Perceived Control and Attendance to Information: Evidence on the Health Risks of Air Pollution*

Anca Balietti
Heidelberg University

Angelika Budjan
University of Stuttgart

Tillmann Eymess
Heidelberg University

Alice Soldà
Ghent University

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Abstract

A failure to attend to self-threatening information foregoes insights that help make better choices and achieve better outcomes. We present an experiment to test whether a treatment that increases perceived control mitigates this failure. Participants can choose to receive information about the regional health risk of air pollution and are then tasked to recall it. With samples from the US and India we find that information avoidance is unaffected by perceived control. In contrast, perceived control improves immediate information retention in India but not in the US. For naïve participants, perceived control is particularly beneficial.

JEL code: C91, D83, I15, Q53
Keywords: air pollution; information avoidance; information retention; perceived control; motivated cognition

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1 Introduction

Attending to information typically involves a trade-off. On the one hand, there are instrumental benefits to a new piece of information that fill an informational gap and help to make better choices that lead to better outcomes. On the other hand, new information can decrease well-being if it generates disutility through negative emotions. When the disutility component prevails, one is tempted to avoid or ignore the information as a tool to regulate emotions and avoid regrets (Hertwig and Engel, 2021) but in doing so, one will forego potentially valuable inputs for decision-making (Golman et al., 2017). Such failure to attend to information may occur in two ways. First, people can distort their attitudes towards information *before* being exposed to it by actively avoiding the sources of information that may contain self-threatening news (see Golman et al. (2017) for a review). We refer to such behavior as information avoidance. Second, people can distort their attitudes towards information *after* consuming it by selectively forgetting the information over time (Zimmermann, 2020; Huffman et al., 2022). We refer to such behavior as selective information retention.[1]

Golman et al. (2022) suggest that people are generally motivated to avoid or acquire information depending on whether they expect to receive enjoyable or threatening news. Such threats may take varying forms, including impending image concerns in social interactions (Bénabou and Tirole, 2006; Grossman and van der Weele, 2017), undermined self-interest (Dana et al., 2007; Ehrich and Irwin, 2005), or life-threatening medical conditions (Brashers et al., 2002). Intuition suggests that whether information is threatening will depend on one's perceived control, *i.e.*, one's belief that a certain outcome can be influenced through own actions. Thereby, one's perceived control may dictate whether information is avoided or selectively forgotten. For example, why seek a diagnosis for a disease that one believes – correctly or not – to not be treatable? When perceived control is low, the confrontation with bad news induces helplessness and reinforces the underlying threat that provokes information avoidance or selective retention. Conversely, when perceived control is high, the threat of negative information is attenuated and its instrumental value increases, implying less need to avoid or otherwise distort it.

In this paper, we test whether perceived control mitigates the failure to attend to self-threatening information. In particular, we contribute to the literature by studying the effect of a change in perceived control on both information avoidance and selective information retention. The social psychology literature provides direct evidence that demand for information increases with perceived control (*e.g.*, Trope et al., 2003). The economic literature has not yet investigated the role of perceived control but provides indirect findings for the same positive correlation. That is, studies show a reluctance to acquire information in scenarios with notoriously low perceived control such as non-treatable genetic diseases (Oster et al., 2013) and own intelligence or beauty (Eil and Rao, 2011; Burks et al., 2013). The literature on selective information retention is more recent and also provides evidence that individuals

[1] Note that failures can also arise while information is being encoded. Here, individuals may underweight bad news (Eil and Rao, 2011; Möbius et al., 2022) or interpret the information self-servingly (Drobner, 2022).

strategically distort their memory about attributes that are typically perceived as a cause of nature rather than nurture. For instance, Zimmermann (2020) finds that individuals who receive negative feedback about their results in an intelligence test are more likely to forget it after one month compared to individuals who receive positive feedback.[2] To the best of our knowledge, we are the first to directly study the effect of perceived control on selective memory retention.

We study the effect of perceived control on information avoidance and selective information retention in the context of health information. Specifically, we use information about the negative health impact of air pollution exposure. To answer our research question, the context of air pollution is ideal for several reasons. First, the adverse health effects of air pollution exposure are considered a major global health burden. According to the World Health Organization (WHO) in 2021, about 6.7 million deaths worldwide are attributable to ambient and household air pollution every year. Therefore, beliefs about the threats that air pollution poses to one's own health have important policy implications. Yet, health information appears particularly prone to being avoided (Oster et al., 2013; Schwardmann, 2019) and if information on health effects of air pollution follows suit, private protection measures may be underutilized, putting additional pressure on public health systems.[3] While access to information about the negative health impact of air pollution has seen improvements over the last decades, demand for better air quality does not necessarily follow the same trend. Particularly in developing countries, the consistently low demand for environmental quality in the face of ever more severe environmental catastrophes is puzzling (Greenstone and Jack, 2015; Pattanayak et al., 2018).[4]

Second, the topic of adverse health effects due to air pollution exposure offers substantial scope to improve perceived control. As air pollution is often an invisible issue, there is a reluctance to acknowledge it (O'Connor, 2019). And for the socio-economically disadvantaged – who often suffer the most – the problem of air pollution exposure is drowned out by more severe threats to their livelihoods. Resulting attitudes towards air pollution and its effect on own health are then often characterized by indifference or denial (Bickerstaff and Walker, 2001; Muindi et al., 2014) and may substantially vary by socio-economic status (Burke et al., 2022). However, there are various effective and to some extent also inexpensive ways in which individuals can protect their health from air pollution including face masks, air purifiers, or the proper ventilation of indoor areas (Carlsten et al., 2020). With a focus on disseminating such tangible advice on protecting one's health against air pollution, perceived control over the issue may improve awareness through less information avoidance and better information retention.

[2] Li (2018) and Chew et al. (2020) find similar results.

[3] For example, a long standing line of research in medical and social sciences has established that individuals tend to avoid medical tests for various diseases. These studies typically show that a large fraction of individuals decline being tested for HIV, fail to return to learn the results of their tests (Lyter et al., 1987; Sullivan et al., 2004; Thornton, 2008), and decline to take predictive tests for genetic predispositions (Kessler, 1994; Lerman et al., 1996, 1999; Oster et al., 2013).

[4] For instance, Greenstone et al. (2021) find a strikingly low take-up rate of free indoor air quality monitors and subsidized air purifiers in Delhi, India.

Third, we are able to exploit natural variation in air pollution exposure to vary the anticipated threat of information about the associated health risks. To do so, we study a sample population from India, an emerging economy with drastically high air pollution and an associated devastating health crisis. Pandey et al. (2021) estimate that India alone accounts for more than 25% of the 6.7 million yearly pre-mature deaths reported by the WHO. Additionally, we study a sample population from the USA, a country representative for the majority of the developed world where ambient and household air pollution leads to several hundred thousand pre-mature deaths per year (Thakrar et al., 2020). In combination with a prior belief elicitation about the severity of regional air pollution, we explore whether information avoidance and selective information retention are dependent on the anticipated threat relative to the true underlying health risk, *i.e.*, to which degree the information is perceived as "bad news".

To address our research question, we present an experiment in which participants have the opportunity to acquire information about the loss of life expectancy due to air pollution for the average resident in their home region. We experimentally increase perceived control over the effect of air pollution on own health for half of the sample. In particular, participants in the high perceived control (HPC) treatment group receive information about various measures to protect their health against outdoor and indoor air pollution. While all participants receive some background information about the negative health effect of air pollution and how it is measured, participants in the control group do not receive information about protective measures. As our two main outcome variables, we measure information avoidance through participants' preference to avoid information about the average number of years of life lost due to air pollution and measure information retention by asking respondents to recall the information both a) shortly after observing it, and b) two weeks later. Additionally, we elicit a post-treatment measure of perceived control that serves as a manipulation check. We collect data on $N = 2,036$ participants in the Indian and $N = 2,272$ participants in the US sample.

We observe information avoidance and imperfect recalls in both samples and find that our HPC treatment – that successfully increases perceived control – significantly reduces selective information retention in the Indian sample. We find that participants in the treatment group are about 25% less likely to forget the information after a short delay than their counterparts in the control group, reducing the likelihood to forget the information from 27% to under 20%. However, we find no differences between the treatment and control group on information retention after two weeks, suggesting that time does not exacerbate treatment effects. In contrast to the Indian sample, we find no significant effect of our treatment on either information avoidance nor information retention in the US sample. In addition to its positive effect on attitudes towards information, the HPC treatment has desirable effects on behavioral outcomes. First, we find that the treatment significantly increases performance in a real effort task for participants who do not receive the self-threatening information. Second, we find that two weeks after being exposed to the treatment, participants in the

HPC group report to engage with defensive measures to protect oneself against air pollution exposure more frequently than participants in the control group.

Finally, we find heterogeneity in the treatment effect with respect to participants' prior about the air quality in their home region. In both the US and the Indian sample, we find the lowest recall rates in the control group among participants who believe – rightly or wrongly – that they experience excellent air quality. But in these subgroups, the treatment improves information retention by about 16 percentage points. The result suggests that selective retention is especially problematic and perceived control particularly helpful for those that are ex-ante oblivious of the underlying problem, be it through naïvetè or willful ignorance.

Our results have important implications. First, we demonstrate that perceived control about the negative effects of air pollution on one's own health can be improved and that the improvement has a positive effect on information retention. As such, policy makers may continue to rely or expand on widespread information and education campaigns. Second, we show that information avoidance and selective retention can be substitutes. While we find no evidence for information avoidance with respect to air pollution, the positive effect of perceived control on information retention in India implies that a share of participants that seek out the information at baseline selectively forgets it afterwards. Results thereby suggest that selective retention is not a last resort when information cannot be ignored. One should not dismiss possible issues with respect to motivated belief formation when information avoidance is not observed as people may still rely on their ability to strategically distort their memory.

2 Material and Methods

2.1 Experimental Design

We present an experiment to investigate (i) whether individuals strategically fail to attend to threatening information about their health and (ii) whether an increase in perceived control can mitigate this failure. We exogenously increase participants' perceived control over the impact of air pollution on their health in our *high perceived control* (HPC) treatment by providing information about measures people can take to protect their health from air pollution to participants. To study information avoidance, we asked participants whether they want to receive information about the number of life-years lost from air pollution in their home region. To study information retention, we asked participants who received the information to recall the number of life-years lost from air pollution in their home region shortly after receiving it, as well as two weeks later.

Information structure. At the core of the experiment, participants were given the opportunity to acquire information about the average number of life-years lost due to constant exposure to the level of air pollution in their home region. Specifically, we include two pieces of information: (a) how the level of air pollution in the participant's home region compares to

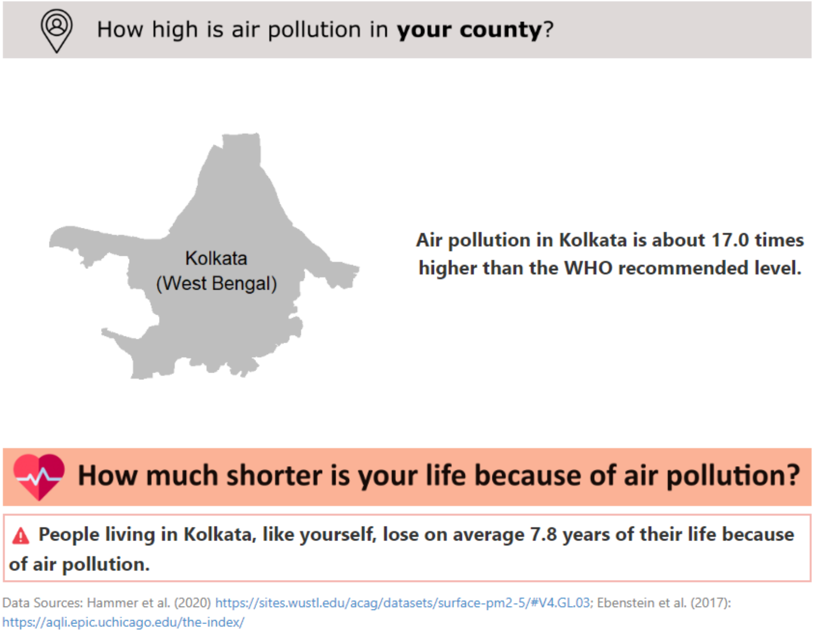

Figure 1: Information screen that includes a comparison of air pollution in the participant's home region with the WHO recommendation and information on the associated average impact on health in terms of life years lost. The example screenshot shows information for a participant that lives in the Kolkata district, West Bengal, India.

the WHO recommendation and (b) how the exceedance of the WHO recommendation translates to an average number of life-years lost due to air pollution.[5] An example is provided in Figure 1.

We chose this design for several reasons. First, air pollution is usually communicated in terms of the concentration of pollutants in the air which – assuming a layperson's understanding – does not allow for an inference on the associated health risk. In contrast, a conversion to the expected loss in life expectancy provides a tangible interpretation. Second, information about the loss of life expectancy is highly relevant but also particularly self-threatening. That is, while information about a loss in life expectancy carries a threat that may prompt information avoidance or selective retention, it may also be compelling enough to motivate a beneficial behavioral change. The personalization of the information to the participant's home region (on the county level in the US and on the district level in India) further increases its relevance.

To ensure that all participants were familiar with the general topic of air pollution, they received additional prior information about the main sources of air pollution, associated illnesses, how it is measured, information on the WHO recommendation of $5\mu g/m^3$ $PM_{2.5}$, how excessive exposure can generally be converted into an average loss of life expectancy, and the total number of pre-mature deaths attributable to air pollution in the respective

[5] The information is based on regional yearly average $PM_{2.5}$ estimates in the raster data by Hammer et al. (2020). We then follow Ebenstein et al. (2016) for a conversion to a loss in life expectancy.

Figure 2: HPC treatment screen for the US. In India, the "avoid smoke from open fires and waste burning" measure was substituted with "use clean cooking and heating fuels". The selection of protective measures follows Carlsten et al. (2020).

country.[6] Throughout, participants were asked to answer comprehension questions.

Perceived control manipulation. Before we asked participants to indicate whether they would prefer to receive information on the average loss of life expectancy due to air pollution in their home region, we exogenously manipulated their perceived control over the effect of air pollution on their health. To do so, participants in the treatment group received information about private measures to protect oneself against air pollution exposure (HPC treatment, see Figure 2). To ensure that participants engage with the information, they were asked to provide a short summary of these protective measures and were only allowed to move on to the next screen after correctly answering a comprehension question.[7] The control group did not receive any information about protective measures. To test whether the treatment successfully increased perceived control, we measured participants' perceived control both indirectly via the general perceived control questionnaire (Pearlin and Schooler, 1978) adapted to the context of air pollution, and directly via the one-item measure by Trope et al. (2003). Both measures were elicited at the end of the study.[8]

Information seeking. To measure our first main outcome of interest, we asked participants to indicate whether they prefer to receive information on the average regional loss of life expectancy as described above. Participants were also informed that their choice will be implemented with a 60% chance. The randomization into receiving the information is

[6]In the US sample, participants were informed that air pollution is associated with 100,000 to 200,000 deaths annually (Thakrar et al., 2020). In the Indian sample, the information was about 1.7 million deaths due to air pollution each year (Pandey et al., 2021).

[7]All instructions are provided in Appendix XX.

[8]The questions used to measure perceived control are provided in Appendix XX.

designed to avoid a selection effect in which selective retention could only be analyzed for the subsample of participants that prefer to receive the information. That is, we ensured that the information was shown to a share of participants that had a preference to avoid it, allowing us to test whether the propensity of selective information retention is conditional on the opportunity to avoid the information beforehand.

Information recall. To measure our second main outcome of interest, we asked participants who received information about the average loss of life expectancy in their home region to recall the information. The task was incentivized by rewarding participants for perfectly recalling the number of life years lost (to the first decimal place) with US Dollar (USD) 0.50 and 40 Indian Rupees (INR), respectively. Additionally, participants were rewarded with USD 0.20 or 20 INR for an imperfect recall that allowed for an error margin of ± 0.5 years. If participants were off by more than 0.5 years, they did not receive any reward. Between the information acquisition and the information recall, participants worked on a real effort task for two minutes. The effort task was set as an incentivized coin counting exercise in which participants earned a fixed piece-rate of either USD 0.02 or 2 INR for correctly counting the number of coins in a randomly generated image. The short delay generated by the task provides participants with an opportunity to strategically forget or misremember the self-threatening information. Participants who did not receive the information also undertook the coin counting task.

Follow-up experiment. After about 14 days, all participants that received the information on the average loss of life expectancy in their home region in the main experiment were invited to participate in a follow-up experiment. In the follow-up, participants were again asked to recall the life years lost information that they received about two weeks earlier. Incentives for a perfect and imperfect recall were identical to those in the main experiment. Participants were neither contacted nor reminded of any information in-between both experiments.

2.2 Procedures and Implementation

Table 1 presents an overview of the procedures in the main and follow-up experiment. The main online experiment started with an entry questionnaire on demographics, including the participant's age, gender, self-reported income, household size, education level as well as their county (US) or district (India) of residence. In particular, the participant's residence is important for personalizing the information on life years lost later in the experiment. Afterwards, participants progressed through the experiment as described in section 2.1 (steps 2-8 in Table 1). We additionally elicited the prior belief about the severity of air pollution in the participant's home region as well as the general worry about air pollution in general (step 3). As previously mentioned, participants completed a perceived control questionnaire (Pearlin and Schooler, 1978) adapted to the context of air pollution and the one item measure by Trope et al. (2003) after the experiment (step 9). Lastly, participants were asked to

Table 1: Experimental procedure in main and follow-up experiment.

		Main	Follow-up
1.	Entry questionnaire	X	X
2.	General information on air pollution	X	
3.	Belief elicitation (AP severity and worry)	X	
4.	HPC treatment variation	X	
5.	Information acquisition decision	X	
6.	Information on life years lost (cond. on randomization and 5.)	X	
7.	Real effort task	X	
8.	Information recall (cond. on 6.)	X	X
9.	Perceived control questionnaire	X	X
10.	Item recognition task	X	
11.	Protective measure questionnaire		X

Notes: The experimental procedures were identical for the US and India samples. Participation in the follow-up experiment was conditional on receiving information on life years lost (step 6).

complete an incentivized item recognition task to measure their memorization ability.[9]

In the follow-up online experiment, we again elicited demographic variables to test for inconsistencies with responses in the main experiment. Then, participants directly progressed to the incentivized recall of the life years lost information provided during the main experiment. The follow-up experiment concluded with two questionnaires: (i) we repeated the measurement of perceived control equivalent to the main experiment, and (ii) we asked participants how often they engage with various protective measures against air pollution exposure.[10]

For the US sample, the experiments were implemented on Amazon Mechanical Turk (MTurk). Data collection was limited to participants from states with the highest average pollution including California, Illinois, Missouri, Mississippi, Tennessee, Iowa, Nebraska, Kansas, Louisiana, Alabama, Georgia, and Arkansas. Participants received a fixed reward of US $3.00 for completing the main experiment (which took about 10 minutes) and US $1.00 for completing the follow-up (which took about 3 minutes). Together with the incentives that participants were able to earn during the experiments, the average reward was US $3.85 and US $1.24, respectively. Upon completing the main experiment, participants were informed that they would be invited for another experiment in two weeks. Information on the purpose of the follow-up experiment was not provided.

For the Indian sample, the experiments were implemented with Dynata, a survey company commonly used for economic research (Stantcheva, 2022). The experiment in India was not

[9]In the item recognition task, participants were instructed to memorize 30 items that were each displayed for one second. Their memory ability was then tested by showing 15 items and asking the participant whether each of them was part of the previous list. Of those 15 items, eight were previously shown while seven were not. For each correct answer, participants received a reward of US $0.05 or INR 5, respectively.

[10]All participants were invited to give open feedback at the end of each experiment. Additionally, we debriefed participants in the control group on the protective measures one can utilize to protect oneself against air pollution exposure. Participants who did not receive information on life years lost were debriefed after the main experiment as they were not re-invited for the follow-up. All others were debriefed after the follow-up experiment.

geographically limited. The completion of both main and follow-up experiment was rewarded by the survey company in the form of panel points that can be redeemed in various forms, including cash payments. In addition, participants received an average bonus incentive payment of just under INR 75 (about USD 0.90) in the main experiment. In line with the implementation in the US, participants were informed that they would be invited for the follow-up experiment in two weeks. During the follow-up, participants earned an average additional reward of INR 22 (about USD 0.27). Exclusion criteria that either prevented participants from completing the experiment or excludes them from the analysis were pre-registered.[11] All experiments were programmed in nodeGame (Balietti, 2017) and conducted in English in November and December 2022.

3 Hypotheses

We use the data from our two experiments to test whether perceived control mitigates the failure to attend to self-threatening information. In particular, we study the effect of a change in perceived control on both information avoidance and participant's propensity to forget the information. Throughout, we will analyse the data and test our hypotheses separately for the US and Indian sample.

The primary goal of our treatment is to generate an exogenous upward shift in perceived control (i.e., one's belief that a specific outcome can be influenced through one's own actions) over the negative effect of air pollution exposure on own health. To do so, the treatment provides information about various actionable measures to protect oneself from air pollution exposure (see Figure 2). We expect that participants who receive such actionable information about air pollution should feel that they have more control over its negative health impact. We formulate our first hypothesis accordingly:

Hypothesis 1: *Participants in the HPC treatment report higher perceived control over the negative impact of air pollution on their health than participants in the control group.*

Next, we focus on the effect of our treatment manipulation on participants' failure to attend to the self-threatening information on the average loss in life expectancy for their home region. In particular, we examine information avoidance and information retention.

[11] We took several steps to ensure good data quality that we applied to the Indian and US sample: First, we included a question designed to detect straight-lining, *i.e.*, choosing the same response option multiple times in a row. Second, we check for consistency with respect to the participant's reported age by including a question with a free numerical input as well as a question with pre-defined age bins. Third, we exclude participants that give unambiguously automated or otherwise entirely nonsensical responses to the free text input feedback questions. And lastly, participants were excluded if they needed more than five attempts to correctly answer any of the comprehension questions during the general information on air pollution (step 2 in Table 1). Due to technical difficulties in recording timing data, we are not able to apply our fifth pre-registered criterion that excludes participants who need less than 5 minutes to complete the entire main experiment. For the pre-analysis plan, see https://doi.org/10.1257/rct.10083-1.0. In addition to our pre-registered criteria, we exclude participants from the analysis of the follow-up experiment if they report a different county or district of residence than in the main experiment. While participants may have moved during the time between main and follow-up experiment, the information we ask them to recall (*i.e.*, the average life years lost in their previous home region) is likely no longer relevant to them.

Regarding information avoidance, we expect perceived control to affect participants' willingness to acquire the information in two ways: First, perceived control is expected to increase the (perceived) instrumental value of the information, thus increasing participant's incentive to acquire it. Second, perceived control is expected to decrease the negative hedonic value associated with the information, thus decreasing the psychological cost of acquiring the information (Trope et al., 2003; Yaniv et al., 2004; Melnyk and Shepperd, 2012). These two effects predict that higher perceived control should lead to less information avoidance.

Hypothesis 2: *Participants in the HPC treatment are more likely to prefer to avoid information about the number of life-years lost in their home region than participants in the control group.*

Participants who receive the information about the number of life years lost in their home region are then asked to recall this number at two points in time: shortly after receiving it, and two weeks later. Because the information is self-threatening, people may be tempted to strategically distort their memory. As in the case of information avoidance, we expect that perceived control mitigates participant's incentives to engage in memory distortion via the same mechanism. We formulate the two following hypotheses.

Hypothesis 3: *Among participants who receive information about the number of life-years lost in their home region, participants in the HPC treatment are more likely to forget this information shortly after receiving it than participants in the control group.*

Hypothesis 4: *Among participants who receive information about the number of life-years lost in their home region, participants in the HPC treatment are more likely to forget this information two weeks after receiving it than participants in the control group.*

In addition to our four main hypotheses, we formulate two secondary predictions. First, we study the effect of perceived control on the performance in the coin counting effort task between information acquisition and information recall (see step 7 in Table 1). The main channel through which we expect perceived control to affect performance in the coin task is a decrease in the cognitive load. As such, the self-relevant and self-threatening information about a loss in life expectancy is likely to generate negative emotions such as stress. In turn, negative emotions tax the brain's executive functions which negatively affect performance (Anderson, 1977). Consequently, participants who receive the information should experience a larger cognitive load and perform worse at the task than participants who do not receive the information. In addition, a lack of control can be stressful in itself (Conway et al., 2013). Therefore, an increase in perceived control should decrease the cognitive load and participants in the HPC treatment are expected to perform better than participants in the control. Overall, we expect the positive effect of perceived control on attenuating the underlying threat of the negative information to compensate the loss in productivity induced by the information. This leads to the following hypothesis.

Secondary hypothesis 1: *Participants who receive information about the number of life-years lost in their home region a) perform worse at the real-effort task than participants who did not receive the information and b) this effect is larger in the control group than in the HPC treatment group.*

Second, we study participant's self-reported use of protective measures against air pollution in the follow-up experiment (see step 11 in Table 1). Recall that in the HPC treatment, we provide participants with information about a set of private measures to protect themselves from air pollution exposure. In the follow-up survey, we ask respondents to report how often they engaged in these activities, offering five response options that range from "never" to "every day".[12] While participants in the control might also be aware of protective measures, our treatment manipulation emphasizes their effectiveness. Consequently, participants in the HPC treatment are expected to engage with the protective measures to a larger extent.

Secondary hypothesis 2: *Participants in the HPC treatment are more likely to report engaging in protective behavior against air pollution than participants in the control group.*

4 Data

In the US sample, a total of 2,340 participants completed the main experiment of which we retain 2,272 observations after applying the pre-registered exclusion criteria.[13] For participant characteristics of the main experiment in the US, see panel A in Table 2. Participants are, on average, 39 years old and live in households with an average of 3.1 members. Just over 50% of the sample is female while about 75% live in urban areas. Average income in the sample is around the median of the national income distribution. For 23% of the sample, the completion of high school is the highest educational attainment, about 55% completed a college degree, and every fifth participant reports to have finished a Masters degree or higher. Based on the reported county of residence, the average participant in our sample loses about half a year of life expectancy due to air pollution exposure with minimum and maximum impacts at 0.1 and 1.5 years, respectively. At an average of about 6 on a 10 point Likert scale, participant's have a moderately high prior belief about the severity of air pollution in their county and are rather worried about air pollution in general (average of 4.5 on a 7 point Likert scale).

A total of 1,302 participants in the US sample received the information on the number of life years lost in their home county and were therefore invited to partake in the follow-up experiment on MTurk. 660 (51%) were recruited out of which 649 completed the follow-up experiment. After addressing inconsistency issues, a total of 502 participants will be used for the analysis.

[12] In particular, we asked about the following nine activities: wearing a face mask, using an air purifier indoors, checking the air quality in the area, avoiding highly polluted areas when commuting, opening windows to ventilate rooms, removing dust in the household, spending time in nature, burning waste, and handling open fires (*e.g.*, for cooking or heating).

[13] A total of 2,518 participants were initially recruited via MTurk, *i.e.*, attrition is at 7%.

Table 2: Summary statistics of participant characteristics.

	Mean	Median	SD	Min	Max
	Panel A: USA				
Age	38.93	37.00	11.79	18	78
Female	0.51	1.00	0.50	0	1
Household size	3.09	3.00	1.86	1	40
Urban	0.74	1.00	0.44	0	1
Income group	5.08	5.00	2.32	1	10
High school graduation	0.23	0.00	0.42	0	1
College degree	0.56	1.00	0.50	0	1
Masters degree or higher	0.21	0.00	0.41	0	1
Average number of life years lost in home county	0.48	0.40	0.28	0.1	1.5
Prior belief impact of air pollution	6.03	6.00	2.16	1	10
Confidence in prior	3.52	4.00	0.89	1	5
Worried about air pollution	4.47	5.00	1.72	1	7
	Panel B: India				
Age	34.13	32.00	11.02	18	80
Female	0.34	0.00	0.47	0	1
Household size	4.34	4.00	2.01	1	63
Urban	0.89	1.00	0.31	0	1
Income group	7.98	9.00	2.63	2	10
High school graduation	0.10	0.00	0.30	0	1
College degree	0.50	1.00	0.50	0	1
Masters degree or higher	0.40	0.00	0.49	0	1
Average number of life years lost in home county	5.85	4.50	2.69	1	11.8
Prior belief impact of air pollution	6.07	6.00	2.52	1	10
Confidence in prior	4.13	4.00	0.78	1	5
Worried about air pollution	5.63	6.00	1.52	1	7

Notes: The table shows summary statistics of pre-treatment characteristics for a total sample of $N = 2,272$ (US) and $N = 2,036$ (India) participants after data cleaning according to the pre-registered exclusion criteria. The calculation of average number of life years lost follows (Ebenstein et al., 2016) and is based on the annual average $PM_{2.5}$ concentration in the participant's county (US) or district (India) of residence (Hammer et al., 2020).

In the India sample, 2,357 participants completed the main experiment of which 2,036 observations are retained after applying exclusion criteria, see panel B in Table 2 for participant characteristics.[14] The sample is typical for online recruitment in developing countries, *i.e.*, participants are, on average, rather young (34.1 years old), predominantly male (76%), live in urban areas (89%), rich (median income between the 80th and 90th percentile of the national distribution), and well educated (40% with a Masters degree or higher). The average loss of life expectancy in our sample at almost 6 years (with maximum values just under 12 years) demonstrates the severity of the air pollution crisis in India. Yet, when asked to rate the severity of the problem in the participant's home district on a 10 point Likert scale, we observe an average response of just over 6. In general, participants in our Indian sample are rather worried about air pollution (average of 5.6 on a 7 point Likert scale).

[14] In India, 2,645 participants were initially recruited through Dynata, *i.e.*, we observe an attrition rate of just over 10%.

A total of 1,198 participants in the India sample received the information on the number of life years lost in their home district and were therefore invited to partake in the follow-up experiment via Dynata. 626 (52%) were recruited out of which 604 completed the follow-up experiment. After addressing inconsistency issues, a total of 494 participants remain for the analysis.

5 Results

We first study the main experiment, testing Hypotheses 1-3 and Secondary hypothesis 1. Afterwards, we shift focus to the follow-up experiment to test Hypothesis 4 and Secondary hypothesis 2. Throughout, we present results for the US and for the Indian sample separately.

5.1 Main Experiment

5.1.1 Perceived Control

First, we examine whether the HPC treatment, *i.e.*, providing information on private protection measures, increases participants' perceived control over the negative health effects of air pollution exposure. Figure 3 plots the distribution of our perceived control index for the Indian sample (upper panel) and the US sample (bottom panel) for participants in the control (in light grey) and treatment group (in dark grey). For both countries, the distribution in the treatment group is shifted to the right, indicating that the HPC treatment has increased perceived control.

We analyze the perceived control questionnaire as an equally weighted index of all eight responses while the one item measure by Trope et al. (2003) will be analyzed as a standardized z-score.[15] We find that the treatment significantly increases perceived control by 0.50 standard deviations in the US sample ($p < 0.001$ in a Mann-Whitney U two-sample test, hereafter MW test, combined N=2,259) and 0.19 standard deviations in the Indian sample ($p < 0.001$ in a MW test, combined N=2,036). Likewise, we find significant treatment effects when studying the one-item measure by Trope et al. (2003). Here, we find that the HPC treatment increases perceived control by 0.52 standard deviations in the US sample ($p < 0.001$ in a MW test, combined N=2,270) and by 0.17 standard deviations in the Indian sample ($p < 0.001$ in a MW test, combined N=2,036). We further substantiate results with regression analyses that control for the actual average life years lost due to air pollution in the participant's home region, how worried the participant is about air pollution in general, and state fixed effects. Results on both our measures of perceived control are robust (see Appendix Table A-1). In summary, we can confidently conclude that the HPC treatment successfully increases perceived control in both samples.

[15] Following Kling et al. (2007), we standardize all responses (in the index and for the one-item measure) as z-scores, *i.e.*, we subtract the control group mean and divide by the control group standard deviation. Thereby, the one-item measure as well as each component of the index has mean 0 and standard deviation 1 for the control group.

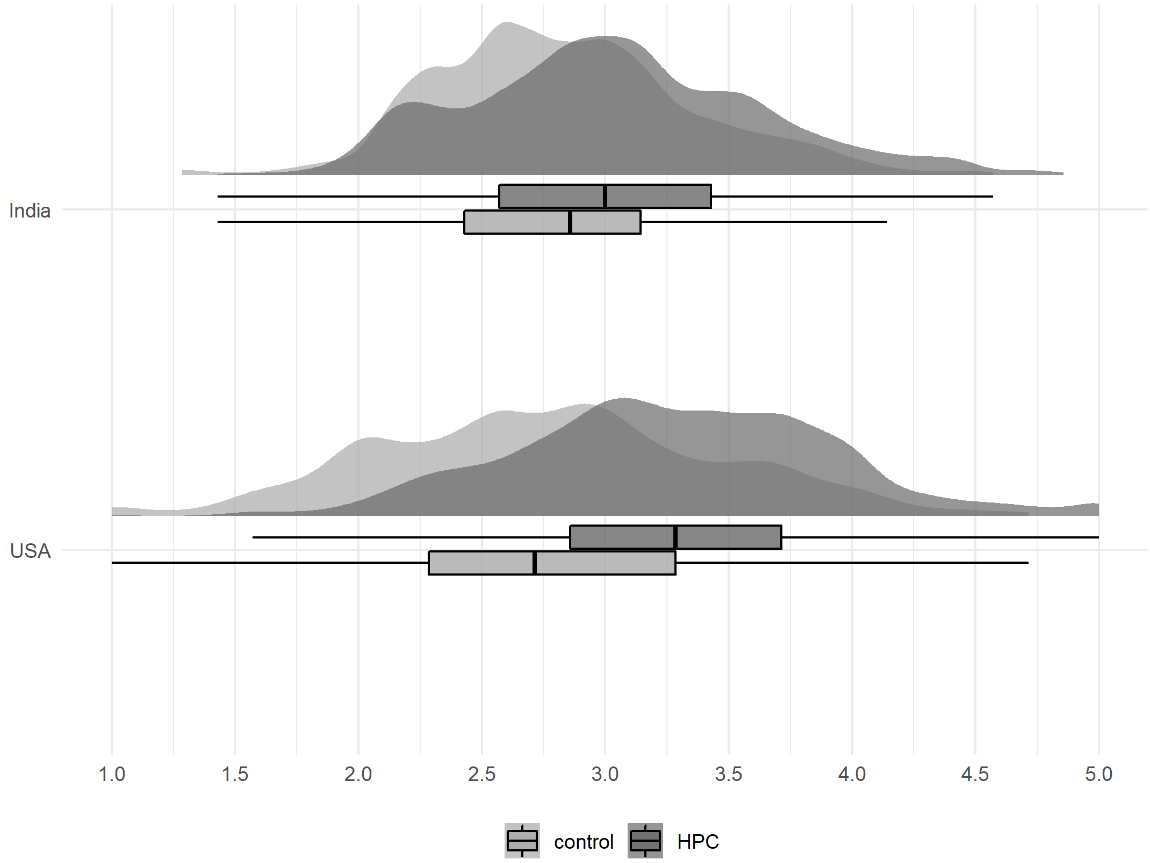

Figure 3: Distribution of the perceived control index in the sample from India and the USA.

Result 1: *The HPC treatment significantly increases the perceived control over the negative health effects of air pollution exposure in the US and Indian sample (support Hypothesis 1).*

5.1.2 Information Avoidance

Next, we focus on how the perceived control treatment affects participants' preference to avoid information about the average loss in life expectancy due to air pollution exposure in their home region. Information avoidance is measured as the share of participants who prefer not to receive the information (independent of whether they were randomized to actually see it). Panel A in Figure 4 shows the share of participants who prefer to avoid (in light grey) and receive (in dark grey) the information in the US sample on the left-hand side and the Indian sample on the right-hand side. We find that in the control group, 16.5% of participants in the US sample and 8.0% of participants in the Indian sample indicate that they prefer not to receive the information. These rates are comparable to studies on the willingness to acquire self-threatening information in the health domain such as getting tested for contagious medical conditions (*e.g.*, Ganguly and Tasoff (2017); Sullivan et al. (2004)). Contrary to our expectations, we find no significant treatment effect on the proportion of participants who prefer to avoid the information in both samples (Fischer exact test: $p = 0.469$ in the US, combined N=2,272; $p = 0.871$ in India, combined N=2,036), thus rejecting hypothesis 2. Appendix Table A-3 shows consistent results using both linear probability models and logistics regressions.

Result 2: *The HPC treatment does not increase the proportion of participants who want to acquire information about the number of life years lost due to air pollution exposure, neither in the US, nor in India (reject Hypothesis 2).*

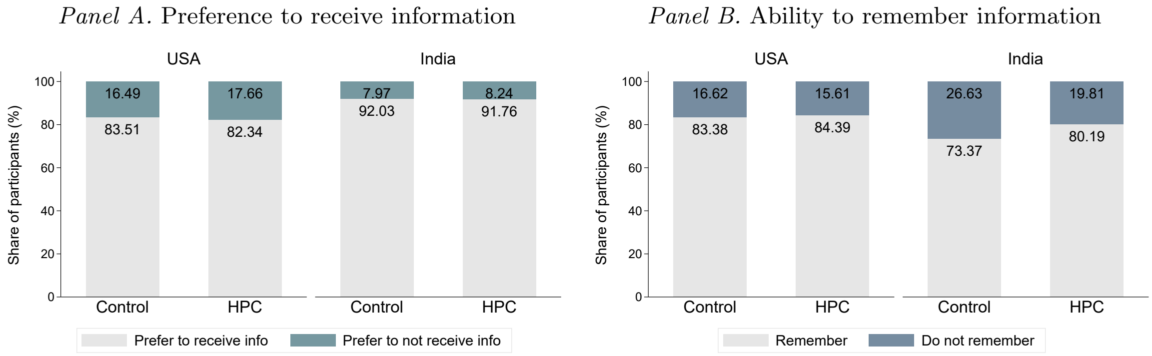

Figure 4: Share of participants that prefer to receive/avoid the information (Panel A) and share of participants that remember/forget the information (Panel B), by country and treatment.

5.1.3 Information Retention

We now examine the effect of the HPC treatment on information retention in our main experiment. As our primary measure, we consider the share of participants who are not able to recall the correct average loss in life expectancy in their home region within a ± 0.5 year error margin. Panel B in Figure 4 shows the share of participants in each sample that is able to recall the average loss in life expectancy in their home region (light gray bars) shortly after receiving it and the share of participants who is not (dark grey bars). Note that we only consider participants that were randomized into receiving the information. In the US sample, 16.6% of participants forget the information in the control group compared to 15.8% in the treatment group. The difference is not significant (Fisher exact test: $p = 0.818$, combined N=1,302). In contrast, we find that the HPC treatment significantly decreases selective information retention in the Indian sample: the share of participants who fail to remember the information decreases by 25% from 26.7% in the control group to 19.8% in the treatment group (Fisher exact test: $p = 0.015$, combined N=1,198).

To probe our results further, we conduct a linear regression analysis of the HPC treatment on an indicator variable for forgetting the information within a ± 0.5 year error margin. The coefficients are displayed in column (1) in Table 3. We include control variables for the participant's prior belief about regional air quality, the performance in the item recognition (memory) task, and the average life years lost (LYL) in the home county or district. The regression confirms that the HPC treatment leads to a decrease in the likelihood to forget the information of 7 percentage points in the Indian sample (see panel B) and has no effect in the US sample (see panel A). Moreover, the regression analysis shows that the ability

Table 3: Estimated effects on immediate information retention.

	Info Forgetting		Recall error	Abs. recall error
	(Error ±0.5y)	(Error 0y)		
	(1)	(2)	(3)	(4)
	Panel A: USA			
HPC	-0.007	-0.011	-0.046	-0.044
	(0.020)	(0.022)	(0.103)	(0.102)
Prior belief about impact	0.036***	0.041***	0.203***	0.207***
	(0.005)	(0.005)	(0.024)	(0.024)
Performance memory task	-0.623***	-0.657***	-3.181***	-3.204***
	(0.091)	(0.101)	(0.478)	(0.476)
Average LYL	0.092**	0.099**		
	(0.037)	(0.040)		
Observations	1,302	1,302	1,302	1,302
Control mean	.17	.22	.68	.69
	Panel B: India			
HPC	-0.072***	-0.039	-0.131	-0.239**
	(0.023)	(0.028)	(0.122)	(0.108)
Prior belief about impact	0.022***	0.011*	0.095***	0.080***
	(0.005)	(0.006)	(0.025)	(0.022)
Performance memory task	-0.603***	-0.523***	-0.864*	-2.294***
	(0.086)	(0.103)	(0.443)	(0.394)
Average LYL	0.007	0.015***		
	(0.004)	(0.005)		
Observations	1,198	1,198	1,198	1,198
Control mean	.27	.44	.17	1.03

Note: Recall error is defined as posterior guess – correct value. Standard errors are reported in parentheses. Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

to recall the information is positively associated with the performance in the memory task. As intuitively expected, those with a better general memory are also better at recalling the information on the average loss of life expectancy. Also, we find that participants who have a prior belief about good air quality are more likely to forget the information. At first glance, the effect may appear counterintuitive since one may expect that forgetting is correlated with beliefs about high pollution exposures that carry a larger threat. Yet, the actual information on average LYL likely interacts with anticipatory beliefs. That is, if one believes to live in a region with excellent air quality, any positive loss in life expectancy may become particularly more threatening which may motivate participants to distort their memory in the absence of a perceived control treatment. We will return to such a bad news effect in Section 5.3. In the US sample, we further document that the actual average loss in life expectancy in one's home region has a negative effect on recall. For each additional year of life expectancy lost, participants are 9 percentage points more likely to forget the information. We find no such relationship in the Indian sample.

To check the robustness of our results, we study several alternative measures for information retention. First, the model in column 2 replicates the model in column 1 using forgetting the information without an error margin (*i.e.*, the ability to recall the number of life years lost to the first decimal place) as the dependent variable. In addition, we study participants' error in recall measured by the difference between the reported recall of the average loss in life expectancy in the respective home region and the actual (correct) value, both by considering positive and negative deviations separately (column 3) as well as in absolute terms (column 4).

In the Indian sample, the HPC treatment leads to an insignificant decrease in the share of participants that is not able to recall the information without any error ($p = 0.167$). Also, with a larger number to remember, the share of participants that forget the information in India increases. Turning to our more fine grained measures, we find that the HPC treatment decreases the average absolute recall error by about 0.24 years, a significant reduction of 23.6% compared to the control group average. We also test whether participants are more likely to bias their memory of the average loss in life expectancy in their home region in a particular direction. For instance, participants who are worried about the negative health effect of air pollution might be tempted to remember the average loss in life expectancy in their home region to be lower than in actual is. The results displayed in column 3 show that this is not the case: the coefficient of the treatment variable is negative but insignificant. In the US sample, we do not observe a significant treatment effect on any of our alternative measure of information retention.

In summary, we find evidence that participants in the treatment group of the Indian sample are significantly less likely to forget the average loss in life expectancy in their home region and remember the number more accurately than participants in the control group. In contrast, we find no such effect in the US sample.

Result 3: *Among participants who receive information about the number of life-years lost in their home region, participants in the HPC treatment are significantly less likely to forget the information than participants in the control group shortly after receiving it, in India but not in the US (support Hypothesis 3 in India, reject in the US).*

5.1.4 Performance in the Real-Effort Task

Between the moment participants receive the information about the average loss in life expectancy in their home region and the moment they are first asked to recall it, they work on a real-effort task for two minutes. Therfore, the design allows us to examine whether receiving self-threatening information affects the performance in the real effort task and – if so – whether the HPC treatment mitigates the effect.

We find no evidence that information on the average life expectancy loss due to air pollution affects performance in the coin counting task. Independent of whether participants receive the information they are able to solve an average of 5.5 coin counting tasks in India and an average of 7 tasks in the US. We reject Secondary hypothesis 1a) for both countries.

To investigate Secondary hypothesis 1b), we conduct an OLS regression using participants' performance in the coin counting task as the dependent variable. Independent variables include a treatment dummy, a dummy variable for whether the participant received the information about the number of life-years lost, and the interaction of the two. The results are displayed in Table 4.

Table 4: Estimated effects on performance in the effort task.

	USA (1)	India (2)
HPC	0.038	0.373**
	(0.155)	(0.167)
Received info	-0.029	0.148
	(0.146)	(0.155)
HPC x Received info	-0.016	-0.350
	(0.204)	(0.218)
Prior belief about impact	-0.165***	-0.193***
	(0.024)	(0.022)
Average LYL	-0.478***	-0.043**
	(0.185)	(0.020)
Observations	2,272	2,036
Control mean	6.96	5.43

Note: Standard errors are reported in parentheses. Significance is denoted as follows: *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

Results support the non-parametric findings that receiving threatening information does not affect performance in the coin counting task in either sample. Similarly, we find that the HPC treatment has no effect on performance for participants in the US sample, independent of whether information about the average loss in life expectancy in their home region was received. Our findings are more nuanced for the Indian sample. That is, we find a positive HPC treatment effect for participants who did not receive information about the average loss in life expectancy in their home region. Among those who did not receive the information about the average number of life-years lost in their home region, those in the HPC treatment complete about 0.4 more coin counting tasks on average, a significant increase in performance by 8%. However, the gain in productivity induced by the treatment is counteracted by the self-threatening information.

Result 4: *In the Indian sample, performance is higher in the HPC treatment than in the control group, but only for participants who did not receive information about the average loss in life expectancy in their home region. We find no such effect in the US sample. (reject Secondary hypothesis 1).*

5.2 The Two-Week Follow-Up

The follow-up study allows us to investigate (i) whether the effect of our treatment manipulation on perceived control persists after two weeks and (ii) how the treatment affects participants' ability to recall the information about the average loss in life expectancy in their home region two weeks after being exposed to it. Because only a sub-sample of our participants took part in the follow-up study, we do not compare the behavior observed in the follow-up study to the behavior in the full sample of the main study. Rather, we only analyze the sub-sample that participates in both experiments.

5.2.1 Perceived Control

Figure 5 displays the mean treatment effect over time (*i.e.*, the difference-in-difference between main experiment and follow-up) for the sub-sample that took part in the main experiment and the follow-up.[16] The average treatment effects estimated in the main study are displayed on the left-hand side of each panel while the average treatment effects estimated in the follow-up study are displayed on the right-hand side.

We find that the effect of our treatment manipulation on perceived control persists after two weeks in both samples. Panel A in Figure 5 shows a strong treatment effect on perceived control in the main study for both countries in our sub-sample of participants who took part in the follow-up study. The graph also shows that even though the treatment effect is smaller, it is still highly significant after two weeks in both countries. In the US follow-up sample, perceived control is 0.42 point higher in the treatment group than in the control group, a significant increase with $p < 0.001$ in a MW test, combined N=501. In the Indian follow-up sample, perceived control is 0.12 point higher in the treatment group than in the control group, a marginally insignificant increase with $p = 0.052$ in a MW test, combined N=494. For the one-item measure by Trope et al. (2003), our results are similar. Perceived control is 0.51 point higher in the treatment group than in the control group in the USA ($p < 0.001$) and 0.24 point higher in India ($p = 0.008$).

5.2.2 Information Retention

We now examine information recall after two weeks. Remember that for the immediate recall in the main experiment we find a negative treatment effect on the likelihood to forget the information in the Indian sample but no treatment effect for the US. In contrast, Panel B in Figure 5 shows no treatment effect for our sub-sample of participants in the main study in both countries. However, because people had more time to strategically distort their memory of the information in the follow-up study we expect the treatment effect to be stronger in the follow-up than in the main study. We find that the majority of participants in both countries are still able to recall the information with an error margin of ± 0.5 years. However, we do not find a treatment effect after two weeks in either of the two samples. For the US sample in the follow-up, 34.6% of participants in the control group and 42.1% in the

[16]For regression results on the follow-up, see Appendix Table A-2.

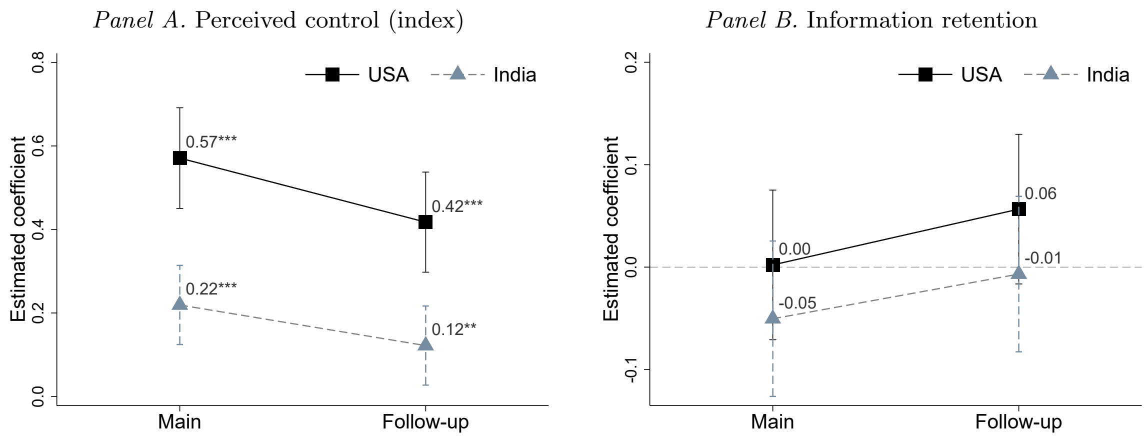

Figure 5: Estimated marginal treatment effects on perceived control (Panel A) and information retention (Panel B) in the main experiment and the follow-up. Both panels show difference-in-difference estimates using the follow-up sample. In both panels, we control for the participant's prior belief about regional air quality. Regressions in Panel B additionally control for the performance in the item recognition task. Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

treatment group cannot recall the information. The difference is insignificant with $p = 0.201$ in a Fisher exact test, combined N=501. For the Indian sample, in both the control and treatment group, 34.6% of participants are not able to recall the information in the follow up ($p = 1.000$ in a Fisher exact test, combined N=494). The right-hand side of Panel B in Figure 5 shows an absence of treatment effect after two weeks in both countries.

Result 5: *Among participants who took part in the follow-up study, we find no treatment effect on participant's tendency to forget the information after two weeks, both in the US and the Indian sample (reject Hypothesis 4.)*

5.2.3 Use of Private Protection Measures

In addition to participants' attitudes towards information, we examine the effect of our treatment on participant's self-reported use of private protection measures against air pollution exposure elicited in the follow-up. Results suggest that providing information about protection measures moderately increases their reported use. To compare the use of private protection measures, we standardize the responses to all nine activities to z-scores following Kling et al. (2007) and then compute an average index. We find that participants in the treatment group report a higher frequency of use of defensive measures than in the control group and the difference is significant in the US sample ($p = 0.011$ in a MW test, combined N=501) but not in the Indian sample ($p = 0.066$ in a MW test, combined N=494). We show robustness of these results with a OLS regressions, see Appendix Table A-4.

To determine which protective measures is most impacted by our treatment manipulation, we examine the effect of our treatment on each component of our aggregated measure separately. The regression results are displayed in Appendix Table A-5 and show that a change in commuting habits drives the HPC treatment effect on our aggregated measure. Results suggests that adjusting commuting routes to avoid highly polluted areas may (i) be fairly easy to implement and (ii) that its effect on health may have been *apriori* underestimated by our participants.

Result 6: *The HPC treatment increases the likelihood to engage in private protection measures against air pollution in the US. The Effect is less pronounced in India (partially support Secondary hypothesis 2.*

5.3 The Health Threat of Air Pollution Exposure: A Bad News Effect?

The information about the average loss in life expectancy provided in our experiment is likely perceived as bad news. However, how *bad* the news is perceived depends on the actual level of air pollution relative to the participants' prior about the air quality in their home region. The difference between participants' beliefs and the actual air quality is an important determinant of selective information retention as it dictates the emotional cost associated with the information (Eil and Rao, 2011; Zimmermann, 2020). Additionally, how confident participants are in their prior belief may play a role. For example, a participant who confidently believes to reside in a region with excellent air quality will be negatively surprised about information that signals any positive loss of life expectancy and perceive the information as considerably bad news. In contrast, a participant that believes to be exposed to bad air quality will be less surprised to learn about the associated loss of life expectancy. While the information may still be perceived as bad news, its anticipation can attenuate the negative shock.

We use the within sample variation in prior beliefs about air quality in one's home region and conduct an exploratory analysis for heterogeneous treatment effects on selective information retention. To elicit beliefs, we asked participants to rate the air quality in their home region from 1 (worst air quality) to 10 (best air quality) before introducing the treatment manipulation (step 3 in Table 1). For the analysis, we split both of our samples into five groups beginning with participants who believe that the regional air quality is very bad (responses of 1 or 2) up to those who believe to experience excellent air quality (responses of 9 or 10). Figure 6 shows the marginal treatment effects with respect to these prior belief groups where we control for the participant's confidence in the prior, the memory ability, and actual life expectancy loss in the participant's home region. To put the marginal treatment effects into perspective, we additionally plot control group means for the true life years lost (LYL) in the participant's home region, the average confidence level in the prior for the control group, as well as the share of participants in the control group that successfully recall the LYL number within a ± 0.5 year error margin.

We find no clear relationship between participants' prior and the treatment effect of perceived control on information retention. Rather, we find a strong treatment effect on information retention for participants who believe air quality in their home region to be very good (responses of 9 or 10). In both the US and the Indian sample, the treatment improves information retention within a ± 0.5 year error margin by about 16 percentage points for

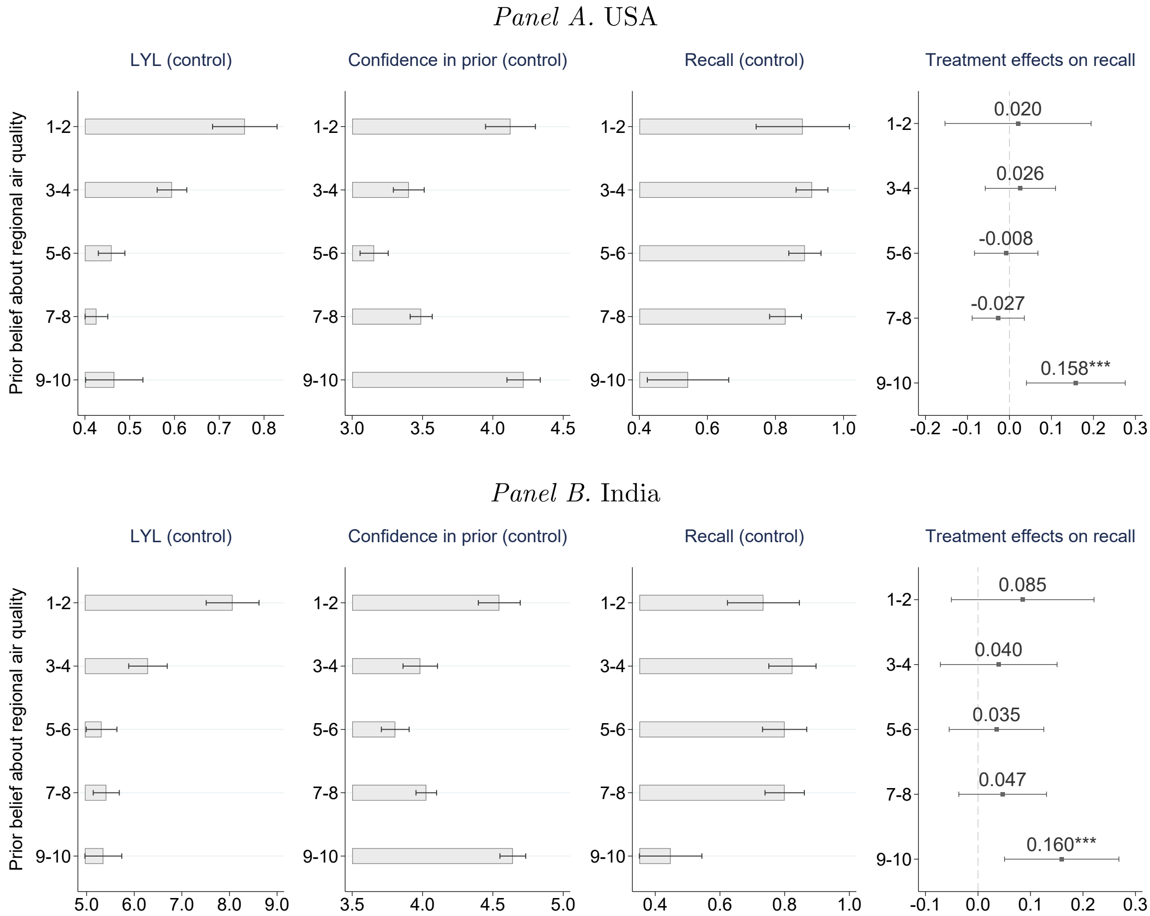

Figure 6: Control group mean for the average regional life years lost (LYL), confidence in the prior belief about air quality, and the share of participants that correctly recall the LYL value within a ±0.5 year error margin as well as marginal HPC treatment effects from an OLS regression on the share of successful recall by prior belief about the regional air quality from 1 = worst air quality to 10 = best air quality. The regression models control for the confidence in the prior, regional average LYL, and performance in the item recognition task. Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

participants who believe they experience excellent air quality and are subsequently informed of the associated average loss of life expectancy in their home region. However, note that these participants do not live with a considerably higher air quality than those with a lower prior. In both samples, the actual average loss of life expectancy is comparable for all participants with a prior of 5 or higher. Furthermore, we observe that those who believe to experience excellent air quality in their home region are particularly confident in their belief and significantly more so than participants with a lower prior. At the same time, this subsample has the lowest recall rates among all participants in the control group: In both samples, about 50% of participants who believe they experience excellent air quality cannot recall the information within a 0.5year margin, while this proportion is below 25% for subgroups with less optimistic priors in both samples.

In summary, our exploration into a “bad news effect” suggests that some participants particularly benefit from the HPC treatment in terms of a significantly better information retention. These participants are characterized by (i) overly optimistic beliefs about their regional air quality and (ii) a high confidence in these beliefs.

6 Discussion

We examine whether perceived control can mitigate individuals' failure to attend to self-threatening information. In particular, we study whether perceived control can reduce avoidance and improve the retention of tangible information on the adverse health effects of air pollution in the form of an average loss in life expectancy due to regional exposure levels. In an online experiment with a sample from India and the US, we exogenously increase perceived control over the adverse health effects of air pollution by providing information on private measures that one can utilize for protection against air pollution exposure. We find that perceived control (a) does not affect information avoidance in either sample, (b) substantially improves information retention in the Indian sample, (c) increases the reported frequency of use of private defensive measures against air pollution, and (d) benefits participants with overly optimistic and overly confident beliefs about the air quality in their home region the most.

Contrary to our expectation, perceived control does not affect information avoidance. Several explanations come to mind. First, information avoidance is not widespread. Thus, an increase in perceived control has limited scope to influence avoidance to a measurable extent. As a matter of fact, the 10% to 20% incidence of information avoidance in our experiment is in line with a large part of the related literature on self-threatening information in the health domain. For example, Ganguly and Tasoff (2017) find that 5% to 16% of participants in their experiment avoid test results on a sexually transmittable disease while Sullivan et al. (2004) observe that 18% of people at high-risk of contracting HIV avoid their test results. Second, some participants may have a potentially overly optimistic prior belief that the information is not self-threatening, thus seeing no reason to avoid it. We provide suggestive evidence for this explanation by showing that those participants who confidently believe to experience excellent air quality and are subsequently informed about the associated loss in life expectancy, appear to react by strategically forgetting the information.

A third explanation is suggested by our results on the Indian sample: selective information retention and information avoidance may be substitutes. That is, if participants anticipate that they can strategically forget about the information, they may not deem it necessary to avoid it. Specifically, we find that perceived control significantly increases immediate recall, suggesting that a share of participants at baseline strategically forgets the information. Paired with the observation that information avoidance is below 10%, our results suggest that selective retention is not used as a last resort whenever information avoidance is not possible.

With the finding on the substitutability of information avoidance and selective retention, our study makes an important methodological contribution to research on how motivated reasoning is used to attend to self-threatening information. In particular, a low rate of information avoidance is not sufficient to conclude that there is no underlying issue of belief distortion. Rather, we believe it to be best practice that information avoidance and selective information retention are studied in a unified framework similar to the one presented in our study. Otherwise, the extent to which people forego the instrumental benefits of new information may be underestimated, compromising the generation of accurate policy implications. We note that these considerations are less important for information that is communicated in dichotomous form (*i.e.*, it is unlikely that one can forget about a diagnosis for a terminal disease), but are relevant to the plethora of examples in and outside of the health domain where motivated reasoning is more easily applied.

Our findings have important policy implications. We show that tangible information on how to mitigate the adverse health effects of air pollution is useful in two ways. First, we find that perceived control over the air pollution issue is substantially increased, that the increase persists for two weeks, and helps to reduce strategic memory distortion with respect to the severity of the underlying health threat. Second, we find that the treatment leads to an increase in the self-reported use of private defensive measures to protect oneself against air pollution exposure two weeks after the intervention. These results are a promising sign for the effectiveness of awareness and information campaigns to initiate beneficial behavioral change. However, we note that our evidence is based on a sample that was informed about the average loss of life expectancy due to regional exposure levels. Therefore, it is possible that the information on private defensive measures is only effective when combined with self-threatening information about the underlying health issue. Future research may aim to disentangle the two.

7 Conclusion

Air pollution is a an example of a major global health crisis that is often not acknowledged, met with indifference, or easily drowned out by other, seemingly more pressing issues (Bickerstaff and Walker, 2001; Muindi et al., 2014; O'Connor, 2019). Our study demonstrates that the attendance to information about the underlying threat should be considered a piece of the puzzle for why policies still struggle to initiate lasting behavioral change. We show that actionable advice on how to protect oneself against the adverse health effects of air pollution can mitigate negligence by increasing information retention. Crucially, the problem is not deliberate ignorance that would show as a strict avoidance but rather a preference to forget bad news when no remedy is provided for the problem at hand.

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Appendix

A-1 Regression Analyses and Robustness

Perceived Control

Table A-1: Estimated effects on perceived control of air pollution: main experiment.

	Index			Trope et al. 2003		
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: USA					
HPC	0.513***	0.514***	0.515***	0.508***	0.504***	0.504***
	(0.028)	(0.028)	(0.028)	(0.039)	(0.039)	(0.039)
Worried about AP		-0.059***	-0.058***		0.020*	0.017
		(0.008)	(0.008)		(0.012)	(0.012)
Average LYL		-0.001	-0.112		-0.231***	-0.201*
		(0.051)	(0.087)		(0.071)	(0.121)
State FE	NO	NO	YES	NO	NO	YES
Observations	2,259	2,259	2,259	2,270	2,270	2,270
Control mean	2.77	2.77	2.77	2.75	2.75	2.75
	Panel B: India					
HPC	0.200***	0.203***	0.205***	0.195***	0.198***	0.207***
	(0.025)	(0.025)	(0.025)	(0.049)	(0.049)	(0.049)
Worried about AP		-0.050***	-0.051***		0.000	-0.001
		(0.008)	(0.008)		(0.016)	(0.017)
Average LYL		-0.012***	0.026		-0.032***	0.016
		(0.005)	(0.024)		(0.009)	(0.047)
State FE	NO	NO	YES	NO	NO	YES
Observations	2,036	2,036	2,033	2,036	2,036	2,033
Control mean	2.84	2.84	2.84	3.16	3.16	3.16

Note: Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

Table A-2: Estimated effects on perceived control of air pollution: follow-up experiment.

	Index			Tropes et al. 2003		
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: USA					
HPC	0.427***	0.430***	0.430***	0.477***	0.478***	0.479***
	(0.066)	(0.066)	(0.067)	(0.084)	(0.084)	(0.086)
Worried about AP		-0.051***	-0.051**		-0.023	-0.027
		(0.020)	(0.020)		(0.025)	(0.026)
Average LYL		-0.001	-0.272		-0.027	-0.338
		(0.132)	(0.234)		(0.169)	(0.301)
State FE	NO	NO	YES	NO	NO	YES
Observations	502	502	502	502	502	502
Control mean	2.7	2.7	2.7	2.57	2.57	2.57
	Panel B: India					
HPC	0.123**	0.126**	0.075	0.265***	0.267***	0.229**
	(0.053)	(0.052)	(0.053)	(0.098)	(0.097)	(0.100)
Worried about AP		-0.014	0.012		0.014	0.043
		(0.018)	(0.019)		(0.034)	(0.037)
Average LYL		-0.017*	-0.095*		-0.061***	-0.161
		(0.010)	(0.053)		(0.019)	(0.100)
State FE	NO	NO	YES	NO	NO	YES
Observations	494	494	489	494	494	489
Control mean	2.82	2.82	2.82	2.97	2.97	2.97

Note: Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

Information Avoidance

Table A-3: Estimated effects on information acquisition.

	OLS			Logistic		
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: USA					
HPC	-0.012	-0.013	-0.013	-0.012	-0.014	-0.021
	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.027)
Worried about AP		0.027***	0.028***			
		(0.005)	(0.005)			
Average LYL		-0.066**	-0.075			
		(0.029)	(0.049)			
State FE	NO	NO	YES	NO	NO	YES
Observations	2,272	2,272	2,272	2,272	2,272	2,272
Control mean	.84	.84	.84	.84	.84	.84
	Panel B: India					
HPC	-0.003	-0.004	-0.002	-0.003	-0.004	-0.007
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.028)
Worried about AP		0.017***	0.016***			
		(0.004)	(0.004)			
Average LYL		0.004*	0.003			
		(0.002)	(0.012)			
State FE	NO	NO	YES	NO	NO	YES
Observations	2,036	2,036	2,033	2,036	2,036	1,985
Control mean	.92	.92	.92	.92	.92	.92

Note: Results of the logistic models are marginal effects. We use a conditional logit model for the fixed effect model in column 6. Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

Use of Defensive Measures

Table A-4: Estimated effects on the stated use of defensive measures: index.

	Index		
	(1)	(2)	(3)
		Panel A: USA	
HPC	0.100**	0.098***	0.087**
	(0.039)	(0.037)	(0.038)
Worried about AP		0.080***	0.077***
		(0.011)	(0.011)
Average LYL		0.112	-0.196
		(0.075)	(0.132)
State FE	NO	NO	YES
Observations	502	502	502
Control mean	0	0	0
		Panel B: India	
HPC	0.075*	0.069*	0.041
	(0.040)	(0.039)	(0.041)
Worried about AP		0.044***	0.042***
		(0.014)	(0.015)
Average LYL		0.014*	0.048
		(0.008)	(0.041)
State FE	NO	NO	YES
Observations	494	494	489
Control mean	0	0	0

Note: Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.

Table A-5: Estimated effects on the stated adoption of defensive measures: components.

	Mask	AP	Med check	Commute	Ventilate	Dust remove	Nature	Waste burn	Fires
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Panel A: USA				
HPC	0.089	0.120	0.198**	0.298***	0.094	0.091	0.098	0.020	0.068
	(0.123)	(0.135)	(0.100)	(0.114)	(0.104)	(0.084)	(0.092)	(0.072)	(0.083)
Obs	501	501	501	501	501	501	501	501	501
C mean	2.8	2.48	2.14	2.26	3.51	3.28	3.4	4.59	4.03
					Panel B: India				
HPC	0.116	0.065	0.093	0.222**	0.128	0.096	0.109	-0.051	-0.100
	(0.111)	(0.132)	(0.119)	(0.108)	(0.087)	(0.079)	(0.090)	(0.114)	(0.131)
Obs	494	494	494	494	494	494	494	494	494
C mean	3.8	2.71	2.99	3.44	4.38	4.3	4.02	3.68	2.83

Note: All models include controls and NO state fixed effects. Significance is denoted as follows: *** p<0.01, ** p<0.05, and * p<0.1.