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Experience or attribution? Exploring the relationship between personal experience, political affiliation, and subjective attributions with mitigation behavioural intentions and COVID-19 recovery policy support

Jagdish Thaker, Christopher Cook
School of Communication, Journalism & Marketing, Massey University, New Zealand

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ABSTRACT
Scholars argue that personal experience with climate change related impacts can increase public engagement, with mixed empirical evidence. Previous studies have almost exclusively focussed on individuals’ experience with extreme weather events, even as scientific research on health impacts of climate change is burgeoning. This article extends previous research in the domain of public perceptions about climate-related public health impacts. Results from a nationally representative sample survey in New Zealand indicates that subjective attribution of infectious disease outbreaks to climate change and to human impact on the environment is positively associated with mitigation behavioural intentions and climate-focussed COVID-19 economic recovery policies. In contrast, knowledge about COVID-19 and self-reported economic impact due to COVID-19 is not associated with policy support. Moreover, significant interaction between political affiliation and subjective attribution to climate change on policy support indicate that learning about the links between health and climate change will particularly help increase mitigation engagement among right-leaning individuals. Subjective attribution may be the key to help translate personal experience to personal engagement.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic is continuing to have an unprecedented impact on public health and the global economy. According to the World Health Organization, while there is no direct link between climate change and COVID-19, the disease caused by the coronavirus SARS-CoV-2, ‘most emerging infectious diseases, and almost all recent pandemics, originate in wildlife, and there is evidence that increasing human pressure on the natural environment may drive disease emergence’ (World Health Organization, 2020, para 3). Climate change influences many socio-ecological components, increasing the risk of infectious diseases for humans, wildlife, livestock, and plants (Campbell-Lendrum, Manga, Bagayoko, & Sommerfeld, 2015; Ostfeld, Wu, Lu, Zhou, Chen, & Xu, 2016). Climate change can impact human health directly by influencing the growth, survival, transmission and virulence of disease-causing pathogens or indirectly through ‘climate-related perturbations in local ecosystems or the habitat of species that act as zoonotic reservoirs’ (Smith et al., 2014, p, 726). A majority of emerging infectious diseases, and almost all recent pandemics such as SARS, MERS, West Nile, H1N1, and Ebola, originate in animals (“zoonotic disease” or “zoonosis”) (Allen et al., 2017).

The global economic cost of the COVID-19 pandemic is estimated to reach $9 trillion (Battersby, Lam, & Ture, 2020). As countries race to support COVID-19 economic recovery, it is important that these policies also address the global crisis of climate change (Hepburn, O’Callaghan, Stern, Stiglitz, & Zenghelis, 2020; Rosenbloom & Markard, 2020) or risk further disease outbreaks (Morens & Fauci, 2020). Scholars have identified five COVID-19 fiscal recovery policies with high potential on both economic and climate impact metrics: clean physical infrastructure, building efficiency retrofits, investment in education and training, natural capital investment, and clean energy research and development (Hepburn et al., 2020). The United Nations also urges bold action to ensure COVID-19 recovery is aligned with Sustainable Development Goals (UN 2020). Public support in enacting and implementing these policies is critical to achieving success as public opinion is associated with government enactment of environmental policies (e.g., Anderson,
and respond to climate change related impacts. The goal of this study is to understand if people subjectively attribute the emergence of infectious diseases such as the COVID-19 to the human impact on the environment and to climate change, and how such an assessment is associated with mitigation behaviour change and support for climate-focussed COVID-19 economic recovery policies. A burgeoning number of studies have evaluated how individuals’ experiences with climate-related events is associated with their beliefs, behaviours, and mitigation policy support (Akerlof, Maibach, Fitzgerald, Gedeno, & Neuman, 2013; Demsiki, Capstick, Pidgeon, Spence, & Spence, 2017; van der Linden, 2014; Marlon et al., 2019; Myers, Maibach, Roser-Renouf, Akerlof, & Leiserowitz, 2013; Ogunbode, Demsiki et al., 2019; Osaka & Bellamy, 2020; Reser & Bradley, 2020; Zanocco, Boudet, Nilson, & Flora, 2019). Research on personal experiences of climate-related events, however, has almost exclusively focused on individuals’ experience with weather anomalies and extreme weather events in shaping public responses (Howe, Marlon, Mildenberger, & Shield, 2019; Howe & Leiserowitz, 2013; McCright, Dunlap, & Xiao, 2014; Ogunbode, Demsiki, et al., 2019; Reser & Bradley, 2020). Moreover, empirical evidence about the impact of personal experiences with beliefs, behaviours, and policy support is mixed, with some studies finding support (Demsiki et al., 2017; Hamilton-Webb, Manning, Naylor, & Conway, 2017; Marx et al., 2007; Zanocco et al., 2019), while others finding little or no evidence (Boon, 2016; Carlton et al., 2016). Prior beliefs and affective responses about climate change also structure how public experience and respond (McCright et al., 2014; Myers et al., 2013; Ogunbode, Demsiki et al., 2019; Reser & Bradley, 2020). In other words, pre-existing climate change beliefs, values, worldviews, and political orientation structure how individuals’ experience, interpret, assimilate, and respond to climate change related impacts.

More recent studies indicate that a key link to explain the dissonance in findings between personal experience and climate change beliefs is subjective attribution (McCright et al., 2014; Ogunbode, Demsiki et al., 2019; Ogunbode, Doran, & Böhm, 2020; van der Linden, 2014). Subjective attribution is defined as “a personal understanding that an extreme weather event is causally connected to climate or is a sign of climate change” (Ogunbode, Demsiki et al., 2019, p. 32). Research that focuses on objective measures of exposure—such as individuals living in an area that was recently flooded or experienced drought conditions—does not always account for how individuals interpret and assimilate experience (Reser & Bradley, 2020; also see Howe et al., 2019). Unless individuals can connect their personal experience of extreme weather events as being associated with climate change, experience alone may not be instrumental in shaping climate change related actions; instead, actions may reflect normal practices (Hamilton-Webb et al., 2017) or the events may be attributed to other causes, such as poor infrastructure management (Ogunbode, Böhm et al., 2019), thereby deflecting attention from climate change. It is important to note that subjective attribution can be independent of, and different to, scientific attribution that an event is caused or influenced by climate change. While scientists can indeed make individual subjective attributions, scientific attribution here is referred to the evolving scientific consensus in attributing the probability and magnitude of specific events to human-induced climate change (Stott et al., 2016; also see; Reser & Bradley, 2020).

This study extends previous findings in several unique ways. First, it draws on experiential learning about climate change (Marx et al., 2007; WeingART & Roberts, 1994) and attribution theory (Weiner, 2006, 2011) in a new context of health impacts of climate change—an area of study that has received scant attention by social science scholars (e.g., Akerlof et al., 2010; Clayton & Manning, 2018; Nisbet, Price, Pascual-Ferra, & Maibach, 2010) as well as little media attention about climate change impacts on health (Weather, 2013). Understanding health impacts of climate change can be more persuasive in shaping public action compared to environmental impacts (e.g., Myers, Nisbet, Maibach, & Leiserowitz, 2012).

Second, this study explores subjective attribution of infectious disease outbreaks such as COVID-19 with two distinct variables: a general measure of the human impact on the environment, and specifically, with climate change being linked to the rise in risks of infectious disease outbreaks. Previous studies indicate that public perceptions may differ based on how they associate with keywords such as climate change (Jang & Hart, 2015) and how public interpretations attribute of different events to climate change (Osaka & Bellamy, 2020; Zanocco et al., 2019). Climate change is a polarising term in several countries; even in New Zealand, ideological divides exist on climate change (Milfont, Harré, Sibley, & Duckitt, 2012). Moreover, climate change perceptions are not a subset of general environmental beliefs (O’Connor, Bord, & Fisher, 1999). Finally, environmental impacts can be perceived as more locally relevant compared to climate change, which may be perceived as distant (Nash, Capstick, Whitmarsh, Chaudhary, & Manandhar, 2019). Whether such differences (environmental impact and climate change) manifest in how individuals subjectively attribute the rise in infectious diseases is explored in this study.

Third, unlike previous studies focussed on mitigation behavioural intentions and general mitigation policies, this study specifically explores these measures in the context of COVID-19 by adding specific costs and inconveniences to the question- wording on behaviours. As the measures become more specific and concrete, such as explicit personal cost for respondents and indicative price for carbon tax, the association between individuals’ climate change beliefs with behavioural intentions and policy support decreases (e.g., Hornsey, Harris, Bain, & Fielding, 2016). Using data from a nationally representative sample survey in New Zealand, this study explores if subjective attribution of infectious diseases such as COVID-19 to the anthropogenic impact on the environment and subjective attribution to climate change is associated with mitigation behavioural intentions and mitigation policy support. Moreover, as previous studies show that political affiliation structure how individuals interpret, assimilate, and respond to climate change related experiences, this study tests if political affiliation moderates the association between subjective attribution and mitigation intentions. Similarly, it tests if personal experience moderates the association between subjective attribution and mitigation intentions. Finally, it tests if political affiliation moderates the association between personal experience and mitigation intentions. In other words, this study seeks to explore how personal experience, political affiliation, and subjective attribution is associated with behavioural intentions and policy support.

2. Literature review

Scholars attribute the lack of public and policy engagement with climate change to the abstract and global nature of the issue, resulting in an impersonal interaction with a presumed distant issue (Capstick, Demsiki, Sposato, Pidgeon, Spence & Corner, 2015; Gifford, 2011; McDonald, Chai, & Newell, 2015; Weber, 2006). Inversely, direct experience with climate changes, such as experience with weather anomalies and extreme weather events, can potentially help the public learn about climate change (Howe et al., 2019; McDonald et al., 2015; Reser & Bradley, 2020).

Yet, previous research indicates mixed evidence. While some studies show that experience with extreme weather events is associated with increased issue salience, risk perceptions, behavioural intentions, and support for mitigation policies (Demsiki et al., 2017; van der Linden, 2015), other studies show modest or no such association (Boon, 2016; Carlton et al., 2016). For example, Boon (2016) found that prior disaster experience had no association with climate change risk perceptions among respondents in four disaster-impacted rural Australian towns. Analysing 10 US communities who were impacted by a range of extreme weather events, Zanocco et al. (2019) found that self-reported harm, but not objective assessments of exposure, was associated with support for climate mitigation policy. Some studies show that experience of extreme
weather events, such as heatwaves, increases public concern in the short-term; however, these experiences are not powerful enough to prompt behaviour change (Larcom, She, & van Gevelt, 2019). A key learning from these studies is that exposure to and experience of extreme weather events, although important, does not provide a complete picture of the psychological reality of how individuals interpret, assimilate, and respond to these events.

A primary limitation of previous studies is theoretical and measurement inconsistency in assessing perceived personal experience of climate change impacts (Howe et al., 2019; Reser & Bradley, 2020). These include exposure to weather events (using objective assessments, self-reported exposure), perceived personal impact (measured as harm to self and property), the geography of impact (local or national), among others. How exposure and impact are likely to make the issue of climate change salient in the public mind remains unclarified. Reser and Bradley (2020) found that only 5 of the 36 studies reviewed directly asked respondents if the environmental change, condition, or event they experienced was a probable manifestation or consequence of climate change. Recent research indicates that unless personal experience with extreme weather events is explicitly understood to be a manifestation of climate change, these experiences are not associated with mitigation intentions and policy support (e.g., Ogunbode, Denski, et al., 2019). In other words, unless the experience is attributed to appropriate causes, risk perceptions and actions to reduce such future negative events may be misdirected (Hamilton-Webb et al., 2017; McCright et al., 2014).

Research using mental models theoretical approaches suggests that how people attribute the causes and consequences of climate change impacts their ability to distinguish between effective and ineffective strategies (Bostrom et al., 1994). Individuals are motivated to explain or attribute various causes of unexpected events that result in negative outcomes and such attribution matters in shaping public action (e.g., Weiner, 2006, 2011). According to the theory of perceived responsibility and social motivation (Weiner, 2006), individuals’ subjective causal attributions to societal issues, such as climate change, obesity, and others, influence their perception, judgment, and action. For example, in climate change research, a number of studies show that individuals who attribute climate change as a result of human activities report higher risk perceptions (e.g., Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015), are more concerned about the consequences (Bord, O’Connor, & Fisher, 2000; Hoogendoorn, Sütterlin, & Siegrist, 2020), and sequentially more willing to engage in mitigation actions and support mitigation policies (Hornsey et al., 2016; Jung, 2013). Indeed, belief about human-causation of climate change is one of the strongest predictors of climate change risk perception across the world (e.g., Lee 2015). Whether such attribution of human activities as the primary driver of climate change also manifests to individual extreme weather events is less explored (Cutler, Marlon, Howe, & Leiserowitz, 2020; Marlon et al., 2019; McCright et al., 2014; Ogunbode, Denski, et al., 2019; van der Linden, 2014).

Subjective attribution is defined as an individual’s understanding that an event is, in part or wholly, caused due to climate change (Ogunbode, Böhm, et al., 2019). In this study, subjective attribution is defined as perceived belief that infectious disease outbreaks such as the coronavirus are in part caused due to human impact on the environment, generally, and climate change, specifically.

Subjective attribution of personal experience to climate change conceptually differs from other climate change related beliefs such as human-causation in scientific attribution because subjective attribution refers to a conscious cognitive attribution (van der Linden, 2014) of a visceral, concrete, and proximal local event experience to climate change, while the other measures refer to an analytical, global idea, where the impact—and the responsibility to act to reduce the impact—is perceived to be distributed universally. Scholars have also distinguished between the constructs empirically: McCright et al., 2014 tested and found that perceived scientific agreement as well as perceived human cause was positively associated with subjective attribution of temperature anomalies to climate change. Similarly, other scholars have distinguished between climate change related beliefs, such as climate change is happening and perceived threat, with subjective attribution, and found positive association between climate change beliefs and subjective attribution (Ogunbode et al., 2020; Shreedhar & Mourato, 2020). Previously, researchers found differences in support for mitigation and adaptation policies (Bateman & O’Connor, 2016; McCright et al., 2014). It is possible that subjective attribution of an event to climate change can bridge the felt responsibility between mitigation and adaptation, as it makes climate change an immediate and personal threat. Using data from 24 countries, Broomell, Budescu, and Por (2015) found that personal experience is strongly associated with specific mitigation actions, even after controlling for beliefs about climate change, worldviews, and political ideology.

2.1. Political affiliation and subjective attribution to climate change

Few studies have explored what factors are associated with subjective attribution and how subjective attribution in turn is associated with public responses. McCright et al. (2014) found that, in the US, political ideology and party identification is associated with subjective attribution, with democrats, liberals and females more likely than their Republican, conservative and male counterparts to attribute the warmer local winter temperatures to global warming than to normal yearly variation. Objective indicators such as state-level temperature anomalies, however, did not influence subjective attribution even though it predicted perceived local winter warming. Ogunbode et al. (2020) found that in Norway, individual flooding experience was only linked to significantly greater subjective attribution than local flooding experience among people with a right-wing political affiliation. These studies suggest that subjective attribution to climate change is most likely associated with political ideology.

Numerous studies have demonstrated a political divide of how people experience unusual changes in local weather patterns and its association with climate change beliefs and mitigation responses (Howe et al., 2019; Howe & Leiserowitz, 2013; Marlon et al., 2019; McCright et al., 2014). Those with liberal or left-leaning political affiliation are more likely to report changes in their local weather patterns, report higher negative impact, and more strongly support public and policy engagement compared to conservatives or right-leaning individuals. For example, Ogunbode, Böhm, et al. (2019) found that right-leaning UK voters were less likely to attribute extreme weather experience to climate change. Zanocco et al. (2019) found that political ideology had the highest magnitude of association on climate mitigation policy support, among the measures they studied. This partisan gap was also observed in studies focussing on human attribution and wildlife disease risks: Roh, McComas, Rickard, and Decker (2015) tested if exposure to human responsibility (vs wildlife) to Lyme disease in the US affects support for pro-environmental behaviours, finding that exposure resulted in fewer Republicans acknowledging anthropogenic attribution to wildlife diseases and intentions to engage in conservation behaviours compared to Democrats.

Even in New Zealand, Milfont et al., (2012, 2017) report political conservatives to be part of a latent profile of respondents (“climate sceptics”) with low agreement levels in the reality and human causation of climate change. In another study, they found that support for Labour Party (centre-left and considered to be pro-environmentally oriented) was positively associated with support climate-change actions whereas support for National Party (centre-right) was negatively associated with support for climate actions among people with children. Based on these findings, this study explores the following hypotheses:

H1a. Individuals who are affiliated with right-leaning political groups will be less likely to subjectively attribute infectious disease outbreaks to human impact on the environment compared to moderate and left-leaning individuals.
H1b. Individuals who are affiliated with right-leaning political groups will be less likely to subjectively attribute infectious disease outbreaks to climate change compared to moderate and left-leaning individuals.

2.2. Subjective attribution and mitigation intentions

Even fewer studies have evaluated how subjective attribution is associated with behavioural intentions and policy support, even as several studies implicitly assume that exposure to and experience of extreme weather events automatically elicits climate change-related behaviours and policy support. A recent study by Ogunbode and colleagues (2019) provides a cautionary tale. They found that personal experience of the 2013/2014 floods in the UK was significantly associated with perceived threat from climate change only among individuals who subjectively attributed flooding to climate change. Moreover, perceived threat mediated an indirect association between flooding experience and mitigation only among those who subjectively attributed the flooding to climate change. Taken together, subjective attribution appears to play a critical role in helping people connect the dots between experience and support for climate change mitigation actions.

While these few studies have focused on subjective attribution of extreme weather events to ascertain climate change beliefs, one can expect that subjective attribution to climate change in other domains can play an equally important role in shaping public action. In this study, subjective attribution that human impact on the environment and climate change is partly responsible for infectious disease outbreaks is explored. As argued in the Introduction section, climate change can directly or indirectly affect disease outbreaks by influencing distribution and incidence of pathogens, vectors, hosts, and the interaction between them (Smith et al., 2014; WHO, 2020). As Anthony Fauci, the most visible face of US response to COVID-19 argued, the “COVID-19 pandemic is yet another reminder, added to the rapidly growing archive of historical reminders, that in a human-dominated world, in which our human activities represent aggressive, damaging, and unbalanced interactions with nature, we will increasingly provoke new disease emergences” (Morens & Fauci, 2020, p. 1089).

As health impacts of climate change have the potential to increase public engagement, even among sceptics of climate change (Myers et al., 2012), this is a promising avenue of research. For example, Roh et al., (2015) experimental study with a representative US sample found that exposure to human attribution for wildlife diseases such as Lyme disease was positively associated with intentions to engage in conservation behaviours. A recent experimental study found that exposure to a narrative about the anthropogenic impact on the natural environment as a cause for the COVID-19 pandemic was associated with greater support for the coronavirus (Shreddiehar & Mourato, 2020). The researchers found that exposure to the human impact on the natural environment narrative “elicited greater mental and emotional engagement, and induced stronger feelings that firms and governments are responsible for mitigating wildlife extinction” (Shreddiehar & Mourato, 2020, p. 965).

This study explores if subjective attribution that a rise of infectious disease outbreaks is linked to human impact on the environment as well as subjective attribution of infectious disease outbreaks to climate change is associated with mitigation intentions and policy support. Previous studies indicate public responses differ based on the wording (e.g., Jang & Hart, 2015) and how they attribute different events to climate change (Osaka & Bellamy, 2020). Compared to environmental impacts, climate change is a politically polarising issue, even in New Zealand (e.g., Milfont et al., 2012). As mentioned earlier, climate change perceptions is not a subset of general environmental beliefs (O’Connor et al., 1999).

H2. Subjective attribution of infectious disease outbreaks to human impact on the environment will be positively associated with mitigation behavioural intentions and policy support.

H3. Subjective attribution of infectious disease outbreaks to climate change will be positively associated with mitigation behavioural intentions and policy support.

In addition, this study explores if subjective experience moderates the association between personal experience and the two outcome variables of mitigation intentions. For example, Ogunbode, Denski, et al., (2019) report that personal experience with flooding in the UK was only significantly associated with perceived threat from climate change among individuals who subjectively attributed the flooding to climate change.

Moreover, this study also explores if political affiliation moderates the association between subjective attribution and the outcome variables of behavioural intentions and policy support.

Finally, similar to previous studies such as Zanocco et al., (2019), this study tests if the association between negative personal experience and mitigation intentions is moderated by political affiliation.

Further, apart from a series of demographic variables used as statistical controls to explore the above hypothesis, this study also accounts for personal economic impact due to COVID-19 and knowledge about COVID-19. Self-reported economic impact due to COVID-19 highlights negative impacts due to an event, similar to financial impact or property damage suffered due to extreme weather events (Albright & Crow, 2019; Zanocco et al., 2018, 2019). From an experiential learning perspective, negative experiences heightens risk perceptions and behavioural responses through the negative emotions they evoke and the salient memories of negative physical or psychological impacts they create.

Further this research explores if, after accounting for knowledge, apropos to analytical learning, there exists a unique association between subjective attribution of infectious disease outbreaks to climate change with behavioural intentions and policy support. Several studies have tested association between climate change knowledge and behavioural intentions and between knowledge and policy support and found weak or no significant association (Hornsey et al., 2016; Rhodes, Axsen, & Jaccard, 2014). Does knowledge about COVID-19—disease origin, transmission, and ways to protect oneself—also have similar weak or insufficient association with mitigation intentions and COVID-19 emergency economic recovery policies is explored in this study.

3. Method

The data for this study comes from a nationally representative online sample survey of 1040 New Zealand adults, aged 18 and older. The self-administered web-based survey was fielded by Qualtrics, an international survey agency, between June 26 to July 13, 2020. Qualtrics and its affiliate partners maintain an active online panel of over 350,000 New Zealanders. The panel members are recruited using a variety of web-based advertising methods such as Google AdWords campaign as well as through partnership with popular local online ‘buy and sell’ website TradeMe and local deals website, GrabOne. Traditionally hard-to-reach segments are targeted through specific tailored campaigns, such as social media targeting and referral bonus. Respondents receive incentives that varies based on audience, incidence rate, along with time in the field. Respondents can redeem these points for gift cards or as sweepstakes entries for larger prizes. The survey was fielded just after New Zealand’s national lockdown was lifted and the country returned to some degree of normality (with recommend safe behaviours, such as mask use in public transport, contact tracing app, etc.). Till the end of the survey, there were about 1500 active cases of COVID-19 (compared to 13.34 million worldwide) and 22 confirmed deaths in New Zealand (compared to 608,610 deaths worldwide) (https://ourworldindata.org/covid-deaths?country=NZL_OWID_WRL). The survey took about 22 min on average to complete. The data were weighted, post-survey, on gender, age, education, and ethnicity to match the New Zealand census estimates. See Table 1 for a summary of demographic variables.
Table 1  
Demographics.  

|                   | Unweighted | Weighted | Unweighted | Weighted |
|-------------------|------------|----------|------------|----------|
| Total             | 1040       | 100      | 1040       | 100      |
| Gender            |            |          |            |          |
| Female            | 609        | 58       | 530        | 51       |
| Male              | 431        | 41       | 510        | 49       |
| Age               |            |          |            |          |
| 18-25             | 189        | 18       | 146        | 14       |
| 26-35             | 220        | 21       | 187        | 18       |
| 36-45             | 175        | 16       | 166        | 16       |
| 46-55             | 163        | 15       | 187        | 18       |
| 56-65             | 127        | 12       | 156        | 15       |
| 66 and above      | 166        | 16       | 198        | 19       |
| Education         |            |          |            |          |
| No qualification  | 96         | 9        | 199        | 19       |
| Level 1 to Level 6 diploma | 577   | 55       | 564        | 54       |
| Bachelor’s degree or higher | 367   | 35       | 277        | 27       |
| Ethnicity         |            |          |            |          |
| European Newzealander | 648     | 62       | 640        | 61       |
| Māori             | 139        | 13       | 170        | 16       |
| Pasifika          | 50         | 4        | 80         | 7        |
| Asian or Another Category | 203 | 19       | 150        | 14       |
| Annual personal income |        |          |            |          |
| Less than $19,999 | 280        | 26       | 286        | 27       |
| $20,000 to $39,999 | 254       | 24       | 273        | 26       |
| $40,000 to $59,999 | 182       | 17       | 188        | 18       |
| $60,000 to $79,999 | 138       | 13       | 130        | 12       |
| $80,000 to $99,999 | 68         | 6        | 59         | 5        |
| $100,000 to $119,999 | 64       | 6        | 55         | 5        |
| $120,000 or above | 50         | 4        | 46         | 4        |

3.1. Measures

The wording of the questions, the range of responses, and other descriptive information is provided in Table 2. Two distinct subjective attribution measures were used in the study: (1) human impact on the environment and (2) climate change. These measures were developed in consultation with researchers at the Center for Climate Change Communication at George Mason University, who have conducted several studies on public perceptions about climate change and health. Principal axis factor analysis with direct oblimin rotation, to account for correlation between the variables, was used to verify if the variables represent distinct factors. Kaiser-Meyer-Olkin measure of sampling adequacy was 0.89, above the commonly recommended value of 0.6, and Bartlett’s test of sphericity was significant ($\chi^2 (28) = 5843.97, p < .001$). Two factors explained 75% of the variance (see Supplementary Table 1). The mean of the variables that comprised the two factors were computed separately for analysis. The two scales of subjective attribution were moderately correlated ($r = .61, p < .001$).

While only few measures in this study specifically used the term “coronavirus,” the term “infectious disease outbreaks” was consistently used in all measures. As there were no other major infectious disease outbreaks during the time of this study, it is assumed that respondents hold such beliefs. In other words, how individuals’ make sense of an event, its causes, and its consequences in their own mind affects actions they will perceive to be needed and consider to be effective (e.g., Bostrom et al., 1994).

Mitigation policy support variables were operationalized based on the Oxford University study that suggested five policy measures to address economic recovery from COVID-19 aligned with climate action, as mentioned in the Introduction section (Hepburn et al., 2020). Mitigation behavioural intentions variables were used following previous studies (Leiserowitz, 2006; Ogumbode, Demske, et al., 2019).

Table 2

| Construct Items                                                                 | M (SD) | α  | r       |
|--------------------------------------------------------------------------------|--------|----|---------|
| **Subjective attribution**                                                      |        |    |         |
| Infectious disease outbreaks and human impact on the environment                | 2.77 (.74) | .83 | .43 to .77, p < .001 |
| Human impact on the environment increases the risk of new infectious diseases  | 3.07 (0.83) |    |         |
| Cutting forests increases the risk of new infectious diseases jumping from wildlife to humans | 2.50 (0.96) |    |         |
| Rapid agricultural expansion in wildlife areas makes it easier for infectious diseases to spread to humans | 2.59 (0.95) |    |         |
| Large-scale animal “factory” farms increase the risks of new disease outbreaks  | 2.92 (0.92) |    |         |
| **Infectious disease outbreaks and climate change**                             |        |    |         |
| Climate change causes the spread of infectious diseases to new places           | 2.36 (.85) | .94 | .72 to .82, p < .001 |
| Climate change increases the risk of new disease outbreaks such as the coronavirus | 2.32 (0.92) |    |         |
| Climate change is making conditions more suitable for disease transmission between wildlife and humans | 2.43 (0.93) |    |         |
| Climate change will result in more pandemics such as the coronavirus           | 2.40 (0.96) |    |         |
| **Mitigation behavioural intentions**                                          |        |    |         |
| Reduce consumption of meat even if it is inconvenient                           | 2.59 (.66) | .8  | .34 to .59, p < .001 |
| Increase use of public transportation, if available in your area, even if increases your travel time | 2.32 (0.98) |    |         |
| Reduce car use even if it is inconvenient for travel                           | 2.56 (0.97) |    |         |
| Buy an energy efficient car even if it costs more initially                     | 2.50 (0.95) |    |         |
| Purchase energy efficient appliances even if you need to pay more initially    | 2.29 (0.99) |    |         |
| **Mitigation policy support**                                                  |        |    |         |
| Industries that receive substantial emergency financial assistance should be required to lower their carbon emissions | 2.65 (0.92) |    |         |
| Funding to airlines should be based on their commitment to reduce their carbon emissions | 2.78 (0.92) |    |         |
| Government funding should require electric utility companies to generate 100% of their electricity from clean energy sources, like solar and wind | 2.83 (0.89) |    |         |
| Support the agriculture sector only if there are concrete plans to reduce environmental problems | 2.89 (0.92) |    |         |
| Farmers that receive government funding should reduce carbon and water pollution | 2.90 (0.89) |    |         |

Note: N = 1040. All the above items were measured on a four-point scale, 1 = strongly disagree, 4 = strongly agree. The mean of the individual items was computed to represent respective scales.

Importantly, these measures contained a cost or inconvenience factor as public intentions decreases with increasing economic costs for behaviour and policies (Hornsey et al., 2016).

Four items, measured dichotomously (Yes, 1, No, 0) were used to assess economic impact due to COVID-19 that started with the prompt, “In the last 60 days, have you or a member of your household experienced any of the following because of the spread of the coronavirus or...”
not?” The measures included “Lost income form a job or business,” (33%), “Had work hours reduced,” (33%), “Lost a job,” (14%), and “Filed for unemployment benefits,” (14%). The mean of the four items were used to compute the scale of COVID-19 economic impact (M = 0.23, SD = 0.30).

In addition, knowledge about COVID-19 origin, transmission, and ways to protect oneself was used to explore the unique association between subjective attribution and outcome variables. Eleven questions, measured dichotomously (True or False), were used to compute knowledge about COVID-19. These questions started with a prompt, “To the best of your knowledge, which of the following statements true or false.” All scientifically accurate statements were coded 1 compared to 0. Eight statements were scientifically accurate relating to symptoms (dry cough (True, 1, 87%), fever (93%)), protection (frequent hand washing, 97%), avoiding large gatherings (92%), 6-feet distance (74%), and cure (“there is currently no cure for the coronavirus, 81%). Five statements were scientifically inaccurate, including on impact on elderly ("only elderly people get infected," False, coded as 1, 94%), and protection ("Hydroxychloroquine can prevent or kill coronavirus,” False, 1, 84%; “antibiotics can prevent or kill the coronavirus,” False, 1, 84%; “exposure to sun or extreme heat can prevent or kill the coronavirus,” False, 1, 76%). Similarly, the respondents who correctly identified conspiracy theories as false were coded as 1 (“5G towers are spreading coronavirus,” False, 1, 93%; “Bill Gates may have created the coronavirus to profit,” False, 1, 90%; “coronavirus was created in a lab,” False, 1, 66%). The scientifically accurate answers were summed to create an index of knowledge about COVID-19 (M = 9.58, SD = 1.56; KR-20 (Kuder-Richardson Formula 20) = 0.58).

Several demographic variables were used in the study, including, gender, age, income, education. The following variables were dummy coded: marital status (married/with partner, de-facto = 1, versus others coded as 0), those with children (1), job status (currently employed = 1), membership in local groups (yes = 1), and smoking status (smoke/roll own tobacco/vape = 1). Group membership was used to account for networks of social support and learning, and smoking status was used to account for higher susceptibility to COVID-19 disease. Asian and other ethnicities were dummy coded in reference to European New Zealanders (European descendants or White), Māori, and Pasifika.

Following previous research in the UK (Ogunbode, Denski, et al., 2019) and New Zealand (Milfont et al., 2012), declared voting intentions for the upcoming national elections were used as an indicator of political affiliation. Respondents who said they will vote for the ‘Green party’ or the ‘Maori party’ were coded as left-leaning, based on the assessment about the political party policies according to an independent organisation of 700 health professionals (Croxford, 2020). Respondents who said they will vote for ‘Labour,’ a centre-left party were coded as the moderate, similar to previous studies (Milfont et al., 2012), and respondents who said they will vote for National, a centre-right party, along with other smaller parties that share the limited government ideal were coded as right-leaning. These smaller parties, such as ACT and New Conservative party, promise to repeal local environmental policies (Zero Carbon Act) and withdraw from the Paris Climate Agreement, respectively (Croxford, 2020). The political affiliation variable ranges from right-leaning (−1), moderate (0) and left-leaning individuals (1).

There were very few missing values, just 2 or 3 on most variables, with 4 (the highest) missing values on income. We substituted mean values of the respective variables for these few cases as such a low number of missing cases are unlikely to bias the results. Variables used to test interactions were mean centred prior to analysis. Analysis of variance and multiple regression was used to test the hypothesis using the statistical software SPSS (version 27). All the variables of interest including the interaction terms were tested simultaneously to control for demographic and other differences among respondents. Regression models with and without interaction terms are presented below.

4. Results

There was a statistically significant difference between political party affiliation and subjective attribution of infectious diseases outbreak to human impact on the environment (F(2, 1037) = 11.15, p < .001), supporting the hypothesis (H1a). A Games Howell post hoc test revealed that right-leaning individuals (M = 2.65, SD = 0.79) were less likely to subjectively attribute infectious disease outbreaks to human impact on the environment compared to moderate (M = 2.81, SD = 0.71, p < .01, Hedge’s g = .22) and left-leaning individuals (M = 3.05, SD = 0.64, p < .001, Hedge’s g = .53). Further, there was a statistically significant difference between the moderates and left-leaning individuals (p < .01, Hedge’s g = .34) on subjective attribution to human impact on the environment. These imply small to medium effect sizes.

There was a statistically significant difference between political party affiliation and subjective attribution of infectious diseases outbreak to climate change (F(2, 1037) = 15.79, p < .001), supporting the hypothesis (H1b). A Games Howell post hoc test revealed that right-leaning individuals (M = 2.16, SD = .85) were less likely to subjectively attribute infectious disease outbreaks to human impact on the environment compared to moderate (M = 2.45, SD = .82, p < .001, Hedge’s g = .35) and left-leaning individuals (M = 2.56, SD = .94, p < .01, Hedge’s g = .47). However, there was no statistically significant difference between the moderates and left-leaning individuals (p = .56, Hedge’s g = .14). See Fig. 1.

As hypothesized (H2), subjective attribution of infectious disease outbreaks to the human impact on the environment was significantly associated with mitigation behavioural intentions (B = 0.20, SE = 0.03, p < .001, 95% CI: [0.13, 0.26]) and mitigation policy support (B = 0.26, SE = 0.03, p < .001, 95% CI: [0.19, 0.32]) in two separate regression analysis, respectively.

As hypothesized (H3), subjective attribution of infectious disease outbreaks to climate change was significantly associated with mitigation behavioural intentions (B = 0.21, SE = 0.03, p < .001, 95% CI: [0.15, 0.27]) as well as mitigation behavioural intentions (B = 0.22, SE = 0.03, p < .001, 95% CI: [0.16, 0.28]).

Knowledge about COVID-19 was negatively associated with mitigation behavioural intentions (B = -.05, SE = 0.01, p < .001, 95% CI: [-0.08, -.03]) but was not significantly associated with policy support (B = -.01, SE = 0.01, p = .49, 95% CI: [-0.04, 0.02])—implications are discussed below. Self-reported economic impact was associated with mitigation behavioural intentions (B = 0.06, SE = 0.03, p < .05, 95% CI: [0.01, 0.11]) but not policy support (B = 0.03, SE = 0.03, p = .27, 95% CI: [-0.02, 0.08]).

Political affiliation was significantly associated with mitigation
behavioural intentions \((B = 0.19, SE = 0.03, p < .001, 95\% CI: [0.12, 0.26])\) and policy support \((B = 0.28, SE = 0.03, p < .001, 95\% CI: [0.21, 0.35])\).

Shifting to interactions, political affiliation did not moderate the association between subjective attribution to environmental impacts and behavioural intentions \((B = -.05, SE = 0.05, p = .29, 95\% CI: [-0.16, 0.05])\). Similarly, political affiliation did not moderate the relationship between subjective attribution to climate change and behavioural intentions \((B = -.01, SE = 0.04, p = .83, 95\% CI: [-0.01, 0.08])\).

Political affiliation did not moderate the association between subjective attribution to environmental impacts and policy support \((B = -.07, SE = 0.05, p = .20, 95\% CI: [-0.17, 0.04])\). However, political affiliation did significantly moderate the association between subjective attribution to climate change and policy support \((B = -.19, SE = 0.05, p < .001, 95\% CI: [-0.28, -.11])\) such that for right-leaning individuals and moderates, higher levels of subjective attribution to climate change was associated with higher levels of policy support. For left-leaning individuals, increasing levels of subjective attribution did not substantially increase their level of policy support (Fig. 2).

Political affiliation did not moderate the association between economic impact and behavioural intentions \((B = -.01, SE = 0.03, p = .88, 95\% CI: [-0.06, 0.05])\). Similarly, political affiliation did not moderate the association between economic impact and policy support \((B = -.01, SE = 0.03, p = .69, 95\% CI: [-0.07, 0.05])\).

There was also no significant interaction between economic impact and subjective attribution with either mitigation behavioural intentions or policy support.

There was no significant difference between men and women on behavioural intentions and policy support. More educated respondents were likely to report higher intentions for mitigation behaviours. European New Zealanders were less likely to report greater mitigation behaviours or higher level of policy support than Asian and other ethnicities (See Table 3) (see Table 4).

5. Discussion

Personal experience with climate change related impacts can act as teachable moments for the public (Demski et al., 2017; McDonald et al., 2015; Reser & Bradley, 2020). Yet, empirical evidence provides mixed evidence on the association between subjective attribution—primarily in the domain of extreme weather events—and climate change beliefs and mitigation actions (e.g., Reser & Bradley, 2020). While a majority of studies have focused on both objective and self-reported experiences with extreme weather events, subjective attribution linking an event as caused by or related to climate change is a critical factor in helping individual make sense of their experiences (Ogunbode, Demsks, et al., 2019). Do individuals attribute other experiences, such as health impacts, to climate change remains unexplored. Based on a national survey of the New Zealand public, the results show that subjective attribution of infectious disease outbreaks to human impact on the environment was positively associated with mitigation behavioural intentions and policy support in the context of COVID-19 emergency economy recovery policies. Moreover, subjective attribution of infectious disease outbreaks to climate change was significantly associated with motivation to undertake mitigation behaviours, even if these were associated with additional costs or were inconvenient (e.g., Hornsey et al., 2016) and support for clean and green COVID-19 recovery policies. These findings suggest that causal attribution is an important aspect of how individuals make sense of and respond to a personal experience. It reflects a “conscious” cognitive attribution of the risk event (van der Linden, 2014), in the absence of which, personal experience seems to have “little theoretical connection with affectivity toward climate change” (p. 434).

This study adds to an emerging body of evidence that similar to subjective attribution of extreme weather events to climate change (McCright et al., 2014; Ogunbode et al., 2020), subjective attribution of health-related impacts to climate change is likely constructed through political lens, with right-leaning respondents less likely to subjectively attribute infectious diseases outbreaks either to environmental impact or climate change. But this study also provides a nuanced finding, namely that while left-leaning respondents differed from moderates on subjective attribution of infectious diseases to human impact on the environment, there was no significant difference in subjective attribution to climate change. In other words, there appears to be a consolation between certain political affiliations (moderates and left-leaning) on climate change but not on human impact on the environment.

This study extends previous findings that have almost exclusively focused on exposure or experience of extreme weather events and climate change perceptions. Compared to previous studies, which found an indirect association between subjective attribution of extreme weather events and mitigation behaviours and policy support (Ogunbode, Demsks, et al., 2019), this study finds a direct and strong association between subjective attribution of health impacts to climate change on public engagement. Moreover, compared to previous studies that found personal experience (Ogunbode et al., 2020) or political affiliation (Ogunbode, Böhms, et al., 2019) to be more strongly associated with climate change concern and mitigation intentions, respectively, than subjective attribution among the variables they tested, this study finds that subjective attributions to be most strongly associated with behavioural intentions and policy support among the several variables tested in this study. Apart from extreme weather events, individuals can personally experience climate change through a variety of other climate signals. One such promising domain is health impacts of climate change—an area that has received scant scholarly attention even as scientific evidence on the complex interaction between climate change, environmental changes, and human factors has gained momentum (Campbell-Lendrum et al., 2015; Lustgarten, 2020; Ostfeld, 2017; World Health Organization, 2020; Wu et al., 2016). As health impacts are more persuasive than environmental frames, particularly among those are sceptical about climate change (Myers et al., 2012), the findings of this study indicate that understanding how individuals attribute health impacts associated with climate change can be a useful avenue for future research. This study adds to the knowledge about factors that are likely to affect citizens support for climate change policies, more urgent now as governments strive to rebuild the economy following COVID-19 impacts. The coronavirus pandemic provides an opportunity to build an economy that is resilient to immediate economic impacts as well as climate-proof for future impacts (Hepburn et al., 2020).

Scholars agree that learning about climate change from extreme weather hazards are usually time and geographically bound, even as individuals can learn from vicarious experiences through media. COVID 19 is likely the most widespread globally shared experience of a hazard event in recent history. Apart from deaths of family and friends, the nature of lockdown in different countries—with restricted travel not just across borders but across neighbourhoods—provided a powerful personal experience with a global issue. Individuals potentially learned...
vicariously about the human impact on the environment through viral images of animals (Chalasani, 2020; Guardian, 2020) and clear skies and vicariously about the human impact on the environment through viral images of animals (Chalasani, 2020; Guardian, 2020). This is in line with other surveys that show that public concern about climate change has increased after COVID-19 (Morton, 2020; Poushter & Huang, 2020). This study indicates the potential to explore how subjective attribution of health impacts due to a global problem such as climate change can provide a powerful stimulus to help people learn about climate change specifically, and human impact on the environment, generally. Factor analysis confirms that subjective attribution of infectious diseases to human impact on the environment and subjective attribution of infectious diseases to climate change are two distinct dimensions and have unique associations with behavioural intentions and policy support.

Furthermore, political affiliation did not moderate the association between subjective attributions with behavioural intentions. Similarly, political affiliation did not moderate the association between subjective attribution to environmental impacts and policy support. However, political affiliation was a significant moderator of the association between subjective attribution to climate change and policy support such that among right-leaning and moderates, increasing levels of subjective attribution was associated with higher levels of policy support. Among left-leaning individuals, who already had higher levels of policy support, increasing levels of subjective attribution did not substantially increase their levels of policy support. This finding is consistent with recent research in the US that shows that for conservatives or Republicans, higher levels of personal harm was associated with greater mitigation policy support (Zanocco et al., 2019). In other words, helping the right-leaning individuals understand the link between climate change and infectious disease outbreaks may reduce the political divide on public support for mitigation policies (Ogunbode et al., 2020; Zanocco et al., 2019).

The inconsistent moderation effects of political affiliation on behavioural intentions and policy support are intriguing and should be a topic for future research. It is possible that political affiliation may be activated when individuals are focussing on public policy rather than on personal behaviours. It is also possible that as the measure of political affiliation used in the study was based on party affiliation, the ideological difference was manifested on policy support but not on behavioural intentions. It is important for future research to disentangle the difference in association between party affiliation and political orientation with climate change related behaviours and policy support. In a recent meta-analysis, Cruz (2017) found that the association between party affiliation and environmental concern has strengthened over time, while the association between political ideology and environment concern has largely remained the same. Cruz (2017) implied that the increasing gap between party affiliation and public attitudes towards environmental issues is a result of changing voting patterns, rather than attitude change. The findings of this study, together with previous studies, indicate an important area of future research.

Surprisingly, self-reported economic impact due to COVID-19 was weakly associated with behavioural intentions but not with policy support. Moreover, there was no significant interaction between economic impact and political leaning either on behavioural intentions or policy support. Moreover, there was no significant interaction between COVID-19 Economic impact and political affiliation (Conservative to Liberal) on behavioural intentions but not with policy support. Moreover, there was no significant interaction between COVID-19 Economic impact and political affiliation (Conservative to Liberal) on behavioural intentions but not with policy support. Moreover, there was no significant interaction between COVID-19 Economic impact and political affiliation (Conservative to Liberal) on behavioural intentions but not with policy support. Moreover, there was no significant interaction between COVID-19 Economic impact and political affiliation (Conservative to Liberal) on behavioural intentions but not with policy support.

Table 3

| Table 3 | Multiple regression analysis predicting behavioural intentions. |
|---------|---------------------------------------------------------------|
|         | Model without interactions | Model with interactions |
|         | B (SE) | 95% CI for B | B (SE) | 95% CI for B | β |
| Constant | 2.47 (0.10)** | 2.27 | 2.67 | 2.89 (0.16)** | 2.58 | 3.20 | 0.11 (0.04)** | 0.04 | 0.18 | 0.13 (0.04)** | 0.05 | 0.21 | 0.09 (0.04) | 0.03 | 0.15 | 0.07 |
| COVID-19 Knowledge | -0.04 (0.01)*** | -0.07 | -0.02 | -0.05 (0.01)*** | -0.08 | -0.03 | -0.12 |
| COVID-19 Economic impact | -0.02 (0.02) | -0.05 | 0.02 | 0.06 (0.03)* | 0.01 | 0.11 |
| COVID-19 Attribution to environmental impact | 0.20 (0.03)** | 0.14 | 0.25 | 0.20 (0.03)** | 0.13 | 0.26 |
| COVID-19 Attribution to climate change | 0.19 (0.03)** | 0.14 | 0.24 |
| COVID-19 Economic impact*Political affiliation | -0.01 (0.03) | -0.06 | 0.05 | -0.01 |
| COVID-19 Economic impact*Subjective attribution to environmental impact | -0.02 (0.04) | -0.09 | 0.07 | -0.01 |
| COVID-19 Economic impact*Subjective attribution to climate change | -0.01 (0.03) | -0.07 | 0.06 | -0.01 |
| COVID-19 Attribution to environmental impact*Political affiliation | -0.05 (0.05) | -0.16 | 0.05 | -0.03 |
| COVID-19 Economic impact*Subjective attribution to climate change | -0.01 (0.03) | -0.07 | 0.06 | -0.01 |
| Demographics | | | | | | | | |
| Female | 0.10 (0.04)* | 0.02 | 0.17 | 0.06 (0.04) | -0.02 | 0.14 | 0.04 |
| Age | 0.01 (0.01) | -0.03 | 0.03 | -0.01 (0.01) | -0.04 | 0.01 | -0.03 |
| Education | 0.09 (0.03)** | 0.03 | 0.15 | 0.09 (0.03)** | 0.05 | 0.16 |
| Income | 0.02 (0.03) | -0.03 | 0.08 | 0.03 (0.03) | -0.04 | 0.09 |
| European-New Zealander | -0.15 (0.06)** | -0.26 | -0.04 | -0.13 (0.06)* | -0.25 | -0.01 |
| Maori | -0.12 (0.07) | -0.25 | 0.02 | -0.12 (0.07) | -0.27 | 0.02 |
| Panifika | -0.12 (0.08) | -0.28 | 0.04 | -0.11 (0.09) | -0.28 | 0.06 |
| Political affiliation (Conservative to Liberal) | 0.17 (0.03)** | 0.11 | 0.23 | 0.19 (0.03)** | 0.12 | 0.26 |
| Employed | -0.05 (0.04) | -0.13 | 0.03 | -0.05 (0.04) | -0.13 | 0.04 |
| Parental status | -0.03 (0.04) | -0.11 | 0.05 | -0.03 (0.05) | -0.12 | 0.06 |
| Marital status | -0.02 (0.04) | -0.10 | 0.05 | -0.04 (0.04) | -0.13 | 0.04 |
| Group membership | 0.11 (0.04)** | 0.04 | 0.18 | 0.13 (0.04)** | 0.05 | 0.21 |
| Smoking | -0.07 (0.04) | -0.15 | 0.01 | -0.09 (0.04) | -0.17 | 0.01 |

ΔR² | 0.26 | 0.26 |

Note. N = 1040. ***p < .001. **p < .01. *p < .05. Gender was measured dichotomously comparing male (0) with female (1). The three ethnicity variables were dummy coded with Asian and other ethnicities coded as the reference category. Employed were coded as 1 for respondents who said they are currently employed compared to others (0). Parental status was coded as 1 with reference to others (0). Marital status was coded for respondents with a spouse, partner, de-facto, live-in relationship to others. Group membership was coded for respondents who said they belonged to a local club with reference to others. Respondents who smoked, rolled their own cigarettes, or vaped were coded 1 with reference to others. Group membership was coded for respondents who said they belonged to a local club with reference to others. Respondents who smoked, rolled their own cigarettes, or vaped were coded 1 with reference to others. Group membership was coded for respondents who said they belonged to a local club with reference to others. Respondents who smoked, rolled their own cigarettes, or vaped were coded 1 with reference to others.
economic impact is but one of the several ways an individual personally experiences an event, with other measures of health and psychological impact should also be considered. Moreover, immediate government relief through income subsidy would have offset some of the economic impacts. Furthermore, perceived threat could be a key mediator between experience, attribution on the one hand, with mitigation in the other (Ogunbode, Demski, et al., 2019).

While scholars argue that economic impact can make an event more personal and result in negative feelings, therefore increasing public engagement with climate change, empirical results have been mixed. Across six Colorado communities, Albright and Crow (2019) found that direct experiences with a flood causing household damage was not significantly associated with change beliefs. Zanocco et al., (2018) reported that “while being closer to an extreme weather event resulted in higher levels of reported personal harm, this proximity measure did not translate to altered climate change views, suggesting that proximity alone was not a crucial factor in the cases we studied” (p. 362). This finding further highlights that while individuals’ may experience a negative impact—negative economic impact in this case such as income or job loss—their subjective attribution plays a key role in how individuals make sense of and respond to their experiences (Ogunbode et al., 2020).

Knowledge about COVID-19 had a negative association with mitigation behaviour intentions and was not associated with policy support. It is possible that more knowledge made individuals feel more in control of the situation and therefore a lesser need for behaviour change. This finding illustrates that personal impact and knowledge alone may have little or no influence on how the public responds to an issue, including as global and visceral such as the COVID-19 pandemic. Previous studies have found limited or no association between knowledge about climate change and mitigation behaviours and policy support (Hornsey et al., 2016; Rhodes et al., 2014). Future research should clarify on the nature of knowledge needed to help improve public engagement.

On a practical note, helping people understand the links between climate change with infectious disease outbreaks is likely to help increase public understanding and engagement (Amelung et al., 2019; Roh et al., 2015). Scholars have suggested that emphasising the links between experiences of extreme weather events and climate change facilitates a congruent cognition-emotion link, likely the most successful approach (van der Linden, 2014). Linking climate policies with direct health impacts can increase individual private behavioural change as well as policy support (Amelung et al., 2019). One such approach by the World Health Organization is “One Health” that seeks to emphasise the interconnectedness of public health issues (https://www.who.int/news-room/q-a-detail/one-health). Apart from personal experience, people learn from vicarious experiences, through media for example. However, we may have missed an important opportunity to engage the public with the bigger crisis of climate change during the COVID-19 pandemic as news coverage of climate change decreased during the COVID-19 pandemic (Boykoff et al., 2021).

### Table 4

Multiple regression analysis predicting policy support.

| Demographics | Model without interactions | Model with interactions |
|--------------|-----------------------------|-------------------------|
|              | B (SE) 95% CI for B         | B (SE) 95% CI for B     |
|              | Lower limit | Upper limit | Lower limit | Upper limit |
| Constant     | 2.95 (0.11) | 2.27 | 2.67 | 3.01 (0.16)** | 2.7 | 3.33 |
| COVID-19 Knowledge | 0.01 (0.01) | -0.07 | -0.02 | -0.01 (0.01) | -0.04 | 0.02 | -0.02 | -0.01 |
| COVID-19 Economic impact | 0.01 (0.02) | -0.05 | 0.02 | 0.03 (0.03) | -0.02 | 0.08 | 0.03 | -0.01 |
| COVID-19 Attribution to environmental impact | 0.27 (0.03) | 0.14 | 0.25 | 0.26 (0.03)** | 0.19 | 0.32 | 0.25 | -0.01 |
| COVID-19 Attribution to climate change | 0.21 (0.03) | 0.14 | 0.24 | 0.22 (0.03)** | 0.16 | 0.28 | 0.25 | -0.01 |
| COVID-19 Economic impact*Political affiliation | -0.01 (0.03) | -0.07 | 0.05 | -0.19 (0.05) | -0.28 | -0.11 | -0.13 | -0.01 |
| COVID-19 Economic impact*Subjective attribution to environmental impact | 0.01 (0.04) | -0.08 | 0.09 | 0.01 (0.04) | -0.02 | 0.11 | -0.04 | -0.01 |
| COVID-19 Economic impact*Subjective attribution to climate change | 0.04 (0.03) | 0.02 | 0.11 | -0.07 (0.05) | -0.17 | 0.04 | -0.04 | -0.01 |
| COVID-19 Attribution to environmental impact*Political affiliation | -0.07 (0.05) | -0.17 | 0.04 | 0.04 (0.03) | -0.02 | 0.11 | -0.04 | -0.01 |
| COVID-19 Attribution to climate change*Political affiliation | -0.19 (0.05) | -0.28 | -0.11 | -0.13 | -0.19 (0.05) | -0.28 | -0.11 | -0.13 |

| **Demographics** | **Model without interactions** | **Model with interactions** |
|------------------|-------------------------------|-----------------------------|
| **Constant**     | 2.95 (0.11)                  | 3.01 (0.16)**               |
| **COVID-19 Knowledge** | 0.01 (0.01)                  | -0.01 (0.01)               |
| **COVID-19 Economic impact** | 0.01 (0.02)                  | 0.03 (0.03)               |
| **COVID-19 Attribution to environmental impact** | 0.27 (0.03)                  | 0.26 (0.03)**             |
| **COVID-19 Attribution to climate change** | 0.21 (0.03)                  | 0.22 (0.03)**             |
| **COVID-19 Economic impact*Political affiliation** | -0.01 (0.03)                 | -0.01 (0.04)             |
| **COVID-19 Economic impact*Subjective attribution to environmental impact** | 0.01 (0.04)                 | 0.01 (0.04)             |
| **COVID-19 Economic impact*Subjective attribution to climate change** | 0.04 (0.03)                 | 0.04 (0.03)             |
| **COVID-19 Attribution to environmental impact*Political affiliation** | -0.07 (0.05)                 | -0.07 (0.05)             |
| **COVID-19 Attribution to climate change*Political affiliation** | -0.19 (0.05)                 | -0.19 (0.05)             |
| **Employed**     | -0.12 (0.05)*                 | -0.11 (0.04)*              |
| **Parental status** | -0.01 (0.05)                 | -0.02 (0.05)              |
| **Marital status** | 0.02 (0.05)                  | 0.02 (0.04)               |
| **Group membership** | -0.05 (0.04)                 | -0.03 (0.04)             |
| **Smoking**      | 0.02 (0.05)                  | 0.02 (0.05)               |

| ΔR² | 0.32 | 0.34 |

Note. N = 1040. ***p < .001, **p < .01, *p < .05. Gender was measured dichotomously comparing male (0) with female (1). The three ethnicity variables were dummy coded with Asian and other ethnicities coded as the reference category. Employed were coded as 1 for respondents who said they are currently employed compared to others (0). Parental status was coded as 1 with reference to others (0). Marital status was coded for respondents with a spouse, partner, de-facto, live-in relationship to others. Group membership was coded for respondents who said they belonged to a local club with reference to others. Respondents who smoked, rolled their own cigarettes, or vaped were coded 1 with reference to others.
5.1. Limitations

A potential threat to the findings of this study is that individuals may readily attribute negative events to climate change. Previous surveys, however, in the UK about flooding (Capstick et al., 2015; Hamilton-Webb et al., 2017; Ogunbode et al., 2019) and heat waves (Larcom et al., 2019) and in the US about California drought (Osaka & Bellamy, 2020) show that individuals are hesitant to attribute these extreme weather events to anthropogenic climate change. A strength of this study is that in contrast to previous studies that used single items to measure subjective attribution (McCright et al., 2014; Ogunbode et al., 2020), this study uses multiple items and in two distinct domains. Another limitation of the study is that the measures of subjective attribution to environmental impacts were presented to the respondents before subjective attribution to climate change, in part of reduce the polarization effects of the term climate change. Future research should test for order effects. Moreover, the association between subjective experiences with behavioural intentions and policy support can be in the opposite direction, where individuals with higher policy support and who are more behaviourally engaged readily attribute events to environmental impact and climate change. This can be a case with left-leaning individuals as the findings show, but the direction of association appears less clear for right-leaning individuals who how lower levels of behavioural involvement and policy support, which increases with increasing attribution. Another research question for future research to test how knowledge moderates the association with subjective attributions on mitigation intentions. Nevertheless, future research should longitudinally and comprehensively measure climate change related beliefs, which may help explain the direction of association, and how these interact with subjective attributions, mitigation behaviour intentions, policy support.

Further, a cross country comparison on economic impact (economic impact/GDP loss, self-reported impacts) and subjective attribution will likely help replicate the findings of the study and provide clarity as to the association between objective and self-reported impacts, subjective attribution, and how they aling with climate change engagement. Other factors that may influence how public attributes events to climate change are perceived government response, where appropriate government response likely decreases the public need to find causes or resolutions for negative events (Zanocco et al., 2019). Yet, the New Zealand government has been universally praised for its role in keeping the infection rates low and deaths limited to 26 even after about a year of the global spread of the COVID-19 disease. Replicating these findings in other countries is important.

5.2. Conclusion

A primary challenge to communicating climate change is its abstract, global, long-term impact. With climate impacts becoming more apparent—such as weather anomalies, extreme weather events and particularly health-related impacts—such experiences are likely to help individuals learn about climate change. However, unless individuals attribute these events as related to anthropogenic climate change, public responses may be misdirected. This study finds that subjective attribution of infectious disease outbreaks such as the COVID-19 to climate change is associated with mitigation behaviour intentions and climate focussed COVID-19 economic recovery policies. Helping public understand how anthropogenic climate change is contributing to infectious disease outbreaks can help improve public understanding and engagement with climate change.

Declaration of competing interest

The author declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2021.101685.

| Subjective attribution items | Factor loading 1 | Factor loading 2 |
|-----------------------------|------------------|------------------|
| Factor 1: Subjective attribution—infectious disease outbreaks with human impact on the environment | 1 | 2 |
| 1. Human impact on the environment increases the risk of new infectious diseases | .26 | .65 |
| 2. Cutting forests increases the risk of new infectious diseases jumping from wildlife to humans | .34 | .77 |
| 3. Rapid agricultural expansion in wildlife areas makes it easier for infectious diseases to spread to humans | .29 | .84 |
| 4. Large-scale animal “factory” farms increase the risks of new disease outbreaks | .16 | .78 |
| Factor 2: Subjective attribution—infectious disease outbreaks with climate change | 1 | 2 |
| 1. Climate change causes the spread of infectious diseases to new places | .84 | .30 |
| 2. Climate change increases the risk of new disease outbreaks such as the coronavirus | .90 | .27 |
| 3. Climate change is making conditions more suitable for disease transmission between wildlife and humans | .86 | .30 |
| 4. Climate change will result in more pandemics such as the coronavirus | .88 | .28 |

Note: N = 1040. The extraction method was principal axis factoring with an oblique (direct oblimin with Kaiser Normalization) rotation.

Declarations

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All respondents were provided with a consent sheet and only after signing the consent sheet the respondents were allowed to complete the survey.
