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The effect of public trust and engagement on climate communication approaches



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The urgency of the climate crisis requires global action, which must account for regional interests and realities. We offer a Canadian perspective by reporting the results of a national survey investigating Canadians' perceptions and beliefs about climate change and who they trust and engage with on matters concerning the climate crisis. We find that while the majority of Canadians believe in anthropogenic climate change, there is not always agreement over who is a trustworthy authority on climate change, nor is there always a willingness to engage in conversations. Our findings suggest that demographic segmentation is not an especially powerful guide for crafting communication approaches, but that probing participants' experience and success in climate conversations and their perception of authorities on climate change provides important insights. Findings are informative both for those hoping to spur climate action through effective communication in Canada, and beyond, through attention to individuals' communicative resources.

The science of climate change offers irrefutable evidence of anthropogenic (i.e., human-caused) causes and it is imperative that human action address the climate crisis¹. Despite widespread public agreement regarding both climate change's anthropogenic origins and consequences for human wellbeing in Canada, necessary climate action remains lacking². Civic discourse on climate is critical to motivate necessary social and policy action³. Climate change is politically polarized⁴ and the domain is ripe with disinformation and misinformation⁵. The climate change debate also often involves generational conflict and generational discounting⁶. With respect to what has been called transgenerational responsibility⁷, international public opinion is that "climate change will harm future generations."⁸ In Canada, 64% of the population believes that by 2028 climate change will cause a "great deal" of harm, 17% a "moderate amount," 7% "only a little," and 4% "not at all," with the remaining share of less than 10% not knowing or not responding⁹. While life cycle seems to influence how Canadians rate critical issues to address, with younger Canadians unsurprisingly concerned with securing affordable housing and older Canadians citing healthcare, there was "no significant differences across age groups in the proportions mentioning the environment and climate change"¹⁰. Understanding more about how people in Canada think about or engage with climate action is important given distinctions from the US context: concerns are quantitatively higher in Canada and qualitative measures such as opinion about the principal cause of recent climate change (e.g., human activity versus natural

cycles) also differ¹¹. Although research has shown that Canadians largely believe climate change is happening, belief about the degree to which *humans* are to blame varies geographically¹². Moreover, Canadians themselves are not a monolith, with partisan affiliations¹³ and baseline concern over climate change¹⁴ influencing belief in and willingness to engage in the climate crisis. Such differences matter as they impact whether and how Canadians choose to participate in or initiate climate conversations.

Climate change conversations have been found to be drivers of climate action^{3,15–17} and such action is especially important as the frequency and severity of climate change related events have increased in recent years¹. However, research suggests that people rarely engage in climate change conversations¹⁸, in part because individuals can fear censure from their communities^{19,20}. Scholarship has explored productive communication strategies between experts and non-experts²¹, but more research is needed exploring climate change discussions among non-experts. Even with so-called "spirals of silence"¹⁸ surrounding climate change, conversations between non-experts have powerful potential to trigger climate action if people feel equipped with the resources and skills to engage with those around them¹⁵. Thus, understanding how Canadians from diverse demographic and socioeconomic situations approach climate change discussions is crucial for fostering productive conversations that lead to engaged climate action. Rather than focusing on climate belief in Canada, into which many large-scale studies have provided critical insights, we examine how

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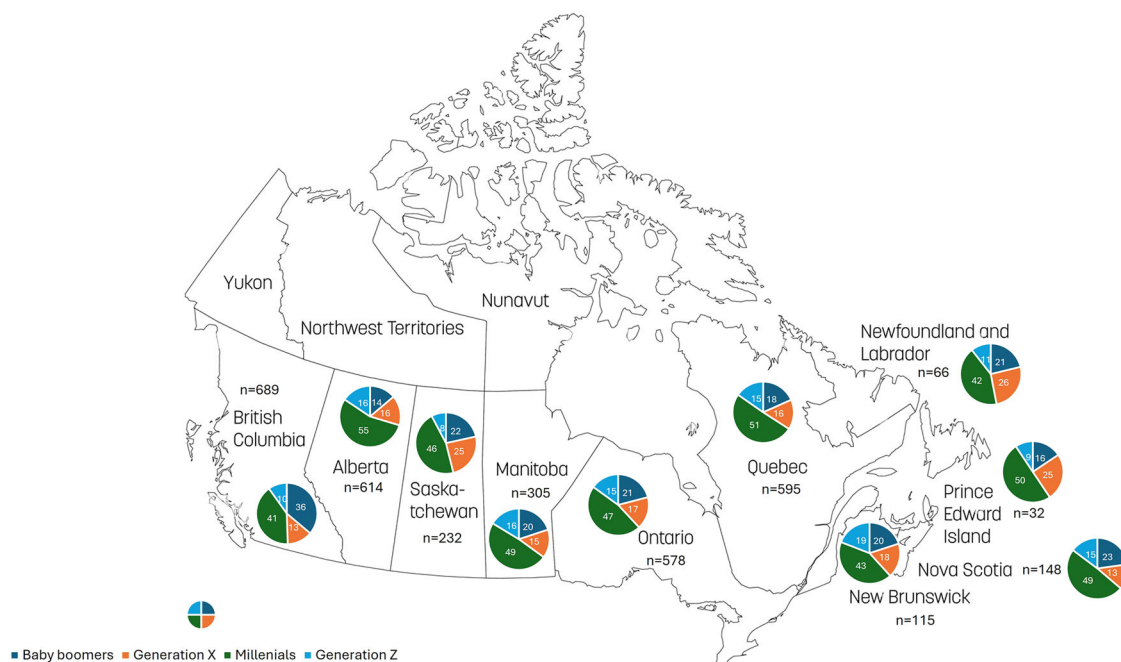


Fig. 1 | Geographical distribution of respondents across Canada and generational clusters.

Canadians report *discussing* climate change. We conducted a national survey of people in Canada to help fill this gap by exploring how Canadians think and talk about climate change, and how their engagement in climate change conversations relates to their beliefs. We wanted to know who Canadians trust and view as authorities on this issue and their likelihood of seeking out or participating in climate change discussions. We report the results using univariate and multivariate statistical analysis and ask three major research questions of the data in this study: (1) How does demographic information correlate with Canadians' belief (or denial) that humans have significantly contributed to or caused climate change? (2) How does belief or denial in anthropogenic climate change affect who Canadians think of as an authority on the issue of climate, climate change, or climate action?; and, finally, (3) How do levels of engagement with climate discourse interact with demographic factors and climate-related beliefs and actions? Our analysis and findings suggest pathways for inciting climate action amongst Canadians and, rhetorically, provide insights into communication strategies to spur such actions.

Results

We identify demographic trends in belief and interesting information about what factors are influential in thinking about anthropogenic climate change. We first describe the general demographic characteristics of respondents before reporting how these characteristics correlate with respondents' belief and engagement in climate change issues and discussions.

General sample characteristics

Respondents are residents of Canadian provinces age 18–75, and there were quotas for four age groupings (Gen Z = 1997–2003; Millennials = 1981–1996; Gen X = 1965–1980 and Baby Boomers = 1946–1964) based on Pew Research Center's generational breakdowns²². The generational cohort variable looks at population-level trends, such analyses acknowledge variation within the variable, which we can see in discussions of 'micro-generations,' for instance. We use the generational cohort as a variable for analysis with awareness of the limitations.

The distribution of respondents across provinces is shown in Fig. 1. Although results vary across provinces, the majority of respondents are white (81%), female (60%) and born after 1980 (Millennials [48%] or Generation Z [14%]). The latter two groups were therefore overrepresented

in the unweighted sample. Five percent of the sample population is aged 18–20 years, 15% 18–25 years, and 14% is between 65 and 75 years. Most respondents were sampled from British Columbia (20%), Alberta (18%), Quebec (18%) and Ontario (17%). The four Atlantic provinces (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador) make up 11% of the total sample population, and the two prairie provinces Saskatchewan (7%) and Manitoba (9%) the remaining 16%.

Although most respondents indicate that their political affiliation depends on the specific election (21%), 17% of the respondents are affiliated with the Conservative Party, followed by the NDP (16%), and the Liberal Party (14%). Another 14% do not have a political affiliation. Less than 4% indicate their affiliation with the Green Party (see Supplementary Materials for detailed demographics). Four percent of all the respondents said that they do not vote.

Belief that humans are mainly responsible for climate change

Our primary research question focuses on who thinks climate change is anthropogenic and who does not. We asked participants to answer "Yes" or "No" to the question "Do you currently think that humans have significantly contributed to or caused climate change?" Overall, 87.9% of respondents answered "Yes" to this question, but belief varies significantly across the 10 provinces from 72% in Saskatchewan to 97% in PEI (Table 1). This implies that on average in 2022 more than one in every 10 people in Canada still believed that climate change is not anthropogenic, and in Saskatchewan more than one in every four people do. Examining the distribution across the ten provinces, those living in Alberta and Saskatchewan are the least likely to believe that climate change is anthropogenic. Interestingly, as the area where respondents live becomes more urbanized so does the probability that they believe climate change is anthropogenic¹². People in large urban centers (>100,000 people) show a significant positive statistical effect for agreement at the 1% significance level, while medium urban centers (30,000–99,999 people) show an effect at the 10% level (Table 1). Similarly, younger people are more convinced than older people that climate change is anthropogenic, and more women than men think climate change is anthropogenic. We also saw political associations affecting beliefs about anthropogenic climate change, echoing the politicization of the issue in other parts of the world, with Conservative Party supporters being significantly less likely to be convinced than any other voter that climate change

Table 1 | Share of Canadians believing climate change is anthropogenic

	Average share of respondents believing climate change is anthropogenic	Test statistic (null hypothesis: equal distribution across categories)
Province		114.524 ($p < 0.001$)
BC	0.89 (0.012)	
AB	0.81 (0.016)	
SK	0.72 (0.030)	
MB	0.88 (0.019)	
ON	0.92 (0.011)	
QB	0.93 (0.010)	
NB	0.92 (0.025)	
NS	0.94 (0.020)	
PEI	0.97 (0.031)	
NL	0.89 (0.038)	
Region		127.217 ($p < 0.001$)
Rural	0.80 (0.013)	
Small urban	0.84 (0.012)	
Medium urban	0.91 (0.015)	
Large urban	0.95 (0.006)	
Gender		30.967 ($p < 0.001$)
Female	0.90 (0.007)	
Male	0.84 (0.010)	
Non-binary	0.94 (0.033)	
Generation		118.010 ($p < 0.001$)
Baby boomers	0.82 (0.014)	
Generation X	0.79 (0.017)	
Millennials	0.91 (0.007)	
Generation Z	0.97 (0.008)	
Political affiliation		289.523 ($p < 0.001$)
Conservative	0.70 (0.019)	
Liberal	0.98 (0.006)	
NDP	0.97 (0.007)	
Green Party	0.97 (0.016)	
Bloc Québécois	0.98 (0.013)	
None	0.85 (0.016)	
Don't vote	0.90 (0.025)	

The shares can be converted into percentages by multiplying them by 100%. Standard errors are presented between brackets. The test statistic refers to the Kruskal–Wallis test.

is anthropogenic. These findings align with a 2023 survey from Pew Research Center, which found that the partisan divide over the threat of climate change has grown in the United States, with 78% of Democrats describing climate change as a major threat to humanity (compared to 58% ten years ago) compared to 23% of Republicans (consistent with responses ten years ago)²³.

In addition to asking respondents about their current beliefs about climate change, we asked whether Canadians ever changed their minds about humans being the cause of climate change. Most Canadians (87%) never doubted that climate change is anthropogenic (i.e., human-caused); however, 13% of Canadians who currently believe in anthropogenic climate change at some point had changed their mind to come to this conclusion.

Although this share is not significantly different at the 5% level across province, degree of urbanization, or generation, significantly more men than women changed their minds, while Green Party voters are significantly less likely to have changed their mind compared to other voters (test results are available from the authors). Another interesting and significant difference between Canadians who did and who did not change their mind is that the former vote on average less frequently for political candidates who make climate action a priority and also less frequently take daily action to minimize their contribution to climate change (e.g., biking or taking public transit to work, eating meat-free meals, minimizing energy use) (test results are available from the authors) (question 5 in Supplementary Materials). Looking to existing surveys on issues facing Canadians, it is possible that those who change their mind about climate change are more concerned with other crises facing Canadians (e.g., affordability, housing) and thus less likely to prioritize climate action even after changing their beliefs²⁴.

Experts and authorities

We were also interested to know how belief in anthropogenic climate change aligns with who people consider trustworthy authorities and authoritative sources on climate change, especially given existing evidence that belief in climate change impacts who is considered an authority on the issue^{25,26}. We asked, “Who do you think of as an authority on the issue of climate, climate change, or climate action?” (survey question 7 in Supplementary Materials) and “How much do you agree or disagree with the following statements. With regard to climate change, my views are influenced by...” (survey question 14 in Supplementary Materials) and correlated these responses with respondents’ belief about anthropogenic climate change. Canadians who believe in anthropogenic climate change base their view of trustworthy and authoritative sources significantly more on statistical evidence or climate models than those who do not believe in anthropogenic climate change, followed in order of priority by their own experience, local knowledge, and Indigenous knowledge (Table 2).

Similarly, those who believe climate change is anthropogenic consider scientists significantly more of an authority than those who believe climate change is not anthropogenic, followed by climate activists like Greta Thunberg (Table 2). On average across both groups, political and religious leaders are not considered an authority, and are even less trusted by deniers that climate change is anthropogenic than believers.

Active engagement in climate change discussions

Respondents were also asked how pro-actively they discuss anthropogenic climate change, varying from initiating such discussions and actively seeking them out to participating in them or avoiding them. Respondents were asked how frequently they initiate, participate in, and avoid these discussions. We were particularly interested in exploring the extent to which certain Canadians are more likely to proactively engage in public discussions about anthropogenic climate change. We then used the survey question we ran to examine groups who (i) take action regularly to reduce their impact on climate change; (ii) consider the available scientific evidence to form an opinion about climate change; or (iii) changed their mind about humans causing climate change.

To this end, we regress their answers to the questions about different levels of active engagement as mentioned above, whilst controlling for a variety of demographic and socio-economic influencing factors that others have also found to be notable^{27–29}. Moreover, in these regressions, we also control for respondents’ self-perceived strength of persuasion (i.e., whether respondents reported persuading others of their climate change beliefs “all” or “most” of the time). The ordered probit regression results are presented in Table 3.

Few systematic patterns can be detected for the socio-demographic characteristics of the respondents across the four models. Women are less likely to initiate or seek out discussions about anthropogenic climate change than men and are more likely to avoid these discussions. Younger generations (Millennials and Generation Z) participate more often than older generations in discussions, although Baby Boomers are more likely to

Table 2 | Information sources and perceived authorities for climate change views and opinions

Information source for climate views	CANADIANS WHO		Standardized Mann-Whitney test statistic
	believe climate change is caused by humans	do not believe climate change is caused by humans	
Statistical evidence/ climate model	1.05 (0.014)	0.02 (0.051)	19.218 ($p < 0.001$)
Own experience	0.72 (0.018)	0.30 (0.057)	6.961 ($p < 0.001$)
Local knowledge	0.55 (0.018)	0.10 (0.058)	6.924 ($p < 0.001$)
Indigenous knowledge	0.26 (0.021)	−0.54 (0.060)	12.185 ($p < 0.001$)
Climate change authority			
Scientists	1.43 (0.013)	0.41 (0.056)	19.295 ($p < 0.001$)
Climate activists	0.31 (0.021)	−1.30 (0.053)	22.466 ($p < 0.001$)
Political leaders	−0.06 (0.021)	−1.23 (0.053)	18.375 ($p < 0.001$)
Religious leaders	−0.76 (0.020)	−1.07 (0.051)	5.378 ($p < 0.001$)

Explanatory note: the average scores (standard errors between brackets) refer to how much respondents agree or disagree with the listed sources and authorities, where strongly agree has the value 2, somewhat agree 1, neither agree or disagree 0, somewhat disagree −1 and strongly disagree −2.

initiate these discussions and less likely to avoid them compared to Generation X and Millennials. Canadians living in large urban areas are significantly more likely to initiate or seek out these active discussions.

Unsurprisingly, the more successful respondents are in persuading others (survey question 10 in Supplementary Materials) about climate change, the more likely they are to initiate, seek out, and participate in climate conversations. To establish persuasiveness, the answers to Q10 probing how persuasive respondents perceived themselves to be from never (0) to always (4) were averaged across the six categories (Friends, People I don't know on social media/the web, etc.). This approach to capturing self-reported persuasive power made use of data across scales and categories in this question. The coefficient estimate is, as expected, negative in Model 4: the more persuasive respondents consider themselves, the less likely they are to avoid public debates.

Similarly, how often Canadians consider climate change in daily activities (e.g., using public transit, minimizing energy use) has a highly significant positive effect on how often they engage in climate change discussions, and a negative effect on avoiding these discussions (Model 4). The coefficient estimates across Models 1 to 3 are the same, indicating that the size of the effect is identical irrespective of how actively respondents engage in discussions. Since persuasion and daily climate action are measured using the same scale, we can compare their coefficient estimates and the former has a two to four times bigger impact on how often Canadians engage in discussions than the latter.

Interestingly, Canadians who say they use scientific evidence to form an opinion about climate change initiate and participate in discussions significantly more often and avoid them less often. Canadians who changed their mind about the anthropogenic nature of climate change seek out discussions about climate change significantly more often than Canadians who never doubted anthropogenic climate change. They also initiate discussions more often, but this effect is lower and slightly less significant at the 5% level. Those who changed their mind participate in conversations more often and at the same time also avoid these discussions more often, but these latter effects are only significant at the 10% level.

Discussion

Overall, we see two broad ways in which these findings can be operationalized. First, even after someone who used to deny that climate change is anthropogenic changes their mind, they remain less likely to participate in actions that mitigate the climate crisis, but more likely to participate in conversations about climate change. Therefore, it may be useful to specifically engage such individuals in conversations about their beliefs and priorities regarding climate change to and see how they may be motivated toward more climate action. Indeed, former climate deniers, if they can be persuaded to engage in conversations more often, may be ideal messengers

for other climate deniers. Face-to-face settings may be one venue for such interaction, as it would allow for depth of discussion, but online discussion spaces can also afford opportunities for those to share in extended discussion. Conversations might be further tailored to encourage participation from those who are less likely to engage; for instance, in rural areas where engagement is less likely, engagement in climate action might be spurred by discussions built around local concerns and interests rather than around climate change action directly²⁰.

Second, those who have always believed in anthropogenic climate change are more likely to participate in activities to mitigate the climate crisis, which, considering the overwhelming majority of Canadians believe in anthropogenic climate change, suggests that it may be more productive to consider ways to initiate and hold conversations that serve to elicit climate action rather than conversations that serve to establish climate change as a pressing issue in most cases^{3,17}. Such findings are in line with recent research showing that guiding people to reflect on social relevance and future outcomes of climate actions, through such means as communicating with future selves and close others, are especially effective in encouraging behavior change³⁰. Practically, this suggests that keeping communications focused on where opportunities for action might be both individually and collectively relevant now and in the future.

We found that Canadians who believe that climate change is anthropogenic are more likely to see scientists and climate models as reliable authorities and evidence. While deficit-based models of science communication are ineffective^{31,32}, there is a place for evidence in argument, and findings suggest that many people will consider scientific evidence compelling. Thus, while approaches to engaging audiences in terms of other values are important, trustworthy scientific evidence remains an important factor in communicating about climate change. Our findings echo others suggesting that relevant scientific expertise is highly respected by much of the public^{33,34}. However, we note recent findings that while public trust in scientists is high, trust in climate scientists is slightly lower than other scientists, yet remains moderately high overall³⁵. Personal experience can complement scientific argument in climate change discussions³³ and as the climate emergency continues to unfold, regrettably, relevant examples of personal experience with climate impacts will increase, as has already been seen in recent decades³⁶, furthering the potential for foregrounding firsthand accounts in climate conversations. For instance, the Canadian Climate Institute reported that 2023 was “Canada’s year of climate chaos,” pushing the country into a new era costing billions in firefighting and emergency response, and millions of dollars in insurance payouts, undoubtedly leaving countless Canadians with formative experiences relating to climate impacts³⁷. Natural disasters have been shown to provide educational experiences relating topics such as resilience, infrastructure, weather, and climate, and increase news coverage of climate change³⁸. Creating better opportunities

Table 3 | Results comparing how demographic and other factors drive Canadians' degree of pro-active engagement in discussions about anthropogenic climate change

	MODEL 1: INITIATE DISCUSSIONS		MODEL 2: ACTIVELY SEEK OUT DISCUSSIONS		MODEL 3: PARTICIPATE IN DISCUSSIONS		MODEL 4: AVOID DISCUSSIONS	
	Coeff. estimate	St. error	Coeff. estimate	St. error	Coeff. estimate	St. error	Coeff. estimate	St. error
PROVINCE (Baseline: Ontario)								
BC	−0.0076	0.0668	−0.0809	0.0665	0.1584**	0.0665	−0.0469	0.0641
AB	−0.0606	0.0706	−0.1320*	0.0710	−0.085	0.0682	0.0177	0.0671
SK	0.0140	0.0954	−0.0212	0.0980	0.0778	0.1049	0.0401	0.0971
MB	−0.0565	0.0844	−0.0618	0.0820	−0.0274	0.0830	0.0228	0.0802
QB	0.0217	0.0742	−0.0898	0.0756	−0.3529***	0.0739	−0.0792	0.0711
NB	−0.0013	0.1260	0.0739	0.1271	−0.1073	0.1246	0.0534	0.1076
NL	0.1282	0.1867	0.0145	0.1851	−0.2679	0.1850	−0.1274	0.1641
NS	−0.0799	0.1112	−0.1335	0.1135	−0.1190	0.1112	0.0697	0.1074
PEI	0.3811**	0.1757	0.2254	0.1701	0.2439	0.1877	−0.1709	0.1702
GENDER (Baseline: Men)								
Woman	−0.1897***	0.0459	−0.1775***	0.0465	−0.0476	0.0453	0.0714*	0.0435
Non-binary	0.1289	0.1463	−0.0021	0.1444	0.3555***	0.1393	−0.0318	0.1373
GENERATION (Baseline: Baby Boomers)								
Generation X	−0.2062***	0.0682	−0.0765	0.0702	0.0056	0.0692	0.1433**	0.0674
Millennial	−0.1997***	0.0607	−0.0947	0.0641	0.1495**	0.0623	0.1470**	0.0611
Generation Z	−0.0254	0.0847	0.0771	0.0841	0.3631***	0.0823	0.0868	0.0783
ETHNICITY (Baseline: White)								
Asian	−0.0197	0.0732	0.0500	0.0701	−0.1220*	0.0671	−0.0007	0.0658
Black	0.0633	0.1318	0.1999*	0.1212	0.1206	0.1232	−0.1707	0.1113
Indigenous	0.2045*	0.1135	0.1809	0.1134	0.1338	0.1083	0.1057	0.0978
Latino	0.0554	0.1653	0.1683	0.1648	−0.0708	0.1683	0.2073	0.1611
Middle East	0.0763	0.1591	−0.1611	0.1797	0.1870	0.1946	0.0130	0.2160
POLITICAL AFFILIATION (Baseline: No political affiliation)								
Liberal	0.0274	0.0635	0.1525***	0.0612	0.1283**	0.0606	0.1240**	0.0591
Conservative	−0.0378	0.0661	−0.0483	0.0698	0.0097	0.0662	0.2178***	0.0623
NDP	0.0929	0.0590	0.1112*	0.0593	0.1150*	0.0604	−0.0373	0.0561
Green Party	0.2618***	0.1006	0.2724***	0.1108	0.3084***	0.1024	−0.0093	0.0918
Bloc Québécois	0.0106	0.1210	−0.1799	0.1249	−0.2145*	0.1199	0.1437	0.1200
Does Not Vote	−0.1407	0.1353	−0.3257***	0.1286	−0.4770***	0.1197	0.2125*	0.1275
REGION (Baseline: Rural)								
Small Urban	0.0338	0.0579	0.0401	0.0610	0.0089	0.0599	−0.0337	0.0562
Medium Urban	0.1258	0.0813	0.0506	0.0829	0.0901	0.0798	−0.0186	0.0763
Large Urban	0.1512**	0.0648	0.1650***	0.0657	0.0323	0.0645	−0.0522	0.0615
CLIMATE FACTORS								
Daily Climate Action	0.2133***	0.0259	0.2077***	0.0266	0.2162***	0.0257	−0.0460**	0.0237
Climate Opinion Based On Scientific Evidence	0.0642**	0.0311	0.0023	0.0306	0.1053***	0.0309	−0.0830***	0.0314
Persuasion Of Others About Climate Change	0.8066***	0.0332	0.8138***	0.0326	0.7074***	0.0310	−0.0813***	0.0285
Changed Mind About Driver Climate Change	0.1280**	0.0620	0.2099***	0.0636	0.1191*	0.0661	0.1065*	0.0611
SUMMARY STATISTICS								
Log-likelihood	−3344.9753		−3189.533		−3455.1384		−4308.895	
Wald χ^2	957.31***		1070.98***		1054.98***		91.42***	
Pseudo R ²	0.1695		0.1739		0.1511		0.0114	
Number Of Observations	2878		2877		2877		2878	

*** significant at 1%, ** 5% and * 10%.

for people to share and discuss these experiences with others, including climate scientists and policymakers, has great potential for positively improving climate communication generally and motivating climate action.

Notably, climate skeptics in our study also indicated more trust in scientists than in any other of the (listed) authorities offered to them. This raises questions about which scientists they deem trustworthy³⁹ as there are some notable climate skeptic scientists (e.g., Tim Ball, Fred Singer)⁴⁰, despite the overwhelming majority of scientists agreeing that climate change is happening and anthropogenic. This group of participants also report an overall tendency to reject most forms of authority (i.e., purporting to trust political leaders, activists, and religious leaders less than their counterparts), which merits further investigation to understand which sources climate skeptics consider trustworthy. Since skeptics reported their own experience, and local knowledge, as being especially trusted sources about climate change, centering conversations in climate impacts that are local, tangible, and recent (e.g., expanded range of ticks in North America⁴¹) offers potential for productive discussions with climate skeptics.

Persuasive ability is found in our study to be a factor in how willing respondents are to engage in conversations about climate change. This, combined with the finding that people who report using scientific evidence to form their opinion initiate and participate in discussions significantly more often and avoid them less often, illustrates the importance of rhetorical training and scientific literacy. Rhetorical training means that people are explicitly taught how people argue, debate, identify with one another, and how persuasive strategies work. Indeed, a speaker should be proficient in making their case, but with specialized subjects like science, specific training in the rhetoric of science could be beneficial for those recognized as climate change authorities⁴² as it would help to illustrate the ways in which scientific knowledge is constructed, how evidence is used in those contexts, and why we might trust that evidence and knowledge. We suggest there may be opportunities for rhetorically informed engaged discussion for some audiences among friends, by climate activists and social media influencers or pro-environmental celebrities. Given the tendency for scientific facts to be deployed in a deficit model approach to persuade, which has been widely discredited³², providing those who *do* engage in climate conversations with rhetorical know-how might circumvent this deficit trap. Specifically, those who consider themselves persuasive and who engage in climate change conversations—including activists, influencers, and engaged citizens—might be trained to discuss climate science in ways that acknowledge that while science is not infallible, it is reliable, trustworthy, and its calls for climate action are warranted. At the same time, a rhetorically savvy communicator will acknowledge the specific concerns of their audience, which may not be about the science itself, but be an issue of values, social concerns, etc. This allows for connection based on the ideas and values important to both participants, and demonstrates good will, values, and reason. Such interventions may be especially helpful for those who change their minds about climate change and yet do not change their activities to mitigate the issue, as research has shown conversations rooted in trust and psychological safety can motivate those unsupportive of environmental policy to live more sustainably³.

Rhetorical study might also help illuminate more complex findings. For respondents who report having changed their minds about climate change, we find that they are at the same time more likely to engage in and avoid conversations. While this may initially seem perplexing, the finding may be related to the sites of climate conversations and the importance of context^{18,20}. While not conclusive, the model seems to be suggesting that there are contexts in which individuals who have changed their minds about climate change are especially willing to engage—and this is notable because the ethos of such people might make for especially engaging conversations not just about the existence of climate change, but actions that may be taken to adapt to and mitigate its effects. We speculate that, for instance, avoidance might be a result of not being around people who they might wish to engage in climate conversations or might equally be a result of being in a context where having climate conversations might be untenable (e.g., living in a community where skepticism of climate science is the norm). Further

qualitative study of this issue would be highly interesting and, we anticipate, informative.

Methods

We conducted a web survey in 2022 of people in Canada (ORE # 43540) using a stratified sampling design based on region of residence. The survey was designed from the perspective of rhetorical scholars, taking a somewhat different approach than other surveys, given the specific interest in how people talk to others about climate change. Given the robust research on climate belief, both in Canada and abroad, our interests narrowed in on climate conversations and how people's engagement (or lack thereof) in these conversations aligns with beliefs and other factors such as demographics. In addition to being a more niche area of study, there is a further challenge of rhetorical studies largely being qualitative in nature, and thus we relied upon experts in the University's Statistical Consulting and Survey Research Unit (SCSRU) to refine questions for a large-scale survey approach. The survey was implemented in English and French by reputable Canadian online panel firms, commissioned by the SCSRU at the University of Waterloo. The survey was initially distributed between March 8 and April 11, 2022 over a period of 5 weeks and targeted a representative sample of Canadians living in the 10 provinces (British Columbia [BC], Ontario [ON], Quebec [QC], Manitoba [MB], Atlantic provinces (including Newfoundland and Labrador [NL], Nova Scotia [NS], New Brunswick [NB], Prince Edward Island [PEI]), and Alberta [AB] and Saskatchewan [SK]), and was subsequently sent out again over a much shorter period of time from June 29 to July 7, 2022 to ensure that a representative sample of both Anglophones and Francophones in each province was included. Invitations to participate were sent to 52,629 panel members, and surveys were completed by 3,776 respondents, of which 18% completed the survey in French (90% of Quebec respondents and 31% of New Brunswick respondents). Data were cleaned for responses that appeared to be "speeders" or those who complete the survey in a notably short time or have suspicious responses such as straight lining (i.e., clicking the same response in a straight vertical line in a series of questions measured on the same scale). In the sampling design, we used a stratified approach based on province groupings following 6 strata: British Columbia (BC), Ontario (ON), Quebec (QC), Manitoba (MB), the Maritimes, and Alberta & Saskatchewan (AB + SK). The design oversampled in AB and SK for greater precision as previous research indicates those provinces may have differing views to the rest of Canada⁴³ the sample included a higher number of young people (grouped as Millennials/Gen Z) than Baby Boomers and GenX because we wanted to ensure precision in younger cohorts given attention to youth voices in climate movements⁴⁴ and thinking about transgenerational responsibility^{7,45}. Weights were calibrated using information from the 2016 Census data from Statistics Canada using a raking algorithm, and it is the weighted data that are used in the analysis. Each survey item is investigated individually and as such we discuss each measure as it appears in the results.

Owing to the limitations of survey approaches, particularly online surveys, analysis through formal inference provides a better method for estimating probabilities related to specific variables. In other words, we wanted to know the effects of variables without said effects being interfered with by other variables (insofar as is possible in a multivariate statistical analysis). The survey had a total of 21 questions. For most of the questions, responses were optional, except for those needed to meet quotas (i.e., questions 1–3) (see Supplementary Materials for survey instrument). Questions 17–21 collected for demographic purposes, and question 4 provided the power calculation question which asks, "Do you currently think that humans have significantly contributed to or caused climate change?"

The results reported here reflect the quantitative data collected during this survey based on Likert-based questions. We also collected responses to open-ended questions for future qualitative analysis, and those results are not included in the findings here. Owing to the large quantity of data collected, we are unable to report all survey responses and instead focus on responses to survey items that are most central to addressing how to talk

about climate change to better understanding dynamics that might influence communications around the subject in Canada.

For models looking at demographic indicators, we included demographic variables of generational grouping, province of residence, ethnicity, gender, and political affiliation. Some ethnicity options were included in “another category” due to low numbers and we combined categories for selecting gender into woman (inclusive of cis and transwomen), man (inclusive of cis and transmen), and other selections.

Given the study represents a snapshot in time in 2022, the study is limited to a relatively short period of time. In addition, while the study makes claims about climate change discourse and debate in Canada, the survey was not distributed to those living in the three territories. The panel firm excluded territorial responses given their relatively small population and lack of representation in their panel. This is a notable limitation given the disproportionate impacts of climate change on this region⁴⁶. The study also faced challenges recruiting rural participants, especially in BC, and recruiting participants in Atlantic Canada (NB, NS, PEI, NL). The survey also needed to be reopened for some areas to fill missing quotas or to make up for missing completed surveys in difficult-to-fill quotas (e.g., Millennials living in rural BC).

We used IBM SPSS for most of the summary and test statistics presented in the first three Results sections and Stata 17 for the ordered probit regression models in the final Results section.

Data availability

Test results from this study are available on request by the corresponding author.

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Author contributions

A.M., S.D., R.B., J.S., and B.M. wrote the manuscript text. A.M., S.D., J.S., C.E., C.K., S.F., and B.M. conceived and designed the study. A.M., S.D., R.B., and J.S. analyzed the data. R.B. prepared the figures and tables. All authors reviewed the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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