

# Higher perceived risk of COVID-19 pandemic, higher concern for climate change: evidence from a longitudinal study in China

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## Article

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## Abstract

COVID-19 is raging globally taking a huge toll on public health. Although there seems to be a silver lining regarding mitigation of climate change given decreased emission of greenhouse gases during the pandemic, climate disruption actually constantly keeps apace. Therefore, it is important for the public to maintain alert to climate change amid the devastating pandemic. The current longitudinal study made a preliminary exploration of the relationship between public risk perception of the pandemic and climate change and we examined two possibly competing mediators which might lead to opposite effects—negative emotions and limited cognitive resources. The results show that pandemic risk perception has positive predictive effect on climate change concern mediated by negative emotions, but public attention to climate change is not impaired by increased concern for the pandemic. We discuss the value of our results and offer inspiring advice to better address climate change during COVID-19 outbreak.

## Background

On March 11, 2020 World Health Organization (WHO) declared coronavirus (COVID-19) outbreak a “pandemic”<sup>1</sup>. Despite global collective efforts to combat the public health crisis, the pandemic is still surging with a second wave posing immense threat to several regions, such as Europe<sup>2</sup>. However, researchers are still struggling to assess the actual deaths<sup>3</sup> whilst SARS-CoV-2 is predicted to continue haunting human society and the future depends on a lot of uncertainties<sup>4</sup>.

Among the multiple impacts this pandemic has caused to the whole society, one striking focus of academic assessment and evaluation is climate change<sup>5</sup> which has been declared as one of the major issues of our time by the United Nations. With dramatically declined transport and altered pattern of consumption due to home confinement, by early April 2020, daily global annual CO<sub>2</sub> emissions was estimated to have decreased by 17% compared with the 2019 mean level (if some social restrictions could remain to the end of this year, the annual CO<sub>2</sub> emissions could be reduced by up to 7%)<sup>6</sup> and the emission fall would be more than any year on record<sup>7</sup>, while NO<sub>x</sub> emissions also declined by as much as 30%, contributing to a cooling effect as well<sup>8</sup>. However, the heating trend of climate never stops<sup>9</sup>, and these seemingly positive effects on the mitigation of climate change by the pandemic are predicted to be temporary and even negligible if not accompanied by long-term supportive policies and practice<sup>6-8</sup>. In fact, the pandemic would pose drastic threats to climate change at the same time because sustainable development depends on sustained economic growth and globalization which have been going through crisis since COVID-19 outbreak<sup>10</sup>.

Climate change would also in turn intensify the negative consequences of COVID-19. Directly, global warming might have provided more suitable conditions for infectious diseases to outbreak<sup>11</sup> and indirectly, migrations driven by climate stressors<sup>12</sup> leave numerous homeless people who live in refugee camps without proper social distancing strategies or healthcare extremely vulnerable to epidemics<sup>13</sup>. Actually, climate change and the pandemic are markedly similar in terms of devastating global impacts and demand for immediate government intervention<sup>5,14,15</sup>. Therefore, tackling climate change problem amid the pandemic and facilitating green socioeconomic recovery programs that address climate mitigation and other environmental goals has received increasing attention from policy makers and scholars<sup>5,16,17</sup>.

At the individual level, however, limited studies have seemingly controversial insights regarding the effect of the pandemic on climate change attitude. For example, a survey by the pollsters Opinium revealed that 48% of the public claimed that the governments should respond to climate change with same urgency as coronavirus<sup>18</sup>, indicating a moderate public recognition of treating the pandemic and climate change as parallel crises; in contrast, a research using difference-in-differences approach (DiD) comparing the Google Trends search popularity indicator (SPI) before and after March 14<sup>th</sup> 2020, when the searching behavior of COVID-19 related topics peaked, discovered a rapid and clear increase in the search for nature topics after this day, but environment topics including CO<sub>2</sub> tax and climate change did not present difference in SPI<sup>19</sup>, which means unchanged concern for climate change with the influence of the pandemic.

The current study intended to make contributions mainly in two ways. First, public perception of the severity of threats is indispensable in the mitigation of both the pandemic and climate change<sup>14,20</sup>, and there exists many above-mentioned parallel characteristics between these two crises<sup>14,15,20</sup>; nonetheless, to the best of our knowledge, there have been little direct exploration of the relationship between public pandemic risk perception and climate change concern; more specifically, whether and how

pandemic risk perception would impact on climate change concern during COVID-19 outbreak should receive more attention given the overall increased awareness of green recovery. Accordingly, the current study aims to offer some preliminary insights into the potential predictive effect of pandemic risk perception on climate change concern to better inspire climate mitigation and adaptation over the pandemic time. Second, another major focus of the study is to explore the underlying mechanism of this association. Given that the pandemic has been estimated to last for years with intermittent relapse of second wave for several regions and countries (for example, Europe is going through an even more serious situation in September, 2020 than its first spring peak with alarming rates of virus transmission, as warned by WHO<sup>21</sup>), a clarification of the underlying mechanism that public risk perception of the pandemic impacts on climate change concern would be of critical importance to enlighten long-term public climate action under the inevitable context that the coronavirus becomes a regular basis of public health threat.

We proposed that there would be two opposite effects public pandemic risk perception impacts on climate change concern. For one thing, according to a spontaneous information processing model—associative processing, similarity between concepts causes activation from one object to the other<sup>22</sup>. Given the well-recognized similarity between the pandemic and climate change<sup>14,15,20</sup>, increased pandemic risk perception might directly stimulate risk perception of climate change. Also, researches have confirmed that negative feelings caused by a former risk event can subsequently increase the risk perception of another threat even independent of similarity between the domains of these two risks<sup>23-25</sup>. According to the risk-as-feeling hypothesis<sup>22</sup> or “the affect heuristic”<sup>25</sup>, affective reactions to risks do not necessarily depend on cognitive process<sup>26</sup>, thus affect elicited by one risk might consequently influence risk perception of another threat<sup>24</sup>. For example, reading a sad story could increase the frequency estimates of a closely related risk as much as that of an unrelated risk while reading a happy story could decrease the subsequent estimates<sup>23</sup>. Accordingly, in time of COVID-19 outbreak, individuals received an excessively large amount of pandemic-related information from media coverage<sup>27</sup> leading to increased health risk perceptions<sup>28</sup>, while these health risks combined with social distancing have caused multiple negative psychological impacts such as anxiety, depression and other mental health problems<sup>29,30</sup>. In this account, therefore, we assumed that negative emotions directly and indirectly related with the pandemic would further increase climate change concern.

For another, according to the information-processing tradition of cognitive psychology<sup>31</sup>, people inevitably suffer from limited cognitive capacity and mental resources when processing information<sup>32,33</sup>. Although generally the public has raised awareness of and concern for climate crisis in recent years<sup>34-36</sup>, they would still struggle to grasp the threats climate change could bring because it is perceived as not happening “here”, “now” or “affecting my life”<sup>37-39</sup>, and in the context of COVID-19 outbreak, public attention to and engagement in climate change issue might further be overshadowed by the more overwhelming and urgent public health crisis. Indeed, the international community is currently giving top priority to human security, improved health, protection of jobs and incomes as well as economic recovery<sup>40</sup>. At the same time, the governments in many nations are also dealing with compound risks of other socioeconomic threats such as economic crisis<sup>16</sup> and racial disparities<sup>13</sup> simultaneously besides COVID-19 outbreak, making sufficient devotion to climate issues even more challenging. Therefore, based on this mode of risk perception, we proposed that higher risk perception of the pandemic should be associated with less attention to climate change crisis which in turn decrease concern for climate change.

In order to examine whether and through which pathway pandemic risk perception impacts on climate change concern, in February 2020 (T1) and March 2020 (T2) we conducted a national longitudinal survey (see Methods) to collect data for the study. The survey measured variables of our major interests—pandemic risk perception, negative emotions, climate change concern, individual attention to climate change, perceived relative danger of climate change compared with other social crises, as well as other psychological covariates that have been clarified to have association with climate change concern—connectedness with nature, knowledge of climate change and ecological worldview (see Methods). Table 1 lists the items used for measuring these variables and the scoring strategies. Participants’ demographic information is presented in Table 2 and Table 3 shows the descriptive statistics as well as the correlations between variables. For the participants surveyed, 1254 of them have heard of climate change (99.1%) and 1245 believe in that climate change is happening (98.3%).

## Results

Pandemic risk perception is positively associated with negative emotions ( $B = 0.400$ ;  $SE = 0.049$ ; 95% CI, 0.303, 0.494) which in turn has a positive effect on climate change concern ( $B = 0.087$ ;  $SE = 0.016$ ; 95% CI, 0.056, 0.118; Fig. 1a). Mediation analysis reveals that the direct effect ( $B = 0.232$ ;  $SE = 0.028$ ; 95% CI, 0.177, 0.287), indirect effect ( $B = 0.035$ ;  $SE = 0.008$ ; 95% CI, 0.020, 0.053) and total effect ( $B = 0.267$ ;  $SE = 0.028$ ; 95% CI, 0.213, 0.321) are all significant, indicating that the positive predictive effect of pandemic risk perception on climate change concern is partially mediated by negative emotions. This model explains 20.17% of the total variance in climate change concern. However, when testing the mediating effects of attention to climate change measured with individual attention to climate change as well as perceived relative danger of climate change, the indirect effects are both not significant ( $B = 0.006$ ;  $SE = 0.006$ ; 95% CI, -0.004, 0.019, Fig. 1b and  $B = -0.001$ ;  $SE = 0.004$ ; 95% CI, -0.010, 0.008, Fig. 1c, respectively), thus disproving the mediating effects of declined public attention to climate change related topics in the relationship between pandemic risk perception and climate change concern. Actually, individual attention to climate change is above the average level ( $M = 4.21$ ,  $SD = 1.449$ , one-sample  $t = 5.122$ ,  $df = 1265$ ,  $p < 0.001$ ), and the public ranked the pandemic and climate change as two most dangerous social crises (the average ranking scores are 3.38 and 3.88 respectively) while the third highest ranking score is greater than 4 (war, 4.26). These results indicate that during COVID-19 outbreak, public attention to climate change still inspiringly remains at a relatively high level instead of being outshined by the pandemic.

## Discussion

The major contribution of the current study is the preliminary exploratory evidence of a potential positive association between the risk perception of the pandemic and climate change, one of the most urgent environmental problems of our time, as well as psychological mechanism underlying this association. Our results revealed that pandemic risk perception does have positive association with climate change concern, implying that not only the governments have increased their concern for climate change as well as awareness of green socioeconomic recovery<sup>5,16,17</sup>, but the general public have also raised their awareness of and attention to climate change, and this relationship is partially mediated by pandemic-aroused negative emotions. These results highlight the importance of emotional pathway in linking pandemic and climate change concern, and we suggest taking these public emotional responses as an opportunity to strengthen climate education. For example, it would be a right moment to promote “One Health”, an idea and approach recognizing that the health of human beings is closely connected to that of animals and our shared environment at the intersection of human health, animal health, and environmental health<sup>41</sup> to embed climate change topics into the currently foremost health crisis. What is also noteworthy is that long duration of household quarantine is associated with increased risks of mental stress connected with negative mood<sup>30</sup>, and we tend to stress the dual value of natural settings nearby the neighborhood which could not only provide a convenient and relatively safe escape from indoor confinement to restore well-beings, such as boosting general health and buffering against stress<sup>42,43</sup>, but also enhance feelings of connectedness with nature<sup>44</sup> which indicates individuals’ subjective sense of connection with the natural world<sup>42</sup> or the extent of belief that they are part of it<sup>45</sup>, and this subjective connection has positive association with pro-environmental attitudes<sup>46-48</sup> which is also supported by our results.

As for the cognitive pathway, it is equally noteworthy that incremental pandemic risk perception does not lead to significantly less attention paid to climate change (although the coefficients of the impacts of pandemic risk perception on individual attention to climate change as well as perceived relative danger of climate change are negative, see Fig.1 b and c). This is actually a rather inspiring result implying that despite the fact that public risk perception has been raised towards the pandemic, attention to climate change issues has not thus been comprised; to be more specific, individuals do not talk less with families and friends about climate change, browse or forward climate change related news less frequently in mass media, or rank climate change as less dangerous due to COVID-19 outbreak. This is consistent with Rousseau and Deschacht’s research of public online search behavior that before and after COVID-19 became the searching peak in twenty European countries, environment topics such as “CO<sub>2</sub> tax” and “climate change” remained unaffected, though not presenting an increasing trend like that of nature topics<sup>19</sup>. As addressed by existing researches, interpersonal discussion can generate information acquisition of climate change related scientific facts thereby leading to increased climate change concern<sup>49</sup> and this discussion seems fairly effective among family members in forms of intergenerational learning (IGL)<sup>50</sup> and contagion from wives to husbands<sup>51</sup> but currently remains a promising yet relatively understudied field. Besides, media coverage of COVID-19 progression is highly likely to drive and shape public attention and response during a global health emergency<sup>52</sup>. As a result, the governments and news media should direct people through mass media to promote and strengthen active discussion about climate change at home during social distancing as a way of maintaining long-term public awareness and attention.

In conclusion, climate change has been one of the most pressing issues of our time needing constant attention as well as collective devotion both from the governments and laypeople, and ensuring uncompromised response to this crisis amidst currently detrimental COVID-19 outbreak is of critical value. Our preliminary study revealed the positive relationship between increased public pandemic risk perception and climate change concern mediated by negative emotions and that public attention to climate issues might not necessarily have been comprised due to foremost pandemic concern, which would be offering great reference value for policy makers and practitioners as we discussed above. But the generalization of our results should be treated with caution considering that the progressions of the pandemic in other regions are not consistent with that in China. Further studies across regions of different stages of the pandemic are in need.

## Methods

**Predictor and outcome variables.** Pandemic risk perception were measured with three items consisting of “severity” (including self-perception and perceived others’ perception) and “impact” adapted from Yu and Xi’s division of risk dimensions<sup>53</sup>. In order for consistency, the wording of the items for the two variables are consistent except for the target of the risks; that is, “COVID-19 epidemic” (because in the first wave of the survey COVID-19 outbreak had not been defined as a “pandemic”) was replaced with “climate change” when measuring climate change concern.

**Mediators.** The scale used for measuring negative emotions was composed of five items including fear, anxiety, anger, disgust and sadness<sup>54</sup>. As for public attention to climate change, for one thing, since laypeople acquire most of their science information from mass media<sup>55</sup>, we proposed that with more individual attention paid to climate change issues, they would be more likely to acquire and share climate change-related information on social media. The items measuring individual attention were adapted from the survey—Climate Change in the American Mind conducted by the Yale Program on Climate Change Communication<sup>56</sup>. For another, we also hoped to get a better understanding of individuals’ subjective priority as for which crisis pose the most threat to the society and needs immediate response from the whole society as another indicator for individual climate change attention. This perceived relative danger was measured with ranking the relative danger of climate change compared with other urgent and severe social crises<sup>23,57</sup>.

**Covariates.** Demographical factors—age and sex<sup>58,59</sup> as well as income<sup>60</sup> was included as potential socio-demographic factors influencing individual climate change perception. We also measured three psychological covariates that might have impacts on climate change concern: first, individuals’ ecological worldview has been proven to have positive association with climate change risk perception<sup>61,62</sup> and it was measured with the revised version of the New Ecological Paradigm (NEP) scale<sup>63</sup>; second, individuals’ subjective sense of connection with the natural world<sup>42</sup> or the extent of belief that they are part of it<sup>45</sup>—Connectedness with nature (CWN)—has positive association with pro-environmental attitudes<sup>46-48</sup> which might also be connected with climate change concern, and it was measured using the Inclusion of Nature in Self scale (INS)<sup>64,65</sup> with a single item consisting of seven pairs of overlapping circles labeled “self” and “nature”; third, knowledge of climate change is a significant predictor of climate change concern<sup>58</sup> measured by directly asking participants to assess their level of knowledge.

**Data collection.** We attempted to acquire a random national sample of roughly 1,500 recipients through an online survey platform Credemo where registered and active users from across China were targeted in this survey. The first wave of online survey was distributed during February 12 and February 25, 2020 (T1) with 1499 valid responses out of the total 1737 collected responses, based on the criteria that (1) all the questions should be answered and that (2) the checking item should be given a certain response in order to assure full devotion of our participants (the wording of the checking item: “This is a checking item. Please choose ‘3’ as the answer.”). The second wave of the survey was conducted during March 25 and March 28, 2020 (T2) targeting the 1499 participants. Finally a total of 1266 participants completed the whole longitudinal survey (a re-interview rate of 84.46%). Our study was approved by Ethical Approval from the Chinese Academy of Sciences.

**Data analysis.** We used SPSS 21.0 to perform descriptive statistical analyses while the mediation analyses was conducted with an SPSS script—PROCESS (Version 3.0) developed by Preacher and Hayes<sup>66</sup>. Firstly, we applied Harman’s one-factor-test as a statistical remedy<sup>67</sup> to examine whether there was common method variance (CMV) problem in the data with an exploratory factor analysis (EFA) adding all the items, and the explained proportions of variance by the first factor for the three models shown in Fig. 1

a-c are 15.010%, 15.499% and 15.460% respectively, lower than the threshold 50%<sup>68</sup>; besides, we also managed to control CMV with procedural remedies, for example, we assured participants anonymity, explained to them the pure academic goal of this study reversely scored perceived relative danger of climate change and separated the measurement of predictor temporarily<sup>67,69</sup>. Next, we conducted Pearson correlation analyses between our variables of interest (Table 3). Finally, significance tests of indirect effects of the mediation models were calculated with bias-corrected bootstrapping set at 5,000 to yield a 95% confidence interval (CI), which is a widely used strategy in mediation analyses because of its greater statistical power compared with alternative methods without making an assumption about the sampling distribution of indirect effects<sup>66</sup>, and if the 95% CI does not include 0, the effects are significant<sup>70</sup>.

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## Tables

Due to technical limitations, Table 1 is only available as a download in the Supplemental Files section.

**Table 2 Demographics of the study sample (total sample  $n = 1266$ )**

	<i>n</i>	%
<b>Sex</b>		
Male	621	49.1
Female	645	50.9
<b>Education</b>		
Junior high school and below	36	2.8
Senior high school degree	186	14.7
College degree	966	76.3
Graduate and above	78	6.2
<b>Monthly income (CNY)</b>		
Less than 3,000	290	22.9
3,000-6,000	456	36.0
6,000-10,000	409	32.3
10,000-30,000	108	8.5
More than 30,000	3	0.2
<b>Careers</b>		
Student	263	20.8
Employee in companies	591	46.7
Employee in institutions	146	11.5
Self-employed household	181	14.3
Farmer	20	1.6
Others	65	5.1
<b>Place of domicile</b>		
Urban	972	76.8
Rural	294	23.2
<b>Age (in years)<sup>a</sup></b>		
≤ 29	732	57.8
30 - 39	442	34.9
≥ 40	89	7.0
<b>Current residential province</b>		
East China	270	21.3
South China	109	8.6
North China	264	20.9
Central China	402	31.8
Northeast China	45	3.6
Southwest China	73	5.8

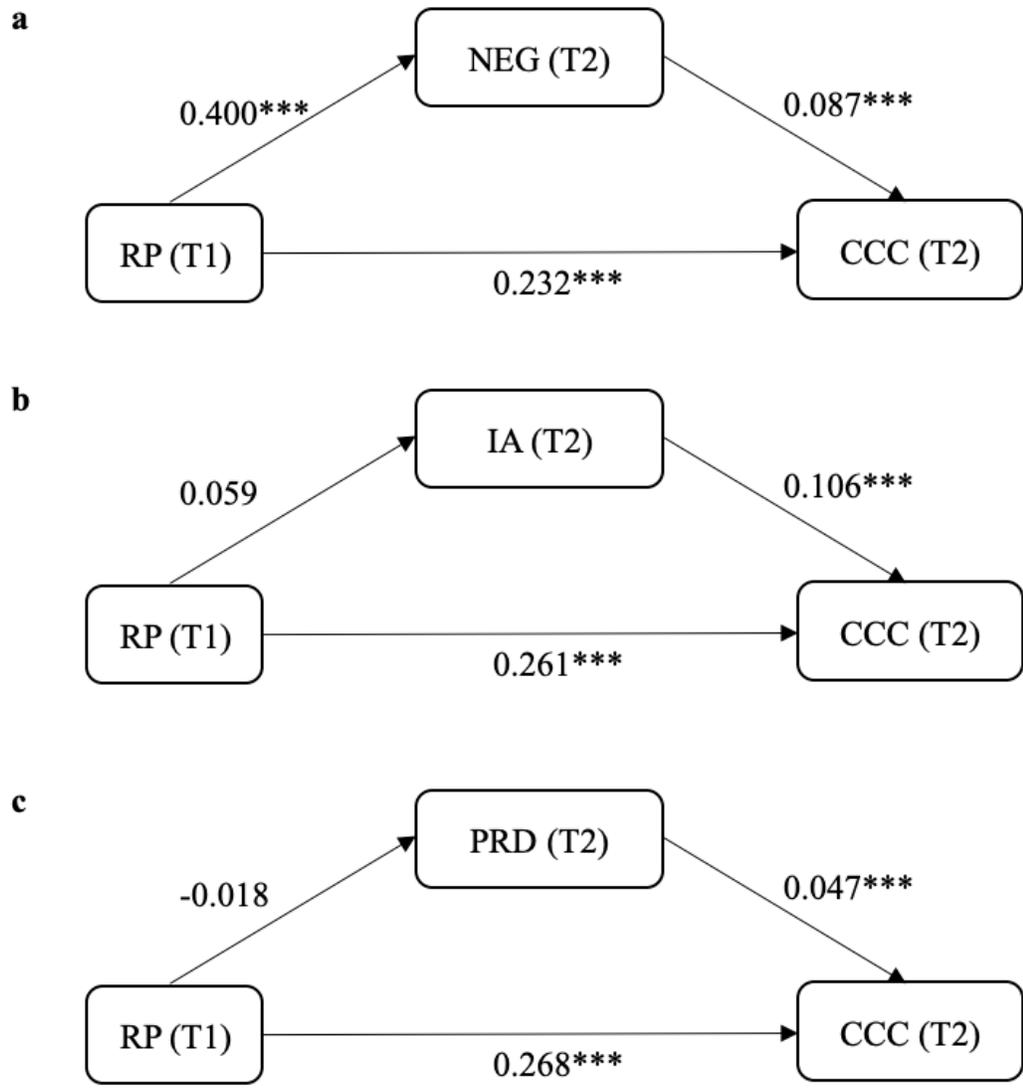
<sup>a</sup> Three participants did not give their ages; before further analyses, the missing values were replaced with series mean.

**Table 3 Descriptive statistics and correlations**

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1 RP (T1)	6.18	0.796	1									
2 NEG (T1)	4.29	1.384	0.341**	1								
3 IA (T1)	4.28	1.424	0.106**	0.105**	1							
4 PRD (T1)	4.07	2.374	-0.056*	-0.034	-0.171**	1						
5 CCC (T1)	5.82	0.966	0.328**	0.229**	0.307**	-0.251**	1					
6 RP (T2)	6.08	0.832	0.493**	0.245**	0.053	0.005	0.212**	1				
7 NEG (T2)	4.71	1.221	0.201**	0.593**	0.088**	0.022	0.064*	0.274**	1			
8 IA (T2)	4.21	1.449	0.056**	0.079**	0.601**	-0.150**	0.163**	0.060	0.169**	1		
9 PRD (T2)	7.12	2.303	0.029	-0.010	0.093**	-0.306**	0.128**	-0.002	-0.027	0.145**	1	
10 CCC (T2)	5.91	0.850	0.318**	0.174**	0.180**	-0.169**	0.485**	0.445**	0.158**	0.221**	0.186**	1

\*  $p < 0.05$ ; \*\*  $p < 0.01$

## Figures



**Figure 1**

Mediating models. The direct and indirect relationship of pandemic risk perception and climate change concern via (a) negative emotions, (b) individual attention to climate change issues and (c) perceived relative danger of climate change, controlling for psychological and demographical covariates as well as climate change concern at T1.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1.docx](#)