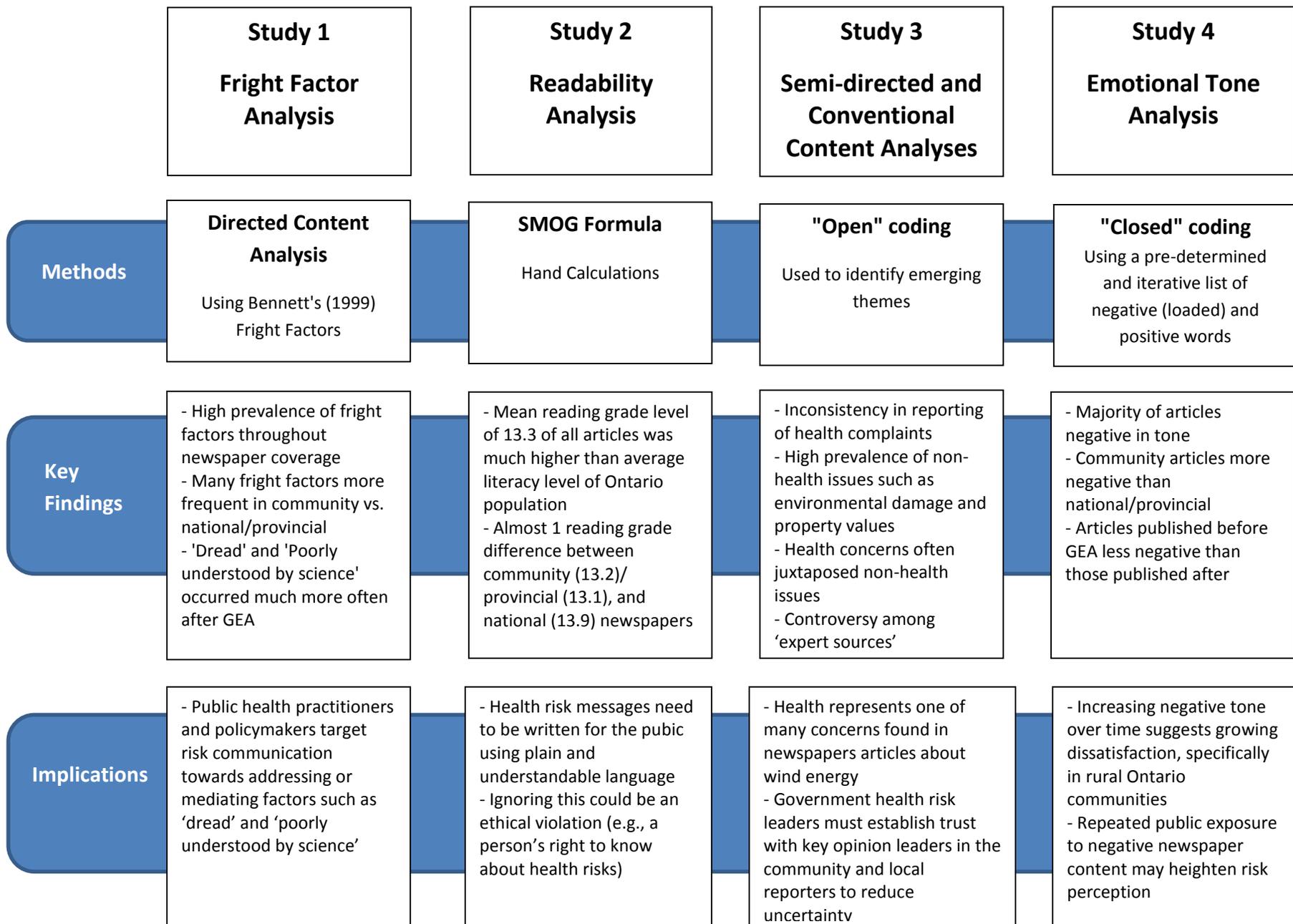


Figure 7: Key findings from each study

7.1.1 Differences by Newspaper Type (Community vs. National/Provincial)

Newspapers selected for study in this thesis research were categorized as national, provincial, or community based on subscription size and distribution statistics. A detailed description of this process, as well as other newspaper characteristics, can be found in Chapter 3 Table 2. The final sample obtained from each newspaper type was 67 articles from two national newspapers, 83 articles from two provincial newspapers, and 271 articles from thirteen community newspapers. In several of the studies conducted for this thesis research, the national and provincial newspapers were combined, creating a combined sample of 150 articles. Collapsing national with provincial newspapers in these studies was necessary to satisfy all of the conditions of chi-square analysis. For example, as shown in Appendix F, the chi-square calculation conducted for the fright factor ‘dread’ for newspaper types that included national, provincial, and community newspapers yielded an expected cell count of less than 5. This violates the criteria originally described by Cochran (1952), in which the chi-square goodness-of-fit test is not valid when expected cell frequencies are below 5. By collapsing national with provincial newspapers, the number of articles expected in each cell increased beyond the minimum of 5.

There were a number of important differences in the content of articles on wind turbines and health between community and national/provincial newspapers. Risk messages in the form of fright factors were consistently mentioned in community compared to national/provincial newspapers, and specifically, the fright factors ‘dread’, ‘poorly understood by science’, ‘inequitable distribution’, and ‘inescapable’ were more prevalent in community newspapers. The emergent themes analysis showed that community newspapers were more likely than national/provincial newspapers to attribute health problems from wind turbines to inadequate

setbacks and electrical exposure. Community news reports were more concerned with issues of financial impact and property values, and these were often juxtaposed with health. In contrast, national/provincial newspapers were more likely to attribute health problems to noise exposure, and be concerned with environmental damage and aesthetic concerns which were then juxtaposed with health. Finally, community newspapers were much more likely than national/provincial newspapers to sensationalise when writing about wind turbines and health by including large numbers of negatively valenced words.

Overall, community newspapers in Ontario published a larger number of articles on wind turbines and health and contained a greater proportion of negative, fear-inducing messages than their provincial counterparts. Although not specifically examined in this research, there may be a relationship between the proximity of a wind turbine to a community, and the frequency of coverage in the corresponding community newspaper. For example, only three articles were retrieved from the *Sault Star*, whose offices are located approximately 30 kilometres from the Prince Wind Farm in Sault Ste. Marie, ON. However, 150 articles were retrieved from five newspapers serving the area surrounding the Ontario Wind Power Wind Farm in Kincardine, ON; in support of this intriguing ‘association’, the closest newspaper office – *The Kincardine News* – was just under 10 kilometres away and contributed 53 articles. A large proportion of the readership catchment of community newspapers was located near wind energy installations and the distribution of wind energy developments in Ontario favours rural areas (Pedersen & Persson Waye, 2004). Therefore, as local residents are more directly affected by wind turbines, this may translate into a greater frequency of newspaper articles on wind turbines and health. Finally, the finding that community newspapers present wind turbines and health in more inflammatory (or

provocative) terms was unexpected and suggests there is more resistance towards renewable energies in rural Ontario.

The readability of national newspaper articles in this sample was almost one full reading grade level higher than the community newspaper articles. This finding, coupled with the differences in content between newspaper types (e.g., community newspapers contain more fright factors), could potentially lead to different understanding or perceptions of the wind turbines and health issue. Relative to national or provincial newspapers, the readership of community newspapers may have a much more negative perception of wind energy because the information they are exposed to is both more understandable (albeit still above the average literacy level of the population) and more biased towards negative health and risk messaging. This may be an important consideration for rural Ontarians who often (although certainly not always) have lower income, education and literacy levels (Alasio, 2003). Lower socioeconomic status can contribute to difficulties with the acquisition and application of health information (Viswanath et al., 2006). The literature also suggests that lower-income and lower-education sub-groups are more likely to use magazines and newspapers as primary health information sources, rather than healthcare practitioners or online sources (Oh et al., 2012). Therefore, rural Ontario communities may face greater challenges in balancing the negative and fear inducing health and risk information found in local newspaper media with other (potentially) more neutral and/or expert sources such as public health units or healthcare practitioners. The typically more affluent readership of national newspapers, on the other hand, are exposed to less negative and fear based messages, and are more likely to supplement information obtained from the newspaper media with online sources or personal interactions.

7.1.2 Differences Relative to the Green Energy Act

The major policy legislation known as the Green Energy Act (GEA) was enacted in May 2009. This document significantly changed the approval process for renewable energy projects in Ontario, and was a major source of criticism from municipal governments. As a result of widespread newspaper coverage of this legislative process, this thesis research was structured approximately two years prior to two years following the introduction of the GEA. This provided a unique opportunity to assess public archives for attitudes prior to the renewable energy legislation in Ontario compared to attitudes after its introduction.

Prior to the introduction of the GEA, only the fright factor ‘identifiable victims’ was more common in newspaper articles. There are two potential reasons for this finding. First, in the initial stages of a possible health risk, newspaper editors/publishers may have elected to report on specific, individual cases. As the problem grew larger, rather than identify specific individuals, editorial/publisher decisions may have led to reporting of clusters of health problems around specific wind energy developments. Second, the decreased appearance of the fright factor ‘identifiable victims’ may be due to a greater collective voice and mobilization of community groups, rather than concerns expressed by individuals. For example, the largest wind turbine opposition group in Ontario was established in late 2008, and has since grown to about 60 grassroots organizations (WCO, 2011). These opposition groups frequently use the newspaper media as a platform for broadcasting opinions and advertising meeting dates. Conversely, the fright factors ‘dread’ and ‘poorly understood by science’ were significantly more prevalent following the GEA. One possible explanation is overall public dissatisfaction with the level of scientific evidence regarding wind turbines and potential health effects. This explanation is

strengthened by the finding in Study 3 which indicates a general increase in discussion regarding scientific evidence for and against moratoriums on wind energy development.

Both the cited causes of health problems, and auxiliary concerns to health from wind energy changed relative to the GEA. Less of an emphasis was placed on electrical exposure and vibration or flicker relative to inadequate setbacks. The promise of an increased number of wind turbines throughout Ontario from the GEA may introduce anxiety by individuals who fear that a wind turbine will be constructed near their home. This prediction is supported by an increased frequency of the fright factors ‘dread’ and ‘inequitable distribution’ in newspaper articles published after the GEA. Although most of the auxiliary concerns to health remained relatively stable before, compared to after, the GEA, the auxiliary concern of environmental damage was cited less often in newspaper articles after the GEA. This could be a reflection on the increased number of required environmental reports prior to implementing each wind energy development.

One emergent theme in the newspaper articles that increased markedly in frequency following the GEA was distrust. The main source of distrust was in the government. Themes such as the centralization of planning decisions and politically-motivated decision-making featured prominently in newspaper reports. The GEA was highly criticized because of its power to ‘trump’ the rights of some rural populations to the health and enjoyment of their properties. This raises issues of environmental and social justice, as the proposed health and environmental benefits of reducing reliance on fossil fuels in favour of renewable energy, may come at the expense of rural Ontarians who are placed in much closer proximity to wind turbines (Shain, 2011). Additionally, the Ontario government may have exacerbated distrust in the population by making decisions with seemingly political motives, such as imposing a moratorium on offshore, but not onshore, wind energy developments.

7.1.3 Impact of Newspaper Reporting on Emerging Technologies

The perception of new technologies in the general public can be influenced by media framing. Framing refers to the selection of some aspects of a perceived reality to make them more salient in communicated text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation (Entman, 1993). In simpler terms, any contentious topic (whether wind turbines, low-income housing, HPV vaccination, or the price of oil) can induce different responses based on how it is described. Results from this study indicate that articles in Ontario newspapers about wind turbines are often framed in a way which induces fear or anxiety in readers. This frame contains information that is too complicated for the average reader to understand and is very sensationalized.

The impact of framing is important to consider with the introduction of new technologies by newspaper media because of the potential for the public to form biases and use heuristics in their reading of article content. As newspapers are often a primary source of information on emerging technologies, they can play an important role in the development of an individual's opinions, attitudes or preconceptions (Scheufele & Lewenstein, 2005). Due to the lag in the development of scientific knowledge, uncertainty is common in emerging health crises, such as West Nile virus, severe acute respiratory syndrome, and anthrax (Freimuth, 2006), but is also common in emerging technologies, such as nanotechnology (Lee, Scheufele & Lewenstein, 2005). Information on emerging health risks is often inadequate, unavailable, or inconsistent (Goodall et al., 2012). Although this leaves a number of potential frames from which newspapers can construct storylines, there is a tendency for the media to use negative tone to reflect a lack of public knowledge as has been shown in the biosolids industry (Goodman & Goodman, 2006).

Confirmation bias is the tendency for people to favour information which confirms or substantiates their beliefs (Moreno & Johnston, 2013). A specific form of confirmation bias, known as positive hypothesis testing bias, refers to individuals who test the validity of a hypothesis by only confirming evidence (Klayman, 1995). Kayhan (2013) elaborates on this concept with the following example:

“an individual who believes that his/her headaches are because of a brain tumor can conduct a search on the Web about the relationship between headaches and brain tumor, and reinforce this belief as a result of retrieving only confirming evidence” (p. 268).

If an individual’s first encounter with information about emerging technologies is negative, it may affect how subsequent information is retrieved and processed. The results of the work presented in this thesis showed the information about wind turbines and health from 2007 to 2011 has been overwhelmingly negative. In fact, newspaper articles were more negative in the two years following the Green Energy Act compared to the two years prior. Therefore, there is ample negative information about wind turbines and health to form and potentially confirm readers’ bias.

Heuristics are subconscious “rules of thumb” that enable an individual to make fast decisions. The availability heuristic is the tendency for people to estimate the probability of a risk by the ease by which examples can be brought to mind (Tversky & Kahneman, 1982). The availability heuristic is commonly used in estimates of environmental risk. For example, survey respondents who could remember flooding events perceived greater risk from future floods than people who could not remember past flooding events (Siegrist & Gutscher, 2006). Therefore, the consistent negative representation of wind turbines and health could help to strengthen the

perception of greater health risk. Additionally, the uneven prevalence of negative and fear-inducing messages about wind turbines in community compared to national/provincial newspapers could also heighten risk perceptions in rural Ontario where wind energy is most commonly generated.

7.1.4 Influence of News Media on Shaping Public Opinion

A number of the key findings of this study, such as a high prevalence of the fright factors ‘dread’ and ‘poorly understood by science’, can be problematic for risk communication in public health. These fright factors are closely related to threat and efficacy constructs in the Extended Parallel Processing Model (EPPM), a theory that explains how fear-arousing messages influence people (Witte, 1992). Although traditionally used to investigate the effectiveness of fear appeals in planned campaigns, the EPPM has been applied to news coverage of emerging health issues, such as H1N1 (Goodall et al., 2012). According to EPPM, an individual must have both confidence in the benefits and self-efficacy to carry out an action to reduce a health threat (such as the potential risk of wind turbines and adverse health effects). When individuals respond adversely, they may ignore subsequent messages, deny the threat, or engage in reactance (Witte, 1992). In the research presented in this thesis, articles in the sample of Ontario newspapers consistently publish messages of health threats from wind turbines, but also cite lack of scientific understanding on how to mediate these concerns. This is consistent with the “message rejection” response to fear appeal messages (a combination of high threat and low efficacy) where individuals will seek to manage or reduce their fear when they cannot avoid the threat (Goodall et al., 2012; Witte, 1992). In the case of wind turbines, individuals experiencing “message rejection” would be forced to reduce their exposure to wind turbines by either increasing their

distance from them (e.g., moving homes), or appealing to halt their development (e.g., call for moratoriums).

Another way of interpreting the influence of media on public attitudes is suggested by Lee, Scheufele and Lewenstein (2005). These scientists describe an integrated model of public attitudes towards nanotechnology (another emerging technology) that includes both cognitive and affective influences. Here, cognitive influences refer to the link between science literacy and public opinion, whereas affective influences refer to the link between emotions (such as concerns or fear) and public opinion. Similarly to nanotechnology, public opinion of wind energy is a combination of these two pathways.

The cognitive influences on public opinion of wind energy are (1) the level of scientific literacy about wind energy and, (2) the health literacy of the population. These findings suggest that scientific understanding of wind turbines and potential health effects is low, and often reported by newspapers in terms that are too complex for the average Ontarian to fully understand. The literature suggests that knowledge of scientific ideas and concepts are required for a range of behaviours and attitudes, such as informed public decision making and support for science (Lee, Scheufele, & Lewenstein, 2005). A mismatch in science literacy and risk information could result in misperceptions and reservations about the meaning of an emerging science (Miller & Kimmel, 2001). Awareness of new technologies are related to public support, but affective influences are necessary to fully explain variations in public opinion.

The affective influences on public opinion of wind energy are (1) negative emotions, such as fear or concern, and (2) trust regarding the level of scientific evidence. Closely related to heuristics, affective influences include emotional responses or mental shortcuts that are used to

form judgements on the risks of new technologies (Lee, Scheufele, & Lewenstein, 2005). Negative emotion, such as ‘dread’ and loaded words, may contribute to worry or fear, which is negatively related to benefit perceptions and positively related to risk perceptions of technology (Finucane et al., 2000). Therefore, the high prevalence of the fright factor ‘dread’, as well as the general negative tone in which wind turbines and health are presented in the Ontario newspaper articles, could skew public perceptions of wind energy. Finally, trust in scientific evidence is a highly influential variable for the formation of attitudes towards new technologies. Siegrist (2000) found that trust in the research conducted by companies in gene manipulations is closely related to public perceptions of benefit and risk, and ultimately public acceptance of gene technology. Trust may also have an enhanced effect when individuals lack scientific knowledge (Earle & Cvetkovich, 1995). This thesis research found that newspaper articles reported a lack of trust in both government and industry related to the implementation of wind energy. This could skew public attitudes towards the risks rather than benefits of wind energy development in Ontario.

Both cognitive and affective influences on public opinion are interactive in nature (Lee, Scheufele, & Lewenstein, 2005). The lack of understandable information regarding health risks from wind turbines, as indicated by fright factors such as ‘poorly understood by science’, themes of ‘lack of scientific understanding’, and the finding that newspaper articles on the subject were written at a high complexity, reduces the influence of cognitive processing on opinion formation. To compensate for this lack of risk information, people’s attitudes are more susceptible to influence from affective or emotional characteristics (Siegrist, Cvetkovich, & Roth, 2000). From an emotional standpoint, the newspaper information on wind turbines and health is negative, contains a large number of fright factors known to increase fear and anxiety, and communicates

distrust about government and industry. The combination of these characteristics could trigger and promote negative risk perceptions of Ontarians about wind turbines and their health effects.

7.2 Implications for Public Health

There is significant debate on the issue of wind turbines and health in Ontario, and two main sources of information are used by the public to make decisions: scientific peer-reviewed literature and the popular media (Knopper & Ollson, 2011). The most readily accessible and understandable information for the public is communicated by mass media. Sensationalist reporting, or the use of emotionally provocative language to present an issue, can have important consequences for how people interpret, understand, and act on health information (Dudo et al., 2007; MacDonald & Hoffman-Goetz, 2002). Additionally, the content of risk messages, including reading grade level and the presence of fright factors, can potentially influence health behaviours (Abdelmutti & Hoffman-Goetz, 2009; Bennett, 1999; Lunin, 1987; McCarthy et al., 2008). Understanding and managing risk messages and information related to wind turbines is a significant concern for policymakers, especially due to the rapid increase in Ontario's renewable energy capacity under the Climate Change Action Plan (MOE, 2010). Heightened public perception of wind turbines as a potential health risk, as voiced and emphasized in newspapers, may contribute to resistance to the implementation of wind turbines across the province. In the long term, reliance on non-renewable energy sources, such as coal, can adversely impact the health of the Ontario population, as evidenced by the association between coal consumption and life expectancy (Gohlke et al., 2011). Differences in risk messages about wind turbines and health between provincial and community newspapers may set the stage for greater or lesser resistance to wind turbines amongst Ontario communities. In general, effective risk communication can help to clarify the nature of disagreements and reduce their scope, enable

people to make more considered decisions, and lessen the resentment caused by people feeling excluded from decisions that affect them by providing a mechanism within which they can articulate their concerns (Bennett, 2010). By identifying characteristics of newspaper reporting on a contentious issue that is known to cause alarm and worry, public health and other government officials can develop more effective health communication campaigns. For example, to address the issue of ‘involuntary exposure’, an online forum could be created where local residents can voice their concerns to municipal and provincial governments about the placement of wind turbines.

7.3 Limitations

There are limitations to the research findings presented in this thesis, many of which have been noted in previous chapters. Specifically, the limitations regarding newspaper sampling, analytical techniques, and other variables should be considered in more detail.

Newspaper articles were retrieved through LexisNexis, an online database, and by manually searching newspaper websites and archives. The national/provincial newspapers were each searchable using the LexisNexis online database, whereas the community newspapers had to be searched either manually or using their respective websites. Although each of the sampling procedures was systematic, there was a potential for bias.

This study obtained newspapers according to a date range that was approximately two years prior to two years following the introduction of a major energy policy in Ontario, the Green Energy Act. Although comparisons were made before vs. after the implementation of this policy, whether these changes are spurious, correlational, or causal in relation to the GEA were impossible to infer from the data. For example, a variety of external factors could have contributed to the increase in the fright factors ‘dread’ and ‘poorly understood by science’

following the GEA. The report published by the Chief Medical Officer of Health in Ontario in 2010 could have promoted discussion of health effects from wind turbines and amplified the prevalence of fright factors. This “celebrity” effect is known to occur in media reporting of other health issues. For example, following the death of Steve Jobs, Chief Executive Officer of Apple® Inc., there was a substantial increase in media reporting of pancreatic cancer (Myrick, Willoughby, Noar, & Brown, 2013).

The analytical techniques of content analyses (including both “open” and “closed” coding), and the SMOG readability formula are subject to limitations. Although content analyses are inexpensive, non-invasive, and accurate proxy measures of prevailing attitudes (Driedger, 2007), they are descriptive rather than explanatory (Benjamin-Garner et al., 2002). In other words, content analysis is very useful in explaining ‘what’ is occurring in newspapers, but lacks the ability to infer ‘why’. Therefore, in this study of newspaper articles on wind turbines and health, inferences can only be made about what is written, but the readers’ interpretation of the content, and the resultant impact on perceptions and actions, are not known. Further study designs, such as survey or interview methodologies, will be necessary to identify the potential influence that wind turbine and health risk messages in newspapers may have on a reader’s behaviour.

Readability formulas do not measure other important elements of reading ease such as text coherence, semantic and syntactic elements, or design components such as white space and fonts (Doak, Doak & Root, 1996). Additionally, only one measure of readability, the SMOG, was used. Alternative methods, such as the Gunning Fog Index Readability Formula (FOG), the Flesch Reading Ease Formula (FRE), and the Fry Graph Readability Formula (FRY) could have

resulted in slightly lower reading grade level scores because their formulas are based on less strict guidelines (Friedman & Hoffman-Goetz, 2006).

7.4 Conclusions

To enable individuals to make informed decisions, researchers must know the factors that influence risk perception (Dohle, Keller, & Siegrist, 2012). Collectively, the studies conducted as part of this thesis identify several factors that are known to contribute to the development of risk perceptions. Ontario newspaper articles on wind turbines and health contained a large number of fright factors, especially ‘dread’ and ‘poorly understood by science’, which both increased in frequency after the introduction of a major policy initiative, and occurred more often in community relative to national/provincial newspapers. The majority of articles were written at a higher RGL than what is normally recommended by health educators for the general public for understanding. On average community newspapers were more readable in terms of text difficulty than national newspapers. Additionally, the health information in Ontario newspapers was often ambiguous, emphasized uncertainty, and provided inconsistent detail about wind turbines and health that was often linked with non-health concerns such as environmental damage and property values. Finally, the majority of articles (especially in community newspapers) were found to be negatively sensationalized.

The information presented in mass media can affect public opinion related to wind turbines and influence the acceptance or resistance to renewable energy technology programmes in Ontario and potentially elsewhere (Dearing & Rogers, 1996). Newspapers reporting of health concerns have widespread influence on the uptake of health campaigns, such as the HPV vaccination programme (Abdelmutti & Hoffman-Goetz, 2009) and on consumer behaviours, such as purchasing genetically modified foods (Frewer et al., 2002). Findings from this thesis

represent a first step in documenting possible effects of newspaper reporting on the issue of wind turbines and health effects on individual, social, or cultural norms (Riffe et al., 1998). Similar content analyses have contributed to understanding the public discourse about other health risks in Canadian newspapers (Holton et al., 2012; Rachul et al., 2011). Methodological approaches, such as surveys or interviews, will be necessary to collect data and to make inferences and predications about whether these characteristics of the newspaper reporting on health risks from wind turbines have a measurable impact on peoples' risk perceptions and behavioural responses to those perceived risks.

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References

- Abdelmutti, N., & Hoffman-Goetz, L. (2009). Risk messages about HPV, cervical cancer, and the HPV vaccine Gardasil: A content analysis of U.S. and Canadian national newspaper articles. *Women & Health, 49*, 422-440.
- Abdelmutti, N., & Hoffman-Goetz, L. (2010). Risk messages about HPV, cervical cancer, and the HPV vaccine Gardasil in North American news magazines. *Journal of Cancer Education, 25*, 451-456.
- Adams, R.J., Appleton, S.L., Hill, C.L., Dodd, M., Findlay, C., & Wilson, D.H. (2009). Risks associated with low functional health literacy in an Australian population. *Medical Journal of Australia, 191*, 530-534.
- Alasio, A. (2003). Rural and urban educational attainment: An investigation of patterns and trends, 1981-1996. *Rural and Small Town Canada Analysis Bulletin, 4*(5), 1-24.
- Alberta Energy. (2012). Launching Alberta's energy future, Provincial energy strategy. Retrieved from <http://www.energy.alberta.ca/Initiatives/1509.asp#production>
- Allan, S. (2002). *Media, risk and society*. Philadelphia: Open University Press.
- Altheide, D. (2002). *Creating fear: News and the construction of crisis*. Hawthorne, NY: Aldine de Gruyter.
- Amin, L., Hamdan, F., Hashim, R., Samani, M.C., Anuar, N., Zainol, Z.A., & Jusoff, K. (2011). Risks and benefits of genetically modified foods. *African Journal of Biotechnology, 10*, 12481-12485.

- Atkin, C. K., Smith, S. W., McFeters, C., & Ferguson, V. (2008). A comprehensive analysis of breast cancer news coverage in leading media outlets focusing on environmental risks and prevention. *Journal of Health Communication, 13*, 3-19.
- Bailin, A., & Grafstein, A. (2001). The linguistic assumptions underlying readability formulae: A critique. *Language and Communication, 21*, 285-301.
- Baker, L.M., Kars, M., & Wilson, F.L. (1997). The readability of medical information on InfoTrac: Does it meet the needs of people with low literacy skills? *Reference & User Services Quarterly, 37*(2), 155-160.
- Bakker, K., & Moulding, R. (2012). Sensory-processing sensitivity, dispositional mindfulness and negative psychological symptoms. *Personality and Individual Differences, 53*, 341-346.
- Baumgartner, F. & Jones, B. (1993). *Agendas and instability in American politics*. Chicago: University of Chicago Press.
- BC Hydro. (2013). Wind Energy: Weighing Wind Options. Retrieved from http://www.bchydro.com/energy-in-bc/meeting_demand_growth/energy_technologies/wind_energy.html
- Benham, G. (2006). The highly sensitive person: Stress and physical symptom reports. *Personality and Individual Differences, 40*, 1433-1440.
- Bernhardt, J.M., & Cameron, K.A. (2003). Accessing, understanding, and applying health messages: the challenge of health literacy. In TL Thompson, AM Dorsey, KI Miller, R Parrott (Eds.), *Handbook of Health Communication* (pp. 583-605). New Jersey, NY: Lawrence Erlbaum Associates, Inc.

- Bernhardt, J.M. (2004). Communication at the core of effective public health. *American Journal of Public Health*, 94(12), 2051-2053.
- Benjamin-Garner, R., Oakes, M., Meischke, H., Meshack, A., Stone, E.J., & Zapka, J., et al. (2002). Sociodemographic differences in exposure to health information. *Ethnicity & Disease*, 12, 124-135.
- Bennett, P. (1999). Understanding responses to risk: some basic findings. In P. Bennett and K. Calman (Eds.), *Risk communication and public health*. New York: Oxford University Press.
- Bennett, P. (2010). Understanding public responses to risk: policy and practice. In P. Bennett, K. Calman, S. Curtis, D. Fischbacher-Smith, (Eds.), *Risk communication and public health (second ed.)*. New York: Oxford University Press.
- Berkman, N.D., Davis, T.C., & McCormack, L. (2010). Health literacy: What is it? *Journal of Health Communication*, 15(S2), 9-19.
- Bernhardt, J.M., & Cameron, K.A. (2003). Accessing, understanding, and applying health communication messages: The challenge of health literacy. In T. L. Thompson, A. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of Health Communication* (pp. 583-605). New Jersey, NY: Lawrence Erlbaum Associates, Inc.
- Bill 150: An Act to enact the Green Energy Act, 2009 and to build a green economy, to repeal the Energy Conservation Leadership Act, 2006 and the Energy Efficiency Act and to amend other statutes. (2009). Assented May 14, 2009. Retrieved from http://www.ontla.on.ca/web/bills/bills_detail.do?BillID=2145
- Burke, D. (2011). GM food and crops: what went wrong in the UK? *EMBO Reports*, 5(5), 432-436.

Caburnay, C.A., Kreuter, M.W., Luke, D.A., Logan, R.A., Jacobsen, H.A., Reddy, V.C., Vempaty, A.R., Zayed, H.R. (2003). The news on health behavior: Coverage of diet, activity, and tobacco in local newspapers. *Health Education & Behavior*, 30(6), 709-722.

Canadian Community Newspaper Database (CCNAD). (2010). Community newspaper readership remains strong across the country. Retrieved from http://www.combase.ca/wp-content/uploads/2007/12/ComBase-2008-2009_ALL-MARKETS-PROVINCES.pdf

Canadian Council on Learning (CCL). (2007). State of learning in Canada: No time for complacency. Retrieved from http://www.ccl-cca.ca/pdfs/SOLR/2007/NewSOLR_Report.pdf

Canadian Council on Learning (CCL). (2008). Health literacy in Canada: A healthy understanding. Retrieved from <http://www.ccl-cca.ca/pdfs/HealthLiteracy/HealthLiteracyReportFeb2008E.pdf>

Canadian Newspaper Association and Canadian Community Newspaper Association (CCNA). (2011). *Canada's Newspaper Industry*. Retrieved from: <http://www.newspaperscanada.ca/about-us/about-us>.

Canadian Wind Energy Association (CANWEA). (2011). *List of wind farms*. Retrieved from: <http://www.canwea.ca/>

Canadian Wind Energy Association (CANWEA). (2012). Powering Canada's Future. Retrieved from http://www.canwea.ca/pdf/Canada%20Current%20Installed%20Capacity_e.pdf

- Canadian Wind Energy Association (CANWEA). (2013). *Canadian wind farms*. Retrieved from:
http://www.canwea.ca/farms/index_e.php
- Ceccoli, S., & Hixon, W. (2011). Explaining attitudes toward genetically modified foods in the European Union. *International Political Science Review*, 33, 301-319.
- Centre for Disease Control and Prevention (CDC). (2011). Adolescent and School Health: National Health Education Standards. Retrieved from
<http://www.cdc.gov/healthyyouth/sher/standards/>
- Chapman, S. (2011). Wind farms and health: who is fomenting community anxieties? *Medical Journal of Australia*, 195(9), 495.
- Chapman, S. (2012). Editorial ignored 17 reviews on wind turbines and health. *BMJ*, 344, e3366.
- Charbonneau, D.H. (2013). An analysis of benefits and risk information on pharmaceutical web sites for the treatment of menopause. *Health Information & Libraries Journal*. DOI: 10.1111/hir.12024.
- Chau, J., Bonfiglioli, C., Chey, T., & Bauman, A. (2009). The Cinderella of public health news: Physical activity coverage in Australian newspapers, 1986-2006. *Australian and New Zealand Journal of Public Health*, 33(2), 189-192.
- Chief Medical Officer of Health for Ontario (CMOH), 2010. *The Potential Health Impact of Wind Turbines*. Toronto: Ministry of Health and Long Term Care.
- Chinn, D. (2011). Critical health literacy: A review and critical analysis. *Social Science & Medicine*, 73, 60-67.

- Claassen, L., et al. (2012). Media coverage on electromagnetic fields and health: Content analysis of Dutch newspaper articles. *Health, Risk & Society*, 14(7-8), 681-696.
- Cochran, W.G. (1952). The X^2 test of goodness of fit. *Annals of Mathematical Statistics*, 23, 315-345.
- Colby, D., Dobie, R., Leventhall, G., Lipscomb, D.M., McCunney, R.J., Seilo, M.T., Sondergaard, B. (2009). Wind turbine sound and health effects: An expert panel review. Prepared for American Wind Energy Association and Canadian Wind Energy Association.
- Corbeil, J.P. (2006). International Adult Literacy Survey (IALS): The Canadian Component of the 2003 International Adult Literacy and Skills Survey (IALSS): The Situation of Official Language Minorities. Retrieved from <http://publications.gc.ca/Collection/Statcan/89-552-MIE/89-552-MIE2006015.pdf>
- Cousin, M. and Siegrist, M. (2011). Cell phones and health concerns: impact of knowledge and voluntary precautionary recommendations. *Risk Analysis*, 31(2), 301-311.
- Crabtree, B., and Miller, W. (1999). Using codes and code manuals: a template organizing style of interpretation. In: B. Crabtree and W. Miller, eds. *Doing Qualitative Research*. Newbury Park, CA: Sage, 163-178.
- Dahlstrom, M.F., Dudo, A., & Brossard, D. (2012). Precision of information, sensational information, and self-efficacy information as message-level variables affecting risk perceptions. *Risk Analysis*, 32(1), 155-166.
- Dearing, J., & Rogers, E. (1996). *Agenda-Setting. Communication Concepts 6*. Thousand Oaks: Sage Publications.

- Deignan, B., Harvey, E., and Hoffman-Goetz, L. (2013). Fright factors about wind turbines and health in Ontario newspapers before and after the Green Energy Act. *Health, Risk & Society*, 15(3), 234-250.
- Devine-Wright, P. (2005). Beyond NIMBYism: Towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy*, 8, 125-139.
- Doak, C.C., Doak, L. & Root, J. (1996). *Teaching patients with low literacy skills*. Philadelphia: J.B. Lippincott Company.
- Driedger, S.M. (2007). Risk and the media: a comparison of print and televised news stories of a Canadian drinking water risk event. *Risk Analysis*, 27(3), 775-786.
- Dudo, A.D., Dahlstrom, M.F., & Brossard, D. (2007). Reporting a potential pandemic: A risk-related assessment of avian influenza coverage in US newspapers. *Science Communication*, 28(4), 429-454.
- Dutta-Bergman, M.J. (2004). Primary sources of health information: Comparisons in the domain of health attitudes, health cognitions, and health behaviors. *Health Communication*, 16(3), 273-288.
- Edwards, A., Elwyn, G., Covey, J., Matthews, E., & Pill, R. (2001). Presenting risk information – A review of the effects of “framing” and other manipulations on patient outcomes. *Journal of Health Communication*, 6, 61-82.
- Einsiedel, E. (1994). Mental maps of science-knowledge and attitudes among Canadian adults. *International Journal of Public Opinion Research*, 6, 35-44.

- Eldridge, J. & Reilly, J. (2003). Risk and relativity: BSE and the British media. *In*: N. Pidgeon, R.E. Kasperson, and P. Slovic, eds. *The social amplification of risk*. Cambridge: Cambridge University Press, 138-155.
- Entman, R. (1993). Framing: Toward clarification of a fractured paradigm. *Journal of Communication*, 43(3), 51-58.
- European Wind Energy Association. (2012). Wind in power: 2011 European statistics. Retrieved from http://www.ewea.org/fileadmin/ewea_documents/documents/publications/statistics/Stats_2011.pdf
- Flynn, J., Slovic, P., & Mertz, C.K. (1993). Decidedly different: Expert and public views of risks from a radioactive waste depository. *Risk Analysis*, 13, 643-648.
- Finnegan, J. R., & Viswanath, K. (2002). Communication theory and health behavior change: The media studies framework. In K. Glanz, B. K. Rimer, & F. M. Lewis (Eds.), *Health behavior and health education: Theory, research and practice* (pp. 363-388). San Francisco: Jossey-Bass.
- Finucane, M.L., *et al.* (2000). Public perception of the risk of blood transfusion. *Transfusion*, 40, 1017-1022.
- Fisher, R. (2013). 'A gentleman's handshake': The role of social capital and trust in transforming information into usable knowledge. *Journal of Rural Studies*, 31, 13-22.
- Friedman, D.B., & Hoffman-Goetz, L. (2006). A systematic review of readability and comprehension instruments used for print and web-based cancer information, *Health Education & Behavior*, 33(3), 352-373.

- Friedman, S.M., & Egolf, B.P. (2011). A longitudinal study of newspaper and wire service coverage of nanotechnology risks. *Risk Analysis*, 31(11), 1701-1717.
- Frewer, L.J. (1999). Public risk perceptions and risk communication. In P. Bennett and K. Calman (Eds.), *Risk communication and public health*. New York: Oxford University Press.
- Frewer, L.J., *et al.* (2002). The media and genetically modified foods: evidence in support of social amplification of risk. *Risk Analysis*, 22(4), 701-711.
- Fung, T.K.F., Namkoong, K., & Brossard, D. (2011). Media, social proximity, and risk: a comparative analysis of newspaper coverage of avian flu in Hong Kong and the United States. *Journal of Health Communication*, 16(8), 889-907.
- Gazmararian, J.A., Williams, M.V., Peel, J. & Baker, D.W. (2003). Health literacy and knowledge of chronic disease. *Patient Education and Counselling*, 51(3), 267-275.
- Global Wind Energy Council. (2012). Global wind statistics 2011. Retrieved from http://www.gwec.net/fileadmin/images/News/Press/GWEC_-_Global_Wind_Statistics_2011.pdf
- Golke, J.M., Thomas, R., Woodward, A., Campbell-Lendrum, D., Pruss-Ustun, A., Hales, S., & Portier, C.J. (2011). Estimating the global public health implications of electricity and coal consumption. *Environmental Health Perspectives*, 119, 821-826.
- Goodall, C., Sabo, J., Cline, R., & Egbert, N. (2012). Threat, efficacy, and uncertainty in the first 5 months of national print and electronic news coverage of the H1N1 virus. *Journal of Health Communication*, 17, 338-355.

- Goodman, J.R., & Goodman, B.P. (2006). Beneficial or biohazard? How the media frame biosolids. *Public Understand. Sci.*, 15, 359-375.
- Gouvernement du Quebec (2012). Wind Energy. Retrieved from <http://www.mrnf.gouv.qc.ca/english/energy/wind/index.jsp>
- Gray, T., Haggett, C. & Bell, D. (2005). Offshore wind farms and commercial fisheries in the UK: A study in stakeholder consultation. *Ethics, Place & Environment*, 8, 127-140.
- Guteling, J.M., Oloffson, A., Fjaestad, B., Kohring, M., Goerke, A., Bauer, T., & Rusanen, T. (2002). Media coverage 1973-1996: Trends and dynamics. In M.W. Bauer, G. Gaskell (Eds.), *Biotechnology – The Making of a Global Controversy* (pp. 95-128). Cambridge, UK: Cambridge University Press.
- Hanning, C.D. & Evans, A. (2012a). Wind turbine noise. *British Medical Journal*, 344, e1527.
- Hanning, C.D. & Evans, A. (2012b). Authors' reply to Chapman. *British Medical Journal*, 344, e3367.
- Hartigan-Go, K. (2012). Challenges of drug risk communications in the Phillipines. *Drug Safety*, 35(11): 995-1004.
- Hesse-Biber, S.N., & Leavy, P. (2011). *The practice of qualitative research (2ndEd.)*. Thousand Oaks: Sage Publications, Inc.
- Hillier, D. (2006). The art and science of health risk communication. In: Hillier, D., ed. *Communicating health risks to the public: a global perspective*. Aldershot: Gower Publishing Limited.

- Holburn, G., Lui, K., & Morand, C. (2010). Policy risk and private investment in Ontario's wind power sector. *Canadian Public Policy*, 36(4), 465-486.
- Hoffman-Goetz, L. & Friedman, D.B. (2005) Disparities in the coverage of cancer information in ethnic minority and mainstream mass print media. *Ethnicity & Disease*, 15(2), 332-340.
- Hoffman-Goetz, L., Donnelle, L., & Ahmed, R. (2014, forthcoming). *Health Literacy in Canada: A Primer for Students*. Toronto: Canadian Scholars' Press Inc.
- Holton, A., *et al.* (2012). The blame frame: media attribution of culpability about the MMR-Autism vaccination scare. *Health Communication*, 27, 690-701.
- Hsieh, H.F., & Shannon, S.E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.
- Ipsos Reid. (2010). Wind energy in Ontario. Retrieved from http://www.canwea.ca/pdf/ipsosreid_ontariosurvey.pdf
- Johnson, B., Henderson, J., Pedersen, P., & Stonecipher, L. (2011). Framing asthma: A content analysis in U.S. newspapers. *Journal of Asthma & Allergy Educators*, 2(3), 135-142.
- Johnson, B.B., & Slovic, P. (1995). Presenting uncertainty in health risk assessment: Initial studies on its effects on risk perception and trust. *Risk Analysis*, 15(4), 485-494.
- Johnson, T. (1998). Shattuck lecture: medicine and the media. *New England Journal of Medicine*, 339, 87-92.
- Joseph, H.A., Fasular, A.M., Morgan, R.L., Stuckey, A., Alvarez, M.E., Margolis, A., Stratford, D., & Dooley, S.M. (2011). "The anticipation alone could kill you": Past

- and potential clients' perspectives on HIV testing in non-health care settings. *AIDS Education and Prevention*, 23(6), 577-594.
- Kaniss, P.C. (1991). *Making local news*. Chicago: University of Chicago Press Ltd.
- Kayhan, V.O. (2013). Seeking health information on the web: Positive hypothesis testing. *International Journal of Medical Informatics*, 82, 268-275.
- Khiefets, L., *et al.* (2010). Risk governance for mobile phones, power lines, and other EMF technologies. *Risk Analysis*, 30(10), 1481-1493.
- Kirschbaum, C., Prussner, J.C., Stone, A.A., Federenko, I., Gaab, J., Lintz, D., Schommer, N., & Hellhammer, D.H. (1995). Persistent high cortisol responses to repeated psychological stress in a subpopulation of healthy men. *Psychosomatic Medicine*, 57(5), 468-474.
- Kitzinger, J. (1999). Researching risk and the media. *Health, Risk & Society*, 1(1), 55-69.
- Klayman, J. & Ha, Y.W. (1995). Varieties of confirmation bias. *Psychology of Learning and Motivation*, 32, 385-418.
- Knopper, L.D., & Ollson, C.A. (2011). Health effects and wind turbines: a review of the literature. *Environmental Health*, 10, 78.
- Kriebel, D., *et al.* (2001). The precautionary principle in environmental science. *Environmental Health Perspectives*, 109(9), 871-876.
- Lee, C-J., Scheufele, D.A., & Lewenstein, B.V. (2005). Public attitudes towards emerging technologies: Examining the interactive effects of cognitions and affect on public attitudes toward nanotechnology. *Science Communication*, 27(2), 240-267.

- LePrevost, C.E., Blanchard, M.R., & Cope, W.G. (2012). Engaging Latino farmworkers in the development of symbols to improve pesticide safety and health education and risk communication. *Journal of Immigrant and Minority Health*, in press.
- Lofstedt, R.E. (2007). The impact of the Cox-2 inhibitor issue on perceptions of the pharmaceutical industry: Content analysis and communication implications. *Journal of Health Communication*, 12, 471-491.
- Liu, X., Vedlitz, A., & Alston, L. (2008). Regional news portrayals of global warming and climate change. *Environmental Science and Policy*, 11(5), 379-393.
- Lundgren, R.E., & McMakin, A.H. (2009). *Risk communication: a handbook for communicating environmental, safety, and health risks (fourth edition)*. New Jersey: John Wiley & Sons Inc.
- Lunin, L.F. (1987). Where does the public get its health information? *Bulletin of the New York Academy of Medicine*, 63(10), 923-938.
- MacDonald, M.M. & Hoffman-Goetz, L. (2002). A retrospective study of the accuracy of cancer information in Ontario daily newspapers. *Canadian Journal of Public Health*, 92(2), 142-145.
- Mazur, A. & Lee, J. (1993). Sounding the global alarm: Environmental issues in the US national news. *Social Studies of Science*, 23, 681-720.
- McCarthy, M., Brennan, M., De Boer, M., & Ritson, C. (2008). Media risk communication – what was said by whom and how was it interpreted? *Journal of Risk Research*, 11(3), 375-394.
- McCombs, M. (2004). *Setting the agenda: The mass media and public opinion*. Cambridge: Polity Press.

- McLaughlin, G. H. (1969). SMOG Grading – a New Readability Formula. *Journal of Reading, 12*, 639-646.
- McMurtry, R.Y. (2011). Toward a case definition of adverse health effects in the environs of industrial wind turbines: Facilitating a clinical diagnosis. *Bulletin of Science Technology & Society, 31* (4), 316-320.
- Meade, C.D., & Smith, C.F. (1991). Readability formulas: Cautions and criteria. *Patient Education and Counseling, 17*, 153-158.
- Meischke, H., Kuniyuki, A., Yasui, Y., Bowen, D. J., Anderson, R. & Urban, N. (2002). Information women receive about heart attacks and how it affects their knowledge, beliefs and intentions to act in a cardiac emergency. *Health Care for Women International, 23*, 149–162.
- Meissner, H.I., Potosky, A.L., & Convissor, R. (1992). How sources of health information relate to knowledge and use of cancer screening exams. *Journal of Community Health, 17*(3), 153-165.
- Merriman, B., Ades, T. & Seffrin, J. R. (2008). Health Literacy in the Information Age: Communicating Cancer Information to Patients and Families. *A Cancer Journal for Clinicians, 52*, 130-133.
- Meyer, P. (2009). *The Vanishing Newspaper: Saving Journalism in the Information Age* (2nd ed.). Columbia: University of Missouri Press.
- Miller, J.D., & Kimmel, L. (2001). *Biomedical communications: Purposes, audiences and strategies*. New York: John Wiley.

- Mills, J., et al. (2011). Organising collective action for effective environmental management and social learning in Wales. *Journal of Agricultural Education and Extension*, 17, 69-83.
- Ministry of Energy (MOEn). (2012). *Ontario's long-term energy plan*. Retrieved from: <http://www.energy.gov.on.ca/en/ltep/supply/>
- Ministry of the Environment (MOE). (2010). *Climate change: Greening our ways*. Retrieved from: <http://www.ene.gov.on.ca/>
- Ministry of the Environment (MOE). (2011). *Climate action: Adapting to change, protecting our future*. Retrieved from: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085424.pdf
- Mistry, B. & Driedger, S.M. (2012). Do the leads tell the whole story? An analysis of story leads of the Walkerton, Ontario E. coli contamination of drinking water supplies. *Health, Risk & Society*, 14(6), 583-603.
- Moreno, J.P., & Johnston, C.A. (2013). The role of confirmation bias in the treatment of diverse patients. *American Journal of Lifestyle Medicine*, 7(1), 20-22.
- Myrick, J.G., Willoughby, J.F., Noar, S.M., & Brown, J. (2013). Reactions of young adults to the death of Apple CEO Steve Jobs: Implications for cancer communication. *Communication Research Reports*, 30(2), 115-126.
- National Energy Board (NEB). (July 2011). Canadian energy overview 2010 – Energy briefing note. Retrieved from <http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/nrgyvrvw/cndnrgyvrvw2010/cndnrgyvrvw2010-eng.html>
- National Research Council (NRC). (1989). *Improving Risk Communication*. Washington, DC: National Academy Press.

- NB Power. (2013). Wind Energy. Retrieved from http://www.nbpower.com/html/en/save_energy/wind_energy/wind_energy.html
- Needham, H.E., Wiemann, C.M., Tortolero, S.R., & Chacko, M.R. (2010). Relationship between health literacy, reading comprehension, and risk for sexually transmitted infections in young women. *Journal of Adolescent Health, 46*, 506-508.
- Nelkins, D. (1987). *Selling science: How the press covers science and technology*. New York, NY: W. H. Freeman and Company.
- Newspaper Audience Databank (NAD). (2011). 2011 overview of results. Retrieved from <http://www.nadbank.com/en/study/readership>
- Nova Scotia Department of Energy. (2012). Nova Scotia Renewables Current Activity in Wind Energy. Retrieved from <http://www.gov.ns.ca/energy/renewables/current-activity/wind.asp>
- Nutbeam, D. (1998). Health promotion glossary. *Health Promotion International, 13*(4), 349-364.
- Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st Century. *Health Promotion International, 15*, 259-267.
- Oh, K.M., Kreps, G.L., Jun, J., Chong, E., & Ramsey, L. (2012). Examining the health information-seeking behaviors of Korean Americans. *Journal of Health Communication: International Perspectives, 17*(7), 779-801.
- Olowokure, B., et al. (2012). Volume of print media coverage and diagnostic testing for influenza A (H1N1)pdm09 virus during the early phase of the 2009 pandemic. *Journal of Clinical Virology, 55*(1), 75-78.

- Papadopoulos, A., et al. (2012). Enhancing public trust in the food safety regulatory system. *Health Policy*, 107, 98-103.
- Pedersen, E. & Persson Waye, K. (2004). Perception and annoyance due to wind turbine noise – a dose-response relationship. *Journal of the Acoustical Society of America*, 116(6), 3460-3470.
- Pedersen, E. & Persson Waye, K. (2007). Wind turbine noise, annoyance and self-reported health and well-being in different living environments. *Occupational and Environmental Medicine*, 64, 480-486.
- Pedersen, E., & Persson Waye, K. (2008). Wind turbines-low level noise sources interfering with restoration. *Environmental Research Letters*, 3, 1-5.
- Pedersen, E. (2011). Health aspects associated with wind turbine noise – results from three field studies. *Noise Control Engineering Journal*, 59(1), 47-53.
- Pedigo, A., et al. (2011). Identifying unique neighborhood characteristics to guide health planning for stroke and heart attack: fuzzy cluster and discriminant analyses approaches. *PLoS One*, 6(7), e22693.
- Peerson, A., & Saunders, M. (2009). Health literacy revisited: What do we mean and why does it matter? *Health Promotion International*, 24(3), 285-296.
- Phadke, R. (2010). Steel forests or smoke stacks: the politics of visualization in the Cape Wind controversy. *Environmental Politics*, 19, 1-20.
- Pidgeon, N, Harthorn B, and Satterfield T. (2011). Nanotechnology risk perceptions and communication: emerging technologies, emerging challenges. *Risk Analysis*, 31, 1694-1700.
- Pierpont, N. (2009). Wind turbine syndrome. Santa Fe: K-Selected Books.

- Putnam, R. (2000). *Bowline Alone – The Collapse and Revival of the American Community*. New York: Simon & Schuster.
- Rachul, C.M., *et al.* (2011). Canadian newspaper coverage of the A/H1N1 vaccine program. *Canadian Journal of Public Health*, 102(3), 200-203.
- Ratnapradipa, D., Getz, T.D., Zarcadoolas, C., Panzara, A.D., Esposito, V.,...Quilliam, D.N. (2010). Environmental health risk communication: Assessing levels of fish-consumption literacy among selected Southeast Asians. *Applied Environmental Education and Communication*, 9, 251-261.
- Rideout, K., Copes, R., & Bos, C. (2010). National Collaborating Centre for Environmental Health: Wind turbines and health
- Riesch, H., & Spiegelhalter, D.J. (2011). ‘Careless pork costs lives’: Risk stories from science to press release to media. *Health, Risk & Society*, 13(1), 47-64.
- Riffe, D., *et al.* (1998). *Analyzing media messages: Using quantitative content analysis in research*. New Jersey: Lawrence Erlbaum Associates, Inc.
- Rimer, B. K., Briss, P. A., Zeller, P. K., Chan, E. C., & Woolf, S. H. (2004). Informed decision making: What is its role in cancer screening? *Cancer*, 101(5 Suppl), 1214–1228.
- Rootman, I., & Gordon-El-Bihbety, D. (2008). A vision for a health literate Canada: Report of the expert panel on health literacy. Canadian Public Health Association, Ottawa.
- Retrieved from: www.cpha.ca.
- Rootman, I., & Ronson, B. (2003). Literacy and health in Canada: What we have learned and what can help in the future? Retrieved from http://www.cpha.ca/uploads/portals/h-l/literacy_e.pdf

- Rowe, G., Frewer, L., & Sjöberg, L. (2000). Newspaper reporting of hazards in the UK and Sweden. *Public Understanding of Science*, 9, 59-78.
- Rudd, R.E., Comings, J.P., & Hyde, J.N. (2003). Leave no one behind: Improving health and risk communication through attention to literacy. *Journal of Health Communication*, 8(S1), 104-115.
- Rudd, R.E., Rosenfeld, L., & Simonds, V.W. (2012). Health literacy: A new area of research with links to communication. *Atlantic Journal of Communication*, 20(1), 16-30.
- Salmon, C., & Atkin, C. (2003). Using Media Campaigns for Health Promotion. In T. L. Thompson, A. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of Health Communication* (pp. 449-472). New Jersey, NY: Lawrence Erlbaum Associates, Inc.
- Scheufele, D.A. (1999). Framing as a theory of media effects. *Journal of Communication*, 49(1), 103-122.
- Scheufele, D.A., & Lewenstein, B.V. (2005). The public and nanotechnology: How citizens make sense of emerging technologies. *Journal of Nanoparticle Research*, 7(6), 659-667.
- Schudson, M. (1978). *Discovering the News: A Social History of American Newspapers*. New York, NY: Basic Books.
- Scroggins, T.G. & Bartley, T.K. (1999). Enhancing cancer control: Assessing cancer knowledge, attitudes, and beliefs in disadvantaged communities. *The Journal of the Louisiana State Medical Society*, 151(4), 202-208.
- Sellers, J. Pickard, L., Mahoney, J.B., Jackson, K., Nelligan, P., Zimic-Vincetic, M., et al.

- (1997). Understanding and enhancing compliance with the second dose of hepatitis B vaccine: A cohort analysis and randomized control trial. *Canadian Medical Association Journal*, 157, 143-148.
- Shain, M. (2011). Public health ethics, legitimacy, and the challenges of industrial wind turbines: The case of Ontario, Canada. *Bulletin of Science Technology & Society*, 31, 346-353.
- Shepherd, D. (2012). Wind farms and health: who is fomenting community anxieties? To the Editor. *Medical Journal of Australia*, 196(2), 1.
- Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis*, 20, 2093-2106.
- Siegrist, M., Cvetkovich, G.T., & Roth, C. (2000). Salient value similarity, social trust and risk/benefit perception. *Risk Analysis*, 20, 713-719.
- Siegrist, M., & Gutscher, H. (2006). Flooding risks: A comparison of lay people's perceptions and expert's assessments in Switzerland. *Risk Analysis*, 26(4), 971-979.
- Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280-285.
- Slovic, P. (1992). Perception of risk: Reflections on the psychometric paradigm. In S. Krimsky & D. Golding (Eds.), *Social Theories of Risk* (pp. 117-152). Westport, CT: Praeger.
- Slovic, P. (2000). Perception of risk. In: P. Slovic, ed. *The perception of risk*. London: Earthscan Publications Ltd, 220-231.
- Smith, J.L., & Haggerty, J. (2003). Literacy in primary care populations: Is it a problem? *Canadian Journal of Public Health*, 94(6), 408-412.
- Soroka, S.N. (2002). *Agenda-setting dynamics in Canada*. Vancouver: UBC Press.

- Sudore, R.L., Mehta, K.M., Simonsick, E.M., Harris, T.B., Newman, A.B., Satterfield, S., et al. (2006). Limited literacy in older people and disparities in health and healthcare access. *Journal of the American Geriatrics Society*, 54(5), 770-776.
- Sunstein, C.R., & Zeckhauser, R. (2011). Overreaction to fearsome risks. *Environmental and Resource Economics*, 48, 435-449.
- Swofford, J., & Slattery, M. (2010). Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. *Energy Policy*, 38, 2508-2519.
- Taylor, C.A., & Sorenson, S.B. (2002). The nature of newspaper coverage of homicide. *Injury Prevention*, 8, 121-127.
- Todt, O., González, M.I. & Estévez, B. (2011). Conflict in the Sea of Trafalgar: offshore wind energy and its context. *Wind Energy*, 14, 699-706.
- Tversky, A., & Kahneman, D. (1982). Availability: A heuristic for judging frequency and probability. In D. Kahneman, P. Slovic, & A. Tversky (Eds.). *Judgement Under Uncertainty: Heuristics and Biases* (pp. 163-189). Cambridge: Cambridge University Press.
- Vilella-Vila, M., Costa-Font, C. (2008). Press media reporting effects on risk perceptions and attitudes towards genetically modified (GM) food. *The Journal of Socio-Economics*, 37, 2095-2106.
- Viswanath, K., Breen, N., Meissner, H., Moser, R.P., Hesse, B., Steele, W.R., & Rakowski, W. (2006). Cancer knowledge and disparities in the information age. *Journal of Health Communication*, 11, 1-17.

- Viswanath, K., Blake, K. D., Meissner, H. I., Saiontz, N. G., Mull, C., Freeman, C. S., & Croyle, R. T. (2008). Occupational practices and the making of health news: A national survey of US health and medical science journalists. *The Journal of Health Communication, 13*, 759–777.
- Vogelzangs, N., Beekman, A.T.F., Milaneschi, Y., Bandinelli, S., Ferrucci, L., & Penninx, B.W.J.H. (2010). Urinary cortisol and six-year risk of all-cause and cardiovascular mortality. *The Journal of Clinical Endocrinology & Metabolism, 95*(11), 4959-4964.
- von Kanel, R. (2012). Psychosocial stress and cardiovascular risk – current opinion. *Swiss Medical Weekly, 142*(w13502), 1-13.
- Waichman, A.V., Eve, E., Nina, N.C.S. (2007). Do farmers understand the information displayed on pesticide product labels? A key question to reduce pesticides exposure and risk of poisoning in the Brazilian Amazon. *Crop Protection, 26*, 576-583.
- Wallington, S. F., Blake, K., Taylor-Clark, K., & Viswanath, K. (2010). Antecedents to Agenda Setting and Framing in Health News: An Examination of Priority, Angle, Source, and Resource Usage from a National Survey of U.S. Health Reporters and Editors. *Journal of Health Communication, 15*, 76-94.
- Warren, C. R. & Birnie, R. V. (2009). Re-powering Scotland: Wind farms and the ‘Energy or Environment?’ Debate. *Scottish Geographical Journal, 125*, 97-126.
- Watson, I., Betts, S., & Rapaport, E. (2012). Determining appropriate wind turbine setback distances: Perspectives from municipal planners in the Canadian provinces of Nova Scotia, Ontario, and Quebec. *Energy Policy, 39*(3), 1647-1658.

- Weaver, D. H. (2007). Thoughts on agenda setting, framing, and priming. *Journal of Communication, 57*, 142–147.
- Welch, J.B., & Venkateswaran, A. (2009). The dual sustainability of wind energy. *Renewable and Sustainable Energy Reviews, 13*(5), 1121-1126.
- Westwood, B., Westwood, G. (1999). Assessment of newspaper reporting of public health and the medical model: A methodological case study. *Health Promotion International, 14*, 53-64.
- Williams, M.V., Baker, D.W., Parker, R.M., & Nurss, J.R. (1998). Relationship of functional health literacy to patients' knowledge of their chronic disease: A study of patients with hypertension and diabetes. *Archives of Internal Medicine, 158*, 166-172.
- Winslow, E.H., & Jacobsen, A.F. (1998). Research for Practice. *American Journal of Nursing, 98*(7), 55-57.
- Wolf, M.S., Feinglass, J., Thompson, J., & Baker, D.W. (2010). In search of 'low health literacy': Threshold vs. gradient effect of literacy on health status and mortality. *Social Science & Medicine, 70*, 1335-1341.
- World Health Organization (WHO). (1998). Health promotion glossary. Retrieved from <http://www.who.int/healthpromotion/about/HPR%20Glossary%201998.pdf>
- World Health Organization (WHO). (2013). Food safety: Risk communication. Retrieved from <http://www.who.int/foodsafety/micro/riskcommunication/en/>
- Wind Concerns Ontario (WCO). (2011). *About Us*. Retrieved from <http://www.freewco.blogspot.ca/>

- Williams, M.V., Baker, D.W., Parker, R.M., & Nurss, J.R. (1998). Relationship of functional health literacy to patients' knowledge of their chronic disease: A study of patients with hypertension and diabetes. *Archives of Internal Medicine*, 158(2), 166-172.
- Witte, K. (1992). Putting the fear back into fear appeals: Implications for effective public health campaigns. *Health Education & Behaviour*, 27, 608-632.
- Witte, K., Meyer, G. & Martell, D. (2001). *Effective health risk messages: A step-by-step guide*. California: Sage Publications, Inc.
- Woodall, E.D., Taylor, V.M., Yasui, Y., Ngo-Metzer, Q., Burke, N., Thai, H., & Jackson, J.C. (2006). Sources of health information among Vietnamese American men. *Journal of Immigrant and Minority Health*, 8(3), 263-271.
- World Health Organisation. (2009). Night noise guidelines for Europe. Copenhagen.
- U.S. Department of Health and Human Services. (2010). *TOOLKIT for Making Written Material Clear and Effective. Part 7: Using readability formulas: A cautionary note*. Retrieved from: <http://www.cms.gov/Outreach-and-Education/Outreach/WrittenMaterialsToolkit/ToolkitPart07.html>
- Young, M.E., et al. (2008). Medicine in the popular press: the influence of the media on perceptions of disease. *PLoS One*, 3(10), e3552.
- Zarghami, M. (2011). Selection of person of the year from public health perspective: Promotion of mass clusters of copycat self-immolation. *Iran Journal of Psychiatry and Behavioral Science*, 6(1), 1-11.

Zijlstra, G.A.R., Tennstedt, S.L., van Haastregt, J.C.M., van Eijk, J.Th.M., & Kempen, G.I.J.M. (2006). Reducing fear of falling and avoidance of activity in elderly persons: The development of a Dutch version of an American intervention. *Patient Education and Counseling*, 62, 220-227.

Appendices

Appendix A: Map of Ontario Wind Generators (Grid-Connected)

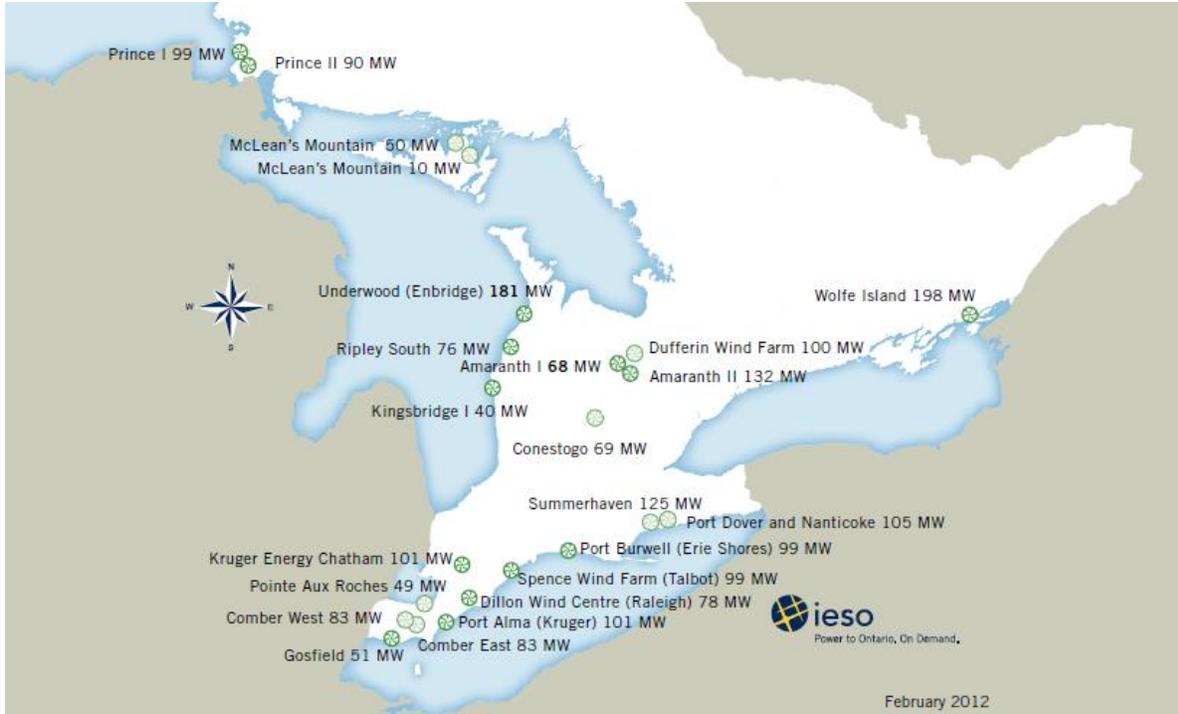


Figure 8: Map of Current Grid-Connected Ontario Wind Generators

Appendix B: Example of Cross-Section of Census Subdivision using Statistics Canada GeoSearch2006 tool and Google Maps (showing roughly the same area: Kincardine, ON)

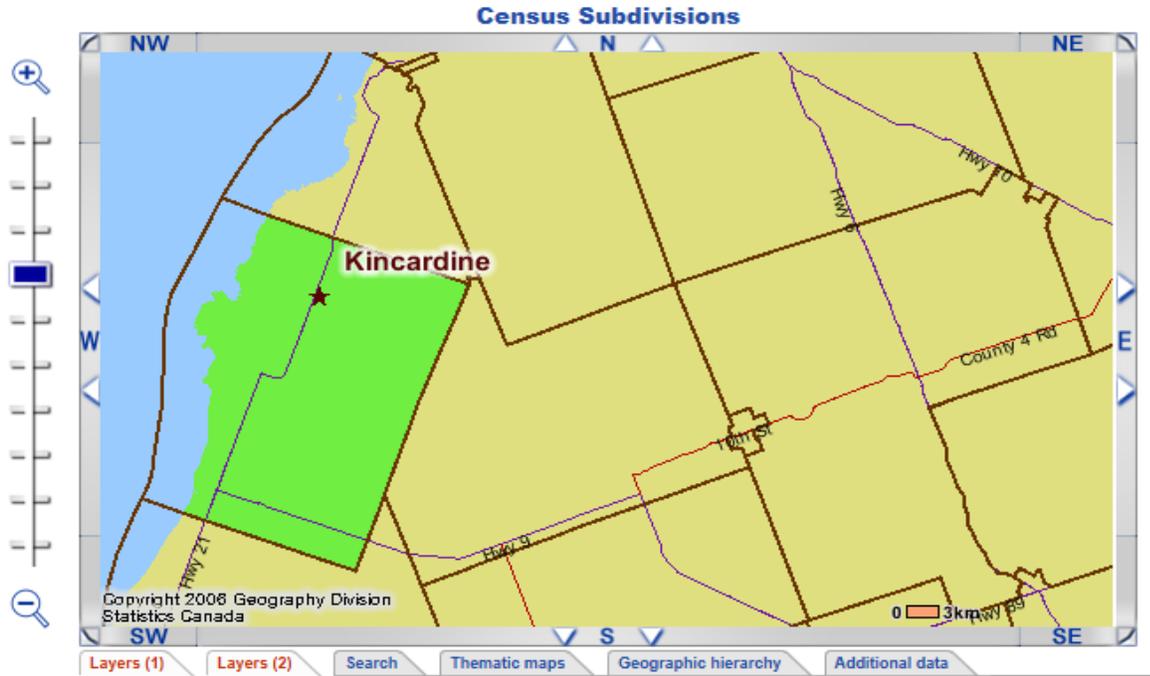


Figure 9: 2006 Canadian Census Subdivisions Map from Statistics Canada

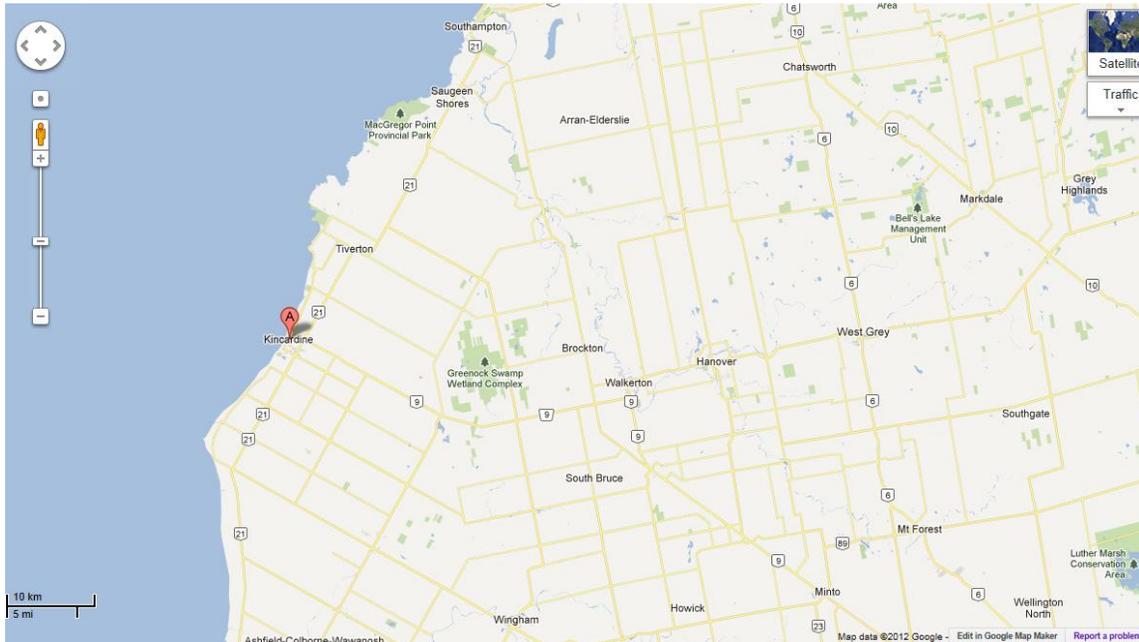


Figure 10: Google Maps View (showing roughly the same area: Kincardine, ON)

Appendix C: Representative statistical output from SPSS data analysis

Study #1: Chi-square tests for the fright factor 'dread' in community and national/provincial newspapers

Paper Type*Dread

Paper Type * Dread Identified Crosstabulation

		Dread Identified		Total	
		No	Yes		
Paper Type	Community	Count	9	262	271
		% within Paper Type	3.3%	96.7%	100.0%
		% within Dread Identified	33.3%	66.5%	64.4%
	National/Provincial	Count	18	132	150
		% within Paper Type	12.0%	88.0%	100.0%
		% within Dread Identified	66.7%	33.5%	35.6%
Total		Count	27	394	421
		% within Paper Type	6.4%	93.6%	100.0%
		% within Dread Identified	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.118 ^a	1	.000		
Continuity Correction ^b	10.715	1	.001		
Likelihood Ratio	11.494	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	12.089	1	.001		
N of Valid Cases	421				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.62.

b. Computed only for a 2x2 table

Study #2: ANOVA for Reading Grade Level by Newspaper Type with Tukey's HSD Post Hoc Test

Between-Subjects Factors

		Value Label	N
Paper Type with Large City Newspapers	1	Community	271
	2	Provincial	83
	3	National	67

Descriptive Statistics

Dependent Variable: Reading Grade Level (SMOG)

Paper Type with Large City Newspapers	Mean	Std. Deviation	N
Community	13.187	1.7939	271
Provincial	13.149	1.7163	83
National	13.860	1.8774	67
Total	13.286	1.8056	421

Tests of Between-Subjects Effects

Dependent Variable: Reading Grade Level (SMOG)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	26.272 ^a	2	13.136	4.088	.017
Intercept	52691.249	1	52691.249	16399.309	.000
PapType2	26.272	2	13.136	4.088	.017
Error	1343.041	418	3.213		
Total	75688.460	421			
Corrected Total	1369.313	420			

a. R Squared = .019 (Adjusted R Squared = .014)

Estimated Marginal Means

Paper Type with Large City Newspapers

Dependent Variable: Reading Grade Level (SMOG)

Paper Type with Large City Newspapers	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Community	13.187	.109	12.973	13.401
Provincial	13.149	.197	12.763	13.536
National	13.860	.219	13.429	14.290

Post Hoc Tests

Paper Type with Large City Newspapers

Multiple Comparisons

Dependent Variable: Reading Grade Level (SMOG)

Tukey HSD

(I) Paper Type with Large City Newspapers	(J) Paper Type with Large City Newspapers	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Community	Provincial	.037	.2249	.985	-.492	.566
	National	-.673*	.2446	.017	-1.248	-.098
Provincial	Community	-.037	.2249	.985	-.566	.492
	National	-.710*	.2944	.043	-1.403	-.018
National	Community	.673*	.2446	.017	.098	1.248
	Provincial	.710*	.2944	.043	.018	1.403

Based on observed means.

The error term is Mean Square(Error) = 3.213.

*. The mean difference is significant at the .05 level.

Study #3: Frequency tables for Auxiliary Concerns to Human Health

Frequency Table

Aux. - Property values

	Frequency	Percent	Valid Percent	Cumulative Percent
No	335	79.6	79.6	79.6
Valid Yes	86	20.4	20.4	100.0
Total	421	100.0	100.0	

Aux. - Financial

	Frequency	Percent	Valid Percent	Cumulative Percent
No	347	82.4	82.4	82.4
Valid Yes	74	17.6	17.6	100.0
Total	421	100.0	100.0	

Aux. - Visually Damaging

	Frequency	Percent	Valid Percent	Cumulative Percent
No	344	81.7	81.7	81.7
Valid Yes	77	18.3	18.3	100.0
Total	421	100.0	100.0	

Aux. - Environmental

	Frequency	Percent	Valid Percent	Cumulative Percent
No	304	72.2	72.2	72.2
Valid Yes	117	27.8	27.8	100.0
Total	421	100.0	100.0	

Study #4: Chi-square test for article tone (positive/neutral or negative) based on human health focus

Focus of Article * Article Tone (positive/neutral vs. negative) Crosstabulation

		Article Tone (positive/neutral vs. negative)		Total	
		Negative	Positive or neutral		
Focus of Article	Human Health	Count	223	11	234
		% within Focus of Article	95.3%	4.7%	100.0%
		% within Article Tone (positive/neutral vs. negative)	59.3%	24.4%	55.6%
	Other	Count	153	34	187
		% within Focus of Article	81.8%	18.2%	100.0%
		% within Article Tone (positive/neutral vs. negative)	40.7%	75.6%	44.4%
Total	Count	376	45	421	
	% within Focus of Article	89.3%	10.7%	100.0%	
	% within Article Tone (positive/neutral vs. negative)	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	19.787 ^a	1	.000		
Continuity Correction ^b	18.400	1	.000		
Likelihood Ratio	20.180	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	19.740	1	.000		
N of Valid Cases	421				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 19.99.

b. Computed only for a 2x2 table

Appendix D: Representative NVivo Coding

Study #1: Fright Factor Coding

Huron-Kinloss council endorses tough resolutions on industrial wind turbines

"Wind turbine health" relevance = 63%

Posted 5 months ago – Mar. 2, 2011

Huron-Kinloss council has not only endorsed tough resolutions against industrial wind turbines by other municipalities, they have created their own.

At the council meeting on Feb. 22, council approved a resolution from the North Perth Municipality calling on the province to put a halt on industrial wind turbines until independent health studies have been completed and a full environmental study done to determine the possible impact.

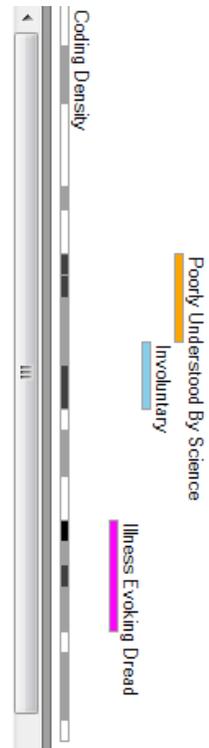
North Perth also wants the province to introduce legislation that restores some power to local councils to deal with these wind turbines, allowing municipalities to set appropriate setbacks specific to its jurisdiction.

Huron-Kinloss also endorsed the resolution from Arran-Elderslie to put a freeze on the issuance of any kind of permits that would lead to the development of industrial wind turbines until the Grey-Bruce medical officer of health, Dr. Hazel Lynn, has completed a study or had a third-party study done to the approval of the Grey-Bruce Health Centre that answers these questions to its satisfaction.

Huron-Kinloss council also approved its own resolution, saying this step was prompted by concerns for the health, safety and well-being of its constituents, as well as the Grey-Bruce medical officer of health, and because the provincial government, having implemented the Green Energy Act, has not shown any concern for the health, safety and well-being of the people the township it represents.

Now the township has adopted a wind turbine development policy in an effort to protect the residents of Huron-Kinloss from health-related and land-development concerns.

The township will not issue building permits for industrial wind turbines to those developers who do not adhere to the policies contained in the wind turbine development policy.



Study #3: Thematic Analysis Coding

Wind study will be refreshing

"Wind farm health" relevance = 52%

Updated 8 months ago – Dec. 7, 2010

The news that Grey-Bruce Medical Officer of Health, Dr. Hazel Lynn, will be is preparing a study on the health effects of wind turbines is refreshing.

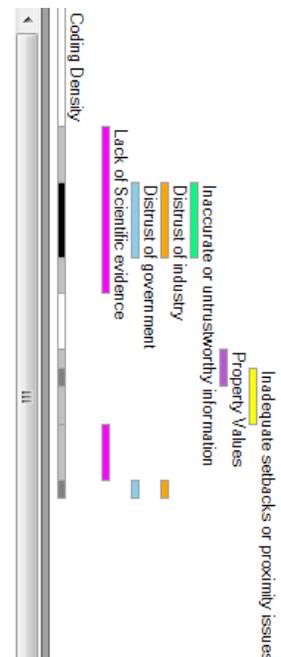
Until now, the health 'studies' that have been referenced have been conducted 'independently' by groups under the payroll of wind companies, their lobby group, or the provincial government, all which stand to gain from the sale and lease of land for wind projects in our area.

While the province's medical officer of health has written off the health issues, Dr. Lynn has maintained there is something more to the issue than to present it as a cut and dried case, releasing the wind companies from any additional responsibilities. There are likely those who are complainers, some who are ultra-sensitive when it comes to wind power and others who let the anti-wind power issue consume them. These are the kind of people the province is targeting in order to write-off the issue as an "annoyance."

Regardless, there are issues beyond what the other 'health studies' have revealed that are impacting people's lives. The stress of the impact on property values and the ability to sell one's home in proximity to turbines is no doubt a factor. The proximity of turbines is also under the microscope.

I'm sure many will anxiously await Dr. Lynn's study and the many cases she's deal with in our area. We have one of the highest concentrations of turbines in the province, so this is the perfect place for a case study.

As anxious as the public will be, I'm sure the province and others who benefit will be the first to respond once it's revealed.



Study #4: Emotional Tone

Bruce County pushing for research on wind turbine health effects

By PAT HALPIN, SPECIAL TO THE NEWS

Updated 1 year ago – Nov. 26, 2010

Bruce County is still pushing for research on the health impacts of wind turbines.

On Thursday the Agriculture, Tourism and Planning committee recommended support of resolutions from Grey County, Grey Bruce Public Health and Kawartha Lakes all calling for investigation into reports of adverse health effects reported by people living near turbines.

All levels of government are under pressure over reports of those adverse health affects, said Warden Mike Smith.

He wants a definitive study to determine if the reports are legitimate.

"There's some question out in the community that there is some health effect to (turbines) in certain conditions," Smith said.

"What we want is some clarification about if they're legitimate and if it is it might perhaps affect how we site (turbines) or how we locate them."

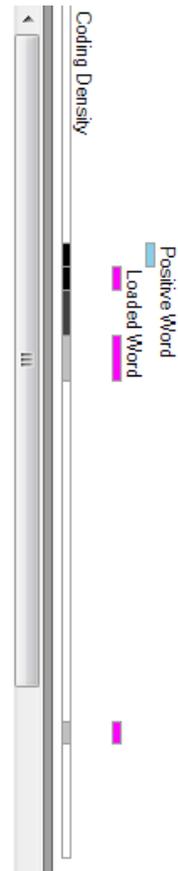
That could mean a need for new rules on where and how turbines are located.

There are already a number of health studies on turbines, but Smith said Bruce County is looking for a more comprehensive study based on broad research.

The province has indicated it's prepared to look for answers.

"In certain cases there seems to be legitimate complaints. It would be nice to answer that question. I think that's really all we're asking. Let's do this definitively," Smith said. "Perhaps we can say where (turbines) should be sited and where they shouldn't be

A definitive health study is important, Smith said, because the province is pressing ahead with turbine deals under the Green Energy Act.



Appendix E: Representative SMOG Analysis

Wind study will be refreshing

Kincardine News – Dec. 7, 2010

The news that Grey-Bruce **Medical Officer** of Health, Dr. Hazel Lynn, will be **preparing** a study on the health effects of wind turbines is **refreshing**.

Until now, the health 'studies' that have been **referenced** have been **conducted 'independently'** by groups under the payroll of wind **companies**, their lobby group, or the **provincial government**, all which stand to gain from the sale and lease of land for wind projects in our **area**.

While the province's **medical officer** of health has written off the health issues, Dr. Lynn has maintained there is something more to the issue than to present it as a cut and dried case, **releasing** the wind **companies** from any **additional responsibilities**. There are likely those who are **complainers**, some who are **ultra-sensitive** when it comes to wind power and others who let the **anti-wind** power issue consume them. These are the kind of people the province is **targeting** in order to write-off the issue as an "**annoyance**."

Regardless, there are issues beyond what the other 'health studies' have revealed that are **impacting** people's lives. The stress of the impact on **property** values and the **ability** to sell one's home in **proximity** to turbines is no doubt a factor. The **proximity** of turbines is also under the **microscope**.

I'm sure many will **anxiously** await Dr. Lynn's study and the many cases she's deal with in our **area**. We have one of the highest **concentrations** of turbines in the province, so this is the perfect place for a case study.

As anxious as the public will be, I'm sure the province and others who **benefit** will be the first to respond once it's revealed.

Number of polysyllabic words (highlighted): 33

Number of sentences: 11

Number of polysyllabic words per sentence: $33/11 = 3$

Number of polysyllabic words in 30 sentences: $3 \times 19 = 57 + 33 = 90$

$$\text{SMOG} = \sqrt{PSW} + 3 = \sqrt{90} + 3 = 12.5$$

Therefore, the SMOG reading grade level of this newspaper article is 12.5

Appendix F: Justification for Collapsing National and Provincial Newspapers in Study #1

Paper Type * Dread Identified

Crosstab

Count

		Dread Identified		Total
		No	Yes	
Paper Type	Local/Community	9	262	271
	Provincial	18	132	150
Total		27	394	421

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.118 ^a	1	.000		
Continuity Correction ^b	10.715	1	.001		
Likelihood Ratio	11.494	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	12.089	1	.001		
N of Valid Cases	421				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.62.

b. Computed only for a 2x2 table

Paper Type separating national and provincial * Dread Identified

Crosstab

Count

		Dread Identified		Total
		No	Yes	
Paper Type separating national and provincial	Community	9	262	271
	Provincial	7	76	83
	National	11	56	67
Total		27	394	421

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.055 ^a	2	.000
Likelihood Ratio	13.722	2	.001
Linear-by-Linear Association	15.812	1	.000
N of Valid Cases	421		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.30.