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How do Canadian media report climate change impacts on health? A newspaper review

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Abstract

Research on climate change media coverage is growing. Few studies, however, have investigated how the media portrays climate change impacts on human health. This review, therefore, presents a quantitative spatiotemporal analysis of Canadian newspaper coverage of climate change impacts on health between 2005 and 2015. Using the ProQuest® and Eureka® databases, a multi-phase systematic review strategy was employed to identify relevant articles from two national and six regional high-circulation newspapers. Quantitative and qualitative data were extracted from 145 articles and analyzed to characterize the range, extent, and nature of climate-health newspaper coverage in Canada, and to compare these characteristics by region and over time. Coverage varied by region, with the highest proportion of climate-health coverage in Northern Territories (Yukon, Northwest Territories, Nunavut). Over time, there was a decreasing publication frequency trend. Almost all articles described negative climate change impacts on health, with a predominant focus on infectious and chronic non-infectious diseases; however, less than half of the articles discussed climate change solutions. These trends suggest that current media coverage might not drive widespread public support for policies and actions needed to protect against projected climate-health risks. Consequently, as climate change continues to challenge human health, increasing media emphasis on climate change impacts on human health, as well as a shift toward enabling and empowering climate change communication, in which viable mitigation and adaptation options are emphasized, could help to spur action to reduce climate change health risks.

Keywords: Climate change; Health; Newspaper; Systematic review; Canada; Media

1. Introduction

The negative impacts of climate change on human health are now considered unequivocal (Smith et al. 2014; Watts et al. 2015, 2017). With climate change impacts on health resulting in over 5.5 million Disability Adjusted Life Years in 2000 (Costello et al. 2009), human health risks are a key climate change concern identified by the Intergovernmental Panel on Climate Change (IPCC) with high confidence (IPCC 2014). The projected health consequences of climate change are wide-ranging, including increased prevalence of infectious diseases, chronic diseases, mental health challenges, injuries, and mortality (Smith et al. 2014; Watts et al. 2015, 2017; Trombley et al. 2017). These impacts vary regionally, and are more pronounced in particular geographical areas (e.g. Arctic regions) and amongst specific populations (e.g. Indigenous populations) (Smith et al. 2014; Watts et al. 2017).

Based on growing climate change concerns, media communication about climate change is substantial and increasing over time (Boykoff 2007a, b; Ahchong and Dodds 2012; Schmidt et al. 2013; Davidsen and Graham 2014; Schäfer and Schlichting 2014; Moser 2016). Newspapers are one of the public's primary information sources for science and policy, including climate change (Boykoff 2007a; Schmidt et al. 2013; Ford and King 2015); this is particularly true in Canada where 87% of Canadian adults read at least some newspaper content weekly (Newspapers Canada 2016). Moreover, since high-circulation newspapers also influence the agenda of other media, including national television and web-based news, newspapers are increasingly recognized for their pivotal influence on public perception by determining the quantity and nature of climate change information that reaches the public (Golan 2006; Dotson et al. 2012). In turn, these media-shaped public perceptions are critical with respect to influencing

government climate change-related decision-making and policy agenda-setting (Soroka 2002; Schmidt et al. 2013; Feldman and Hart 2018).

Reflecting the media's influential role on climate change perceptions and decision-making, there has been a proliferation of research investigating climate change media coverage and agenda-setting (Antilla 2005; Liu et al. 2008; Ahchong and Dodds 2012; Schmidt et al. 2013; Schäfer and Schlichting 2014; Belfer et al. 2017; Feldman and Hart 2018). These studies identify that news media exert their influence in several ways (Liu et al. 2008; Ahchong and Dodds 2012; Ford and King 2015). First, through controlling the number of published articles addressing a particular issue, media coverage affects the salience, and therefore public awareness and political agenda-setting, of issues (Liu et al. 2008; Dotson et al. 2012). Salience is believed to be one of the most important factors in generating public thought and opinion, with studies showing concordance between media coverage and public perceptions of issue salience (Blood and Phillips 1997; Liu et al. 2008; Dotson et al. 2012). Second, through the use of specific frames (i.e. terminology, tone, and themes), the media can portray an issue in a particular way and thus influence public perceptions, including issue certainty and potential solutions (Boykoff 2008; Dotson et al. 2012; Schuldt and Roh 2014; Ford and King 2015; Feldman and Hart 2018). For example, a recent body of research focusing on the emotions associated with climate change media coverage has found that stories evoking worry, interest, and hope are those most likely to elicit climate change policy support (Myers et al. 2012; Smith and Leiserowitz 2014; Feldman and Hart 2016, 2018; Prescott and Logan 2018). Furthermore, research shows that the framing of climate change as a public health issue, as opposed to solely an environmental issue, enhances individual engagement in mitigation and adaptation activities (Nisbet 2009; Myers et al. 2012; Watts et al. 2017; Weathers et al. 2017; Prescott and Logan 2018).

Despite the consensus that climate change will have negative impacts on population health, as well as the media's recognized role in influencing public perception and policy-making, few studies have investigated how climate change impacts on health are portrayed in the media. Given the increasing threat climate change poses for health outcomes, understanding how the issue is framed publicly is important for policymakers and practitioners, and can help inform communication and outreach efforts (Liu et al. 2008; Ford and King 2015; Watts et al. 2017; Weathers et al. 2017). Additionally, although climate change impacts and potential solutions vary regionally, most existing climate-media research focuses on national-level media outlets, whereas few studies provide insights into regional media coverage trends (Liu et al. 2008; Davidsen and Graham 2014). In response to these gaps, this study presents a quantitative spatiotemporal analysis of the coverage of climate change impacts on health in two national and six regional high-circulation newspapers across Canada between 2005 and 2015. The main goal of this review was to characterize the range, extent, and nature of climate-health newspaper coverage in Canada. Specifically, we examine the statistical differences in coverage, if any, over space and time. Although this article specifically explores Canadian newspapers, the results more broadly inform climate-health media communication strategies, and illustrate the importance of examining media trends in order to improve the effectiveness of climate-health media communication.

2. Methods

2.1 Search Strategy and Screening

Following Ford & King's (2015) approach to reviewing newspaper reporting, a multi-phase screening strategy was employed to locate relevant articles published between January 1st, 2005

and December 31st, 2015. Potentially relevant articles were identified through an online ProQuest® database search; the Eureka® database was used to search Le Journal de Montréal as it was not indexed within ProQuest® (Lanovaz et al. 2015). The search string was comprised of key population (e.g. Canadian, public), exposure (e.g. climate change, global warming), and outcome terms (e.g. infectious, sickness) (Supplementary File 1). The search string accounts for the plurality of language used in the media to describe 'climate change', and aligns with previous study methodologies investigating climate change newspaper coverage (Liu et al. 2008; Ahchong and Dodds 2012; Schmidt et al. 2013; Davidsen and Graham 2014; Ford and King 2015). The database search was conducted on October 13th, 2016. To capture geographical variations in climate-health newspaper coverage[1], the review included the two most highly circulated national-level newspapers and the most highly circulated newspaper in each Canadian region (Ford and King 2015; Newspapers Canada 2015) (Table 1). As outlined in Table 1, regions were defined according to Statistics Canada's regional boundaries and included one to four provinces/territories (Statistics Canada 2015a).

Potentially relevant articles retrieved by the initial search were imported into EndNote™ Basic (Thomas Reuters, 2016) for de-duplication. Remaining articles were then imported into the online screening software DistillerSR© (Evidence Partners, 2016). To manage the large number of newspaper articles matching the initial search, a three-stage, two-reviewer screening process was used to evaluate each article's suitability for inclusion in the final review. A set of *a priori* inclusion and exclusion screening criteria was developed for each screening stage to include only climate-health articles relevant to the North American population (Supplementary File 2). Articles were first screened according to title, which resulted in a feasible number of articles

[1] For the purposes of this paper, we consider "coverage" to include articles that focused on climate change impacts on health, reflected by its mention within the first paragraph of the article.

moving into the second screening stage (Hoppe et al. 2014). During abstract screening, the first paragraph of each article was reviewed according to the inclusion and exclusion criteria; articles identified as relevant in this stage were subsequently subjected to a full article screening. The majority of excluded articles addressed animal health or did not explicitly link climate change and health. The Kappa score[2] for each screening stage was automatically calculated by the DistillerSR© software (Evidence Partners, 2016).

2.2 Data extraction and analysis

To investigate trends in climate-health newspaper coverage, the newspaper source and publication date of each article was extracted from relevant newspaper articles. Descriptive and analytical statistics were calculated to assess trends and associations in Canadian climate-health newspaper coverage. Consistent with other studies on climate change media coverage, the newspaper article was used as the unit of analysis (Ahchong and Dodds 2012; Ford and King 2015). The frequencies of climate-health articles published in each region (i.e. newspaper outlet) and two-year intervals were tabulated; to facilitate comparability between regions and years, these frequencies were normalized by calculating proportions using the total number of articles published by each newspaper during the study period or the total number of articles published in all included newspaper outlets during each two-year interval, respectively (Schmidt et al. 2013; Schäfer et al. 2016). The total number of articles published in each newspaper was determined through individual ProQuest® or Eureka® database searches for all articles published in each newspaper during the study time period. Results for each newspaper were then disaggregated into two-year intervals and summed across newspaper outlets to determine the total number of

[2] $\kappa = \frac{p_o - p_e}{1 - p_e}$ where p_o is the relative observed agreement between reviewers, and p_e is the hypothetical probability of chance agreement, using the observed data to calculate the probabilities of each reviewer randomly seeing each category.

articles published in all included newspapers during each two-year interval. Subsequently, chi-squared tests were conducted to compare the proportions of climate-health articles published between regions and between years. Linear regression analyses were used to analyze temporal trends in publication frequency and proportion. All differences were considered significant at $\alpha<0.05$. Statistical analyses were conducted in R® version 3.1.1 (The R Foundation, 2016).

Qualitative data were also extracted to gain further insight on the influence of climate-health newspaper coverage on public perceptions. A five-step thematic analysis process included: (i) data familiarization through reflective memo-writing; (ii) preliminary codebook creation based on emerging trends; (iii) data coding and initial theme identification; (iv) thematic map creation; and, (v) code collation and theme naming (Braun and Clarke 2006). The codebook was co-developed by two researchers and was extensively pre-tested prior to being used. The final codebook included categorizing articles according to health outcomes discussed, valence (i.e. the nature of climate change's impact on health as described by the article), and climate change concepts used (Table 2).

Following full article content coding, the frequencies and proportions of articles discussing specific disease types (acute non-infectious, chronic non-infectious, infectious, and mental), implying particular valences (neutral, positive, negative, uncertain), and discussing particular climate change solutions (i.e. adaptation, mitigation, or both) were tabulated. Data were then disaggregated by region and two-year interval to identify heterogeneity in climate-health coverage. Mitigation was defined as an intervention to reduce the causes of climate change, whereas adaptation was defined as an adjustment in response to actual or expected climate change impacts to minimize negative climate change impacts (Liu et al. 2008). Chi-squared tests were conducted to compare the proportions of climate-health articles discussing

adaptation compared to mitigation strategies. All coding and respective analysis was conducted in Dedoose© version 6.1.10 (Dedoose, 2016) qualitative coding software.

3. Results

3.1 Systematic Newspaper Article Review

In total, 6,277 newspaper articles were identified in the initial database search and 145 were maintained after all three levels of screening (Figure 1; Supplementary File 3). Inter-reviewer agreement for the three screening levels ranged from "substantial" to "almost perfect" (Landis and Koch 1977): title screening had a Kappa score of 0.94, abstract screening had a Kappa score of 0.85, and full article screening had a Kappa score of 0.64[3].

3.2 Regional Distribution: Highest Coverage in northern Territories

The Atlantic region of Canada (n=0) had the lowest climate-health newspaper coverage frequency, while Ontario (n=36) had the highest. With respect to proportions of articles reporting on climate change and health, proportions were lowest in national and Atlantic publications and highest in the Territories, the most northern Canadian region consisting of the Yukon, Northwest Territories, and Nunavut (Table 3; Figure 2). Regional newspapers were 3.449 times (95% CI: 2.097-6.006) more likely to report on climate-health issues compared to national newspapers. Coverage did not significantly differ between the two national newspapers (p=0.8741). The proportion of articles published in the Northern Territories was significantly higher than all other regions (p<0.001) (Table 4a).

[3] The Kappa value for full article screening was low compared to the other two stages due to the high percentage of agreement for this stage. Due to the First Paradox of Kappa, a high percentage of agreement, which inherently occurs when the outcome (i.e. inclusion) is rare, can convert a high percentage of observed agreement into a low value of Kappa (Feinstein and Cicchetti 1990). Consequently, this lower Kappa score does not necessarily indicate low overall agreement between reviewers (Feinstein and Cicchetti 1990).

3.3 Temporal Distribution: Decreasing Overall Trend

Climate-health newspaper coverage fluctuated yearly (Table 4b, Figure 3). There was a decreasing trend in overall publication frequency (β= -3.700, 95% CI: -6.911- -0.4894). When analyzing the overall proportion of climate-health articles over time, however, the trend was not significant.

3.4 Climate Change Impacts on Health: Focused on Negative Impacts, and Infectious and Chronic Non-Infectious Diseases

The majority of articles described negative climate change impacts on health (n=136, 94%), while the remainder discussed positive (n=4, 3%), neutral (n=4, 3%), or uncertain (n=2, 1%) impacts. Articles describing positive impacts were published at the national level (n=3) and in British Columbia (n=1); they cited decreased winter morbidity and mortality from the common cold, pneumonia, and influenza due to increased winter temperatures, and improved food security due to new agricultural opportunities in Canada. One article stated that "many people worry warmer weather will lead to a rise in diseases such as malaria or water-borne pests that thrive in warm weather, but Mr. Moore, author of Climate of Fear: Why We Shouldn't Worry About Global warming, says it is poor sanitation and poverty that causes such diseases to survive" (Thorpe 2007). Articles describing neutral climate change impacts on health (i.e. no impact) were sourced from the national-level (n=2) or British Columbia (n=1). These articles argued that air pollution did not impact hospital admissions for respiratory illnesses and that heat waves were not responsible for increased summer morbidities. For example, one national-level article reported that "A Canadian economist known for his controversial critique of climate-change science turned his sights on the health effects of smog, concluding in a new study that air

pollution has no impact on the number of hospital admissions for respiratory illness" (Blackwell 2010). Two articles from British Columbia did not clearly establish a valence position.

Overall, infectious (n=64, 44%) and chronic non-infectious diseases (n=49, 34%) were the most commonly discussed health outcomes impacted by climate change, whereas acute non-infectious illnesses (n=18, 12%) and mental health disorders (n=15, 10%) were less frequently mentioned. Articles discussing infectious diseases focused primarily on vector-borne illnesses such as Lyme disease and dengue; for example one article states that "a new study has documented the rapid growth in Canada of ticks that can cause Lyme disease, and global warming is thought to be a factor" (Abma 2012). Articles discussing chronic non-infectious diseases focused primarily on allergies and asthma. Chronic non-infectious diseases were most commonly discussed in Ontario and the Territories, while infectious illnesses were most commonly discussed in the Prairies, Quebec, and British Columbia (Table 5a; Figure 4a). At the national level, infectious and chronic non-infectious diseases were mentioned equally and more than acute non-infectious diseases or mental health disorders. Coverage of each health outcome varied yearly (Table 5b; Figure 4b).

3.5 Climate Change Solutions: Predominate Focus on Mitigation

Less than half (n=71, 49%) of the articles covered climate change solutions in a health context. Mitigation strategies (n=49, 34%) were discussed more frequently than adaptation strategies (n=38, 26%); however, this difference was not significant. Examples of mitigation strategies included decreasing greenhouse gas emissions by installing solar panels, improving household insulation, and increasing active transport use. Suggested adaptation strategies included creating community adaptation plans, cutting back on strenuous outdoor activity on hot or smoggy days, and building coastal protection. Adaptation was discussed more frequently than

mitigation in Quebec, the Prairies, and British Columbia (Table 5a), and adaptation was also more frequently mentioned than mitigation between 2007 and 2008 compared to other years (Table 5b).

4. Discussion

The proportion of climate-health newspaper articles was significantly higher in the Northern Territories—Yukon, Northwest Territories, Nunavut—than all other regions. Climate change health consequences are projected to be most severe and are already being reported in Arctic regions (Smith et al. 2014; Ford et al. 2014), which may account for the increased frequency of coverage in the Territories. Moreover, since Indigenous populations are already bearing, and are expected to continue to bear, an unequal burden of climate-health impacts (Ford et al. 2010a; Government of Canada 2016) and the proportion of Indigenous people in the three Territories is higher than all other provinces (NU: 86.3%; NT: 51.9%; YT: 23.1%) (Statistics Canada 2015b), this may result in additional urgency to take action against climate change in the Territories, thus encouraging increased climate-health newspaper coverage. Nevertheless, while the proportion of Indigenous peoples in the three prairie provinces—Manitoba, Saskatchewan, and Alberta—are also above the national average (MB: 16.7%; SK: 15.6%; AB: 6.2%; CAN: 4.3%) (Statistics Canada 2015b), the proportion of climate-health articles published in the prairie provinces was relatively low. As such, the combination of demographic and geographic sensitivity and exposure might contribute to the increased media coverage in the Territories. While the frequency of reporting on climate change impacts on health was highest within the Territories, several climate-health articles published in other regions also reported on Arctic regions. Similarly, Belfer et al. (2017) documented that reporting on Indigenous peoples in four

high income nations focused disproportionately on the Arctic. Although this focus may increase the awareness of climate change concerns relevant to the Arctic, it may result in the misconception that climate change impacts on health will be confined to Arctic regions and may impede the arousal of concern, which is productive for public engagement (O'Neill and Nicholson-Cole 2009). Moreover, as compared to stories that make climate change personally relevant, studies find that stories which emphasize geographically remote threats can result in less concern and more hopelessness, thus decreasing public engagement (Nisbet 2009; O'Neill and Nicholson-Cole 2009). Consequently, additional focus on local public health implications of climate change could render climate-health media coverage more engaging.

Consistent with previous studies examining general climate change media coverage, the salience of climate change impacts on health fluctuated yearly (Liu et al. 2008; Ahchong and Dodds 2012; Davidsen and Graham 2014; Ford and King 2015; Belfer et al. 2017). In contrast to almost all climate change media studies on non-health topics, however, a decreasing salience of climate change impacts on health was observed (Ahchong and Dodds 2012; Dotson et al. 2012; Schmidt et al. 2013; Davidsen and Graham 2014; Ford and King 2015). Given the media's influence on public perceptions and policy decisions, the decreasing publication frequency and overall low salience of health risks could minimize the perception of the climate change health threat and therefore lead to inaction towards solutions necessary for protection against projected climate-health risks (Watts et al. 2017).

Given that climate change is an ongoing threat to human health, it is important that the public receives scientifically accurate climate-health information (Antilla 2005; Boykoff 2007b). An insufficient understanding of climate change is one of the largest perceived barriers to individual engagement in mitigation and adaptation actions (Depoux et al. 2017; Watts et al.

2017). Contrary to findings from American television and newspaper coverage (Boykoff 2007b, 2008), almost all documented Canadian newspaper articles reported actual or anticipated negative health outcomes. In doing so, newspapers are increasing awareness of climate-health impacts, and may thereby enhance engagement (Watts et al. 2017).

Infectious diseases, such as Lyme disease, and chronic non-infectious conditions, including allergies and asthma, were the most highly covered health outcomes in the newspaper articles captured, which reflects climate change impacts on health that have already been recorded across Canada (Ogden et al. 2008; D'Amato et al. 2015). The frequent coverage on infectious diseases may also be partly attributable to them being amongst the most highly researched climate-related health outcomes (McMichael et al. 2006). In comparison, despite the growing research base indicating that climate change will negatively impact mental health through a variety of direct and indirect mechanisms (Watts et al. 2015; Clayton et al. 2017; Trombley et al. 2017), mental health outcomes were mentioned in only 10% of captured articles. Minimizing the impact of such emerging health threats will require that appropriate health information be issued to the public (Ogden et al. 2008).

Fewer than half of climate-health articles discussed adaptation or mitigation strategies, which was lower than findings from previous studies examining climate change newspaper coverage (Liu et al. 2008; Ahchong and Dodds 2012; Belfer et al. 2017). Similarly, Depoux et al. (2017) found that only 16% of newspaper articles linking climate change and health in Le Monde provided information about health benefits which related to adaptation or mitigation. These findings also corroborate a study by Dotson et al. (2012), which reported that despite an expectation that climate change media coverage would mature to focus more on solutions than problems, solutions remained secondary topics in climate change media coverage. The limited

coverage on climate change solutions may contribute to the feelings of hopelessness commonly associated with climate change, thereby undermining the public's feelings of self-efficacy and impetus to engage in climate-mitigating or adaptive actions (O'Neill and Nicholson-Cole 2009; Ahchong and Dodds 2012; Moser 2016; Feldman and Hart 2018). Research suggests that in the context of climate change, worry and hope are two important emotional predictors for mitigation and adaptation support and action (Feldman and Hart 2016, 2018). As such, messaging that covers both climate change risks as well as efficacy messages that portray climate change as an addressable problem by identifying potential solutions, may increase participation in climate change actions by increasing public concern as well as hope and the public's belief in their ability to minimize negative climate change outcomes (Ockwell et al. 2015; Feldman and Hart 2016, 2018; Moser 2016). Such citizen political engagement is also a critical factor in pressuring policy makers to pass meaningful climate mitigation policies (Ockwell et al. 2015; Feldman and Hart 2018). A shift toward enabling and empowering climate change media communication, in which viable solutions are discussed, could serve as the impetus for both grassroots and higher level climate change actions (Feldman and Hart 2016, 2018; Moser 2016; Depoux et al. 2017). Such communication could also emphasize the health co-benefits of climate change adaptation and mitigation efforts; for example, increasing cycling as a mode of transportation can decrease greenhouse gas emissions, reduce motor-vehicle-related injuries and deaths, increase physical activity, and decrease obesity (Weathers et al. 2017).

As found in previous studies, media coverage discussed mitigation more than adaptation (Liu et al. 2008; Ahchong and Dodds 2012; Ford and King 2015). Recent climate-health literature states that while mitigation is essential, adaptation will be necessary to manage unavoidable health consequences associated with climate change (Ford et al. 2010b; Ford and

Berrang-Ford 2011). Nevertheless, the limited climate change adaptation media coverage may hinder adaptation actions, as it contributes to an absence of adaptation consciousness among the public and decision-makers alike (Ford and Berrang-Ford 2011; Ford and King 2015; Watts et al. 2017).

While these findings expand our understanding of how climate change impacts on health have been portrayed in Canadian newspapers, there are some limitations to this study. First, the review was limited to Canadian newspapers, despite the known influence of American media on Canadians (Biltereyst 2003). Investigating newspaper reporting on a larger geographic scale may provide a better understanding of the reporting trends for climate change impacts on health. Second, due to the screening process used to manage the large number of articles matching the initial search, articles that only mentioned climate change impacts on health late within the article may have been excluded. Third, newspaper articles were the only media form included in this study; as such, future research should identify and compare how climate change impacts on health are reported across other media sources, such as television, radio, and web platforms (Watts et al. 2017). Lastly, this study was limited to newspaper articles that concerned the North American population; future studies could include articles reporting on other regions, countries, or continents.

5. Conclusion

This review used quantitative and qualitative methods to identify spatiotemporal trends in newspaper coverage of climate change impacts on health in Canada between 2005 and 2015. By providing new insights on regionally-specific climate-health media coverage, the findings can inform ongoing considerations regarding climate-health media coverage in Canada and abroad

that will maximize the public's understanding of climate change risks on health and promote engagement in mitigating and adaptive actions. The findings suggest that Canadian newspaper coverage of climate change impacts on health varies both geographically, with the proportion of articles being highest in Northern Territories, and temporally, with an overall decreasing frequency over the study period. Fewer than half of the articles discussed adaptation or mitigation. As climate change continues to threaten human health, increasing emphasis on climate change impacts on human health, as well as a shift toward enabling and empowering climate change communication, in which viable mitigation and adaptation options are emphasized, could help to reduce climate change health risks.

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7. Figure Captions

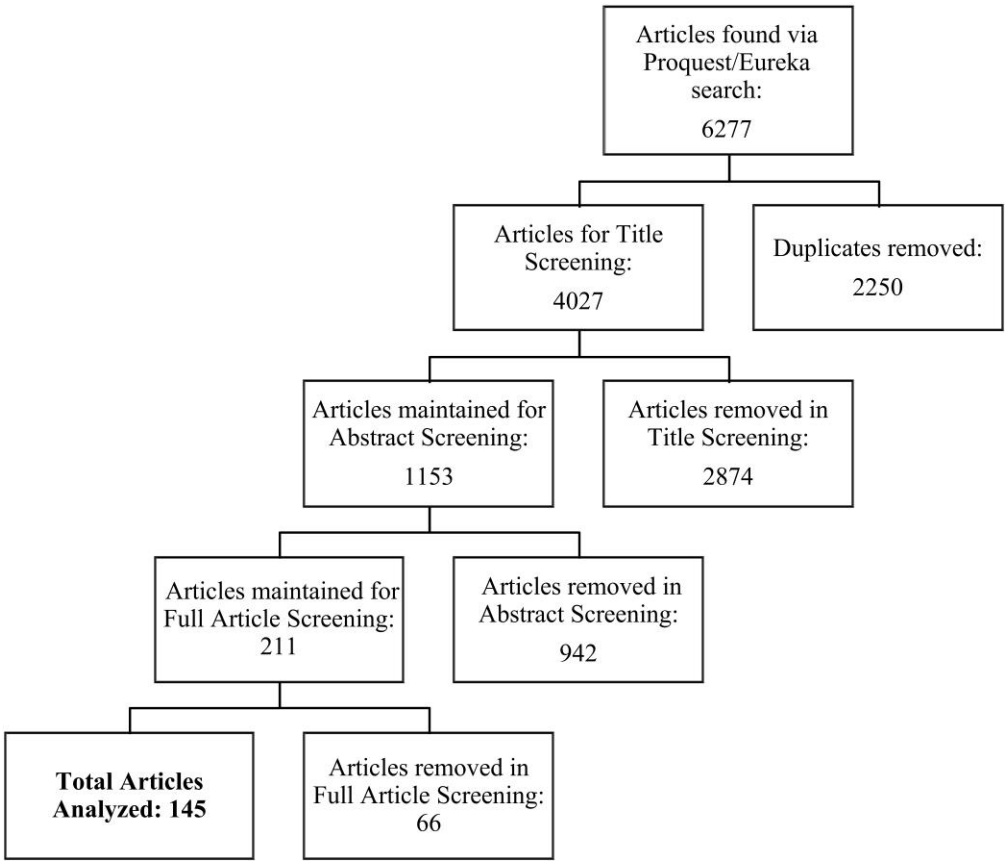

Figure 1 Systematic article screening process for a systematic review of newspaper coverage of climate change impacts on health in Canada between 2005 and 2015

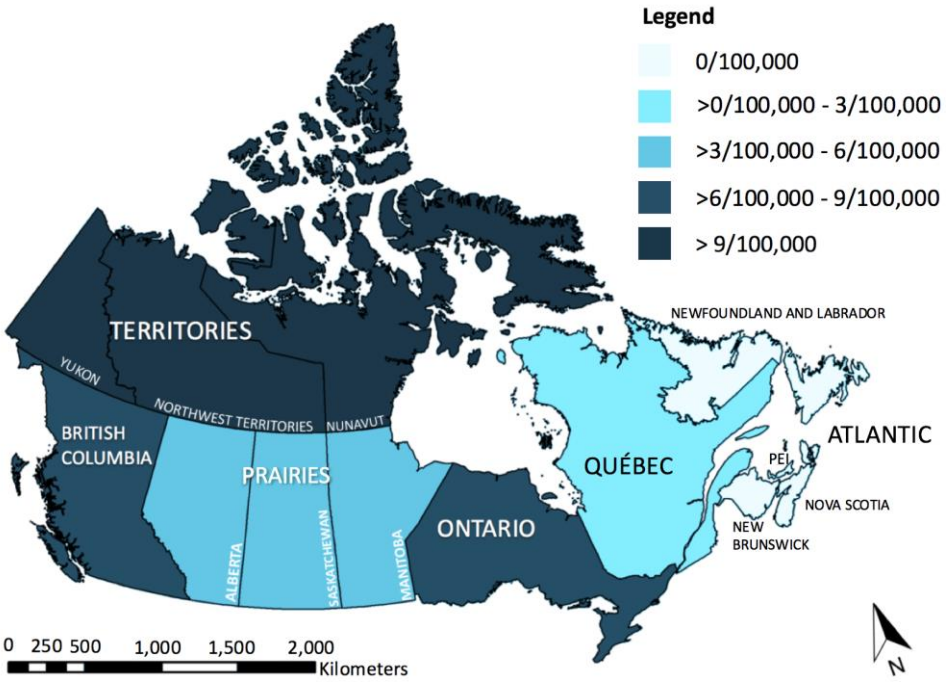

Figure 2 Proportion of newspaper articles reporting on climate change impacts on health per Canadian region

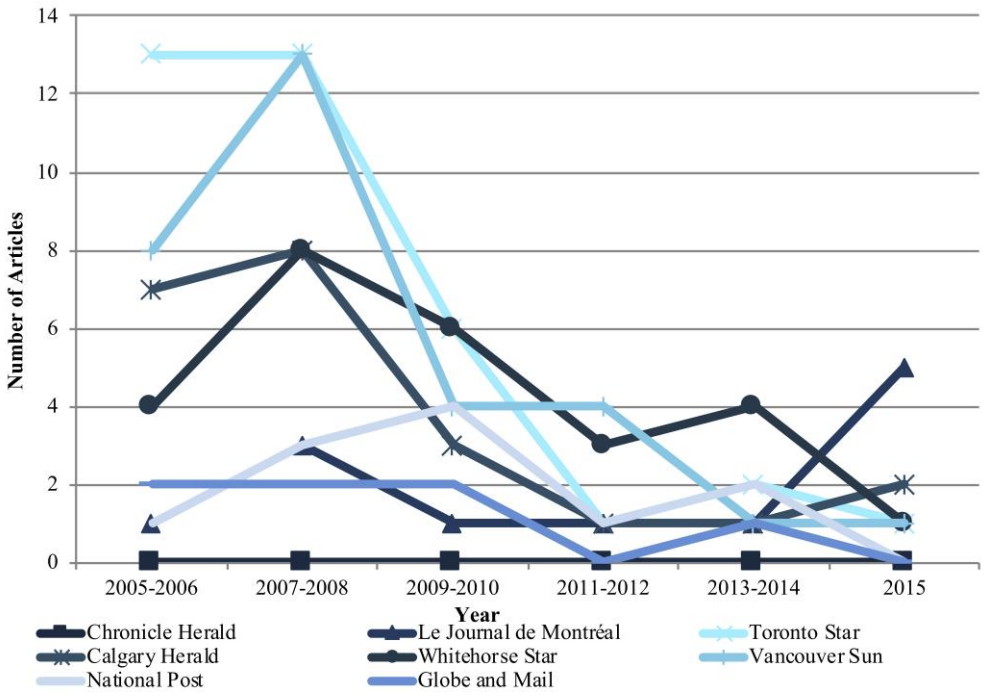

Figure 3 Frequency of newspaper articles reporting on climate change impacts on health per publication over time

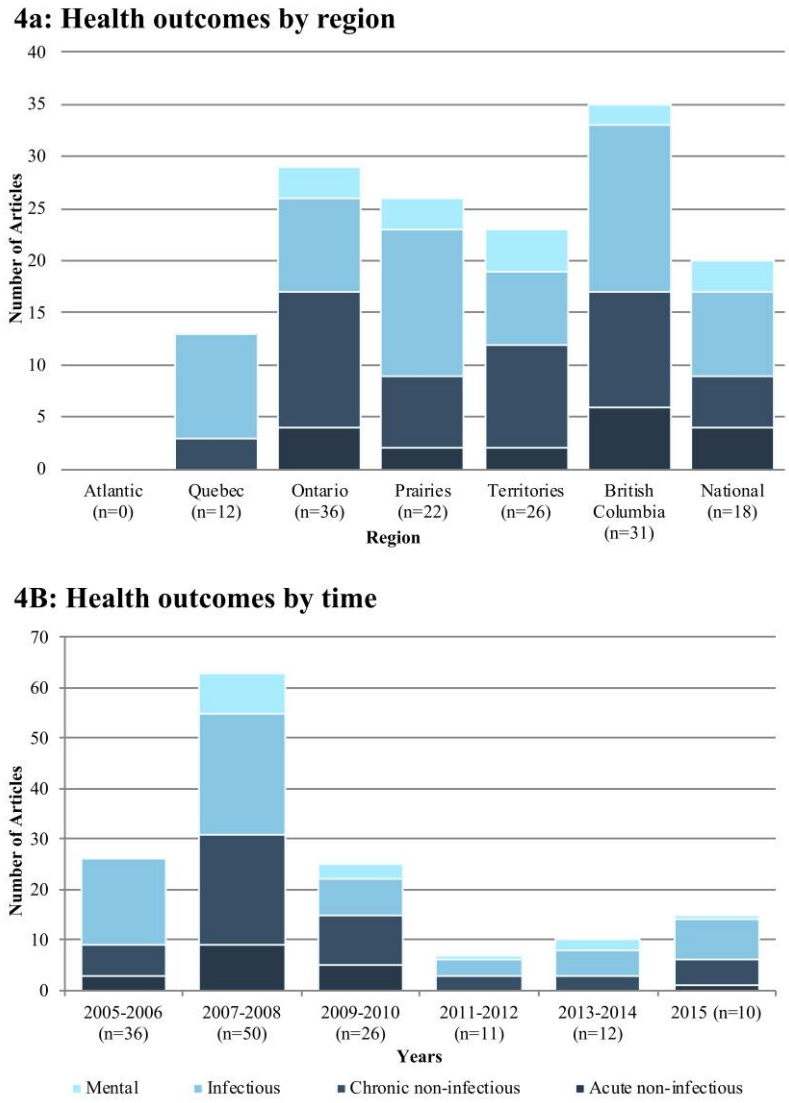

Figure 4 Frequency of climate-health newspaper articles mentioning various health outcomes by Canadian region (4A) and time (4B)

8. Table Captions

Table 1 Selected newspapers, average daily circulation, and associated regions and populations used for a systematic review of newspaper coverage of climate change impacts on health in Canada between 2005 and 2015

Newspaper	Average 2015 daily circulation (print and digital)*	Region† ; population‡
The Vancouver Sun	136,787	British Columbia; 4,400,055
The Chronicle Herald	91,490	Atlantic (Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland and Labrador); 2,327,645
Whitehorse Star	686	Territories (Nunavut, Northwest Territories, Yukon); 107,260
Toronto Star	318,763	Ontario; 12,851,820
Le Journal de Montréal	232,332	Quebec; 7,903,000
The Calgary Herald	106,916	Prairies (Manitoba, Saskatchewan, Alberta); 5,886,910
The Globe and Mail	336,487	National; 33,476,690
National Post	186,108	National; 33,476,690

* (Newspapers Canada 2015)
† (Statistics Canada 2015a)
‡ (Statistics Canada 2016)

Table 2 Qualitative codebook and descriptions for a systematic review of newspaper coverage of climate change impacts on health in Canada between 2005 and 2015

Code	Description
Health outcomes	
Acute non-infectious	Statement discusses an acute non-infectious health condition, excluding any infectious diseases.
Chronic non-infectious	Statement discusses a chronic non-infectious health condition.
Infectious	Statement discusses an infectious disease, including vector borne illnesses.
Mental	Statement discusses a general or specific mental health condition.
Valence statements	
Positive	Overall article implies that climate change is beneficial to human health (i.e. fewer cold related illnesses and injuries).
Negative	Overall article implies that climate change is detrimental to human health (i.e. change in disease prevalence, incidence, patterns, trends, seasons, vectors).

Neutral	Overall article discusses climate change impacts on health but does not indicate a positive or negative impact. This is to highlight cases in which the impact is seen as not changing for the better or worse, but does not include statements of uncertainty.
Uncertain	Overall article discusses climate change and human health impacts but is unsure whether or not the impact is positive or negative.
Climate change responses	
Mitigation	Statement discusses the population mitigating climate change impacts. Also coded according to time period to indicate changes in action over time. This code will only be used once per article. Note: Indicate articles that refer to both mitigation and adaptation.
Adaptation	Statement discusses the population adapting to climate change impacts. Also coded according to time period to indicate changes in action over time. This code will only be used once per article. Note: Indicate articles that refer to both mitigation and adaptation.

Table 3 The frequency and percent of newspaper articles on climate change impacts on health over time and by region from 2005-2015

Region	**2005-2006**	**2007-2008**	**2009-2010**	**2011-2012**	**2013-2014**	**2015**	**Frequency (and percent) of articles per region**
Atlantic	0	0	0	0	0	0	0 (0.0)
Quebec	1	3	1	1	1	5	12 (0.0018)
Ontario	13	13	6	1	2	1	36 (0.0074)
Prairies	7	8	3	1	1	2	22 (0.0039)
Territories	4	8	6	3	4	1	26 (0.0187)
British Columbia	8	13	4	4	1	1	31 (0.0073)
National (National Post)	1	3	4	1	2	0	11 (0.0015)
National (Globe and Mail)	2	2	2	0	1	0	7 (0.0007)
Frequency (& percent) of articles per period	36 (0.0054)	50 (0.0066)	26 (0.0044)	11 (0.0019)	12 (0.0019)	10 (0.0033)	145

Table 4a Comparisons of proportions of newspaper coverage of climate change impacts on health between 2005 and 2015 by region

Comparing Regions	**Atlantic**	**Quebec**	**Ontario**	**Prairies**	**Territories**	**British Columbia**	**National**
Atlantic	X	--	--	--	--	--	--
Quebec	--[a]	X	--	--	--	--	--
Ontario	--[a]	<0.001*	X	--	--	--	--
Prairies	--[a]	0.0308*	0.0158*	X	--	--	--
Territories	--[a]	<0.001*	<0.001*	<0.001*	X	--	--
British Columbia	--[a]	<0.001*	0.9798	0.0204*	<0.001*	X	--
National	--[a]	0.6807	<0.001*	0.003*	<0.001*	<0.001*	X

*p<0.05
[a]Chi-square assumption not valid when cell count is <5

Table 4b Comparisons of proportions of newspaper coverage on climate change impacts on health in Canada by time period between 2005 and 2015

Years	2005-2006	2007-2008	2009-2010	2011-2012	2013-2014	2015
2005-2006	X	--	--	--	--	--
2007-2008	0.3754	X	--	--	--	--
2009-2010	0.4026	0.0889	X	--	--	--
2011-2012	0.0014*	<0.001*	0.0167*	X	--	--
2013-2014	0.0012*	<0.001*	0.0161*	0.9641	X	--
2015	0.1678	0.0449*	0.4615	0.1918	0.1982	X

*p<0.05

Table 5a Frequency (and percent) of climate-health newspaper articles mentioning various health outcomes and climate change responses, by Canadian region between 2005 and 2015

Region	Acute non-infectious	Chronic non-infectious	Infectious	Mental	Adaptation	Mitigati
Atlantic (n=0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Quebec (n=12)	0 (0)	3 (25)	10 (83)	0 (0)	2 (17)	1 (8)
Ontario (n=36)	4 (11)	13 (36)	9 (25)	3 (8)	7 (19)	13 (36)
Prairies (n=22)	2 (9)	7 (32)	14 (64)	3 (14)	4 (18)	2 (9)
Territories (n=26)	2 (8)	10 (38)	7 (27)	4 (15)	3 (12)	9 (35)
British Colombia (n=31)	6 (19)	11 (35)	16 (52)	2 (6)	5 (16)	3 (10)
National (n=18)	4 (22)	5 (28)	8 (44)	3 (17)	1 (6)	5 (28)
Total (n=145)	18 (12)	49 (34)	64 (44)	15 (10)	22 (15)	33 (23)

Table 5b Frequency (and percent) of climate-health newspaper articles mentioning various health outcomes and climate change responses in Canada between 2005 and 2015

	Health outcomes of interest				Climate change respons	
Years	**Acute non-infectious**	**Chronic non-infectious**	**Infectious**	**Mental**	**Adaptation**	**Mitigati**
2005-2006 (n=36)	3 (8)	6 (17)	17 (47)	0 (0)	3 (8)	8 (24)
2007-2008 (n=50)	9 (18)	22 (44)	24 (48)	8 (16)	11 (22)	6 (12)
2009-2010 (n=26)	5 (19)	10 (38)	7 (27)	3 (12)	4 (15)	9 (35)
2011-2012 (n=11)	0 (0)	3 (27)	3 (27)	1 (9)	1 (9)	4 (15)
2013-2014 (n=12)	0 (0)	3 (25)	5 (42)	2 (17)	1 (8)	2 (17)
2015 (n=10)	1 (10)	5 (50)	8 (80)	1 (10)	2 (20)	4 (40)
Total (n=145)	18 (12)	49 (34)	64 (44)	15 (10)	22 (15)	33 (23)