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Barriers to Civic Action for Air Pollution

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Abstract:	What prevents citizens from demanding better environmental quality? When might individuals who privately value clean air be unwilling or unable to communicate that value to policymakers? To answer these questions, we propose a survey experiment in Delhi to: (1) Measure demand for indoor and ambient clean air and (2) Test for information asymmetries that limit respondents' expressions of these demands. We provide revealed preference measurements for indoor air quality improvements, ambient air quality enhancements, and willingness to engage in environmental advocacy. We test three information treatments: indoor and ambient PM2.5 levels and standards with health and well-being impacts of pollution, successful global and local policies in tackling air pollution, and a combination of both. Our findings will highlight barriers to fostering public demand for clean air in large cities in developing countries.
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Contents

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Abstract

What prevents citizens from demanding better environmental quality? When might individuals who privately value clean air be unwilling or unable to communicate that value to policymakers? To answer these questions, we propose a survey experiment in Delhi to: (1) Measure demand for indoor and ambient clean air and (2) Test for information asymmetries that limit respondents' expressions of these demands. We provide revealed preference measurements for indoor air quality improvements, ambient air quality enhancements, and willingness to engage in environmental advocacy. We test three information treatments: indoor and ambient PM2.5 levels and standards with health and well-being impacts of pollution, successful global and local policies in tackling air pollution, and a combination of both. Our findings will highlight barriers to fostering public demand for clean air in large cities in developing countries.

Keywords: Air pollution, Collective Action, Willingness to pay, Public Goods, India

JEL codes: D12, I15, O13, O18, Q52, Q53

Study pre-registration: AEARCTR-0012818

Proposed timeline *(required)*

We are planning to collect data in the Delhi metropolitan area. Our data collection activities in Delhi will last from January 24 2025 to February 28 2025. We expect to have results from this exercise by July 2025.

1 Introduction

Air pollution levels in large cities in India and other parts of South and South East Asia are among the highest in the world (IQAir World Air Quality Report 2021) and were responsible for 1.67 million

deaths in 2019 (India State-Level Disease Burden Initiative). Despite the substantial health costs, air pollution remains a relatively low policy priority for policymakers (Mookherjee 2022). This study focuses on understanding the barriers to public demand for action on improving air quality in India. Existing work shows that willingness-to-pay (WTP) for clean air exists even in low- and middle-income settings (Ito & Zhang, 2020; Baylis et al., 2023; Chowdhury et al, 2024), but that it does not always lead to effective policy change despite its substantial health effects (Ebenstein et al., 2017). In principle, public provision of an environmental good like air quality should reflect underlying private demand for its provision. In practice, both informational and governance failures could impede the process by which individual preferences are reflected in public policy (Greenstone and Jack, 2014). However, we are not aware of any work which either a) quantifies both, demand for private air purification and demand for public policies that improve ambient air quality in the same sample or b) tests for whether each of these is limited by informational or governance failures.

Our study aims to make progress on both fronts. Specifically, we plan to address two key research questions: (1) Among the same sample, how much do individuals value indoor (i.e., "private") improvements in air quality vis-a-vis ambient (i.e., "public") improvements in air quality? and (2) How do information interventions, targeting knowledge gaps on impacts on health and welfare, and governance interventions, focusing on trust in the state's ability to improve air quality, affect private and public demand? In particular, we test whether informational interventions, which naturally target private demand (e.g., willingness to pay for air purifiers), and governance interventions, which likely focus on public demand (e.g., trust in government policies), influence private and public demand differently—either separately or in combination. By comparing these demands in the same sample, we directly test how these failures might impact the alignment between private and public preferences.

We specify two sets of hypotheses related to private WTP and public demand measures, following our main outcomes and treatments.

Our first set of hypotheses examines how information influences private WTP for indoor air quality improvements. Specifically, we test whether individuals provided with information about air quality levels relative to established standards and the associated health consequences exhibit higher private WTP for indoor air quality improvements. A positive effect would align with research highlighting the importance of information in shaping private demand for clean air (Baylis et al., 2023; Chowdhury et al., 2024). Conversely, a null effect would suggest that respondents already perceive themselves as adequately informed about their indoor air quality and its health risks. We also investigate whether information on state capacity to address air pollution through policies affects private WTP. The null hypothesis posits that such information will not influence private WTP since it primarily targets public action beliefs. However, a positive effect would indicate that trust in government capacity complements private investment. Finally, we test whether combining health information with state efficacy information amplifies private WTP, providing insight into the interplay between these informational interventions.

Our second set of hypotheses explores how information affects public demand for ambient air quality improvements and willingness to participate in civic engagement. We test whether individuals provided with information about air quality standards, health impacts, and wellbeing exhibit greater public demand (revealed and stated) and engagement in environmental advocacy including measures such as willingness to donate to air quality initiatives or sign a petition to the local government. While direct evidence on this is limited, we hypothesize that such information could positively influence public priorities. Additionally, we examine whether information about state capacity to address air pollution increases public demand and engagement. A positive effect would imply that belief gaps about government effectiveness hinder the expression of public demand for clean air, while a null effect might indicate that respondents' priors about government efficacy remain unchanged. Finally,

we assess whether the combined effect of health and well-being information and state efficacy information enhances public demand and engagement, indicating that both types of information address complementary barriers to public action.

By answering these questions, we aim to identify the relationship between public and private demand for clean air and test whether information interventions that address potential barriers can move the relationship between the two.

An important element of the design of the information and governance interventions is that they are, as we describe above, "locally relevant." By this, we mean that in the sample setting we consider, we partner with a local NGO to ensure the treatment conditions reflect best practices--as understood by local experts--for encouraging respondents to attend and be responsive to air quality issues in their homes and communities.

Existing research has demonstrated that public engagement can improve governance in addressing civic issues like air pollution. For instance, a nationwide field experiment in China demonstrated that public appeals by citizens led to a reduction of more than 60% in violations of standards by firms, as well as a decrease in air and water pollution (SO2 and COD) concentrations by 12.2% and 3.7%, respectively (Zheng et al., 2014; Buntaine et al., 2024a; Buntaine et al., 2024b). However, public reports of violations are often varied by researchers rather than triggered by citizens (Buntaine et al., 2024b), begging the important question of what generates citizen demand for public action. In reality, explicit demand for public action to tackle environmental degradation remains low (Singh and Thachil, 2024, Page and Ruebeck 2024). Additionally, information on pollution levels alone may not facilitate citizen participation (Buntaine, Zhang, and Hunnicutt 2021; Page, Ruebeck, and Walsh, 2023; Dechezleprêtre et al,. 2022). In addition to information on pollution levels and health effects, we will test whether showcasing successful policies and current action plans can overcome fatalism about government capacity and increase willingness to engage in environmental advocacy (Page, Ruebeck, and Walsh, 2023; Dechezleprêtre et al., 2022).

This study makes two contributions to the literature on private and public demands for air quality. First, we establish new measures to reveal demand for policies that deliver improvements in community air quality and test how private demand for air quality relates to public demand for clean air. Second, our treatment interventions, which intuitively target either private or public demand, allow us to examine how each type of intervention influences both forms of demand separately and whether their combined effect differs from their individual impacts. Furthermore, most studies in developing country contexts look at outcomes on behaviour and not beliefs (Kremer, Rao, and Schilbach, 2019), furthering the importance of our contribution on measuring beliefs on climate policies in the Indian context. Last, our study contributes to the broad literature on the power of information in moving policy atittudes (Haaland, Roth, and Wohlfart, 2023)[1].

2 Research Design

Overview

Our research design will be conducted through a door-to-door survey experiment in apartment complexes. Figure 1 provides an overview of the survey experiment. The survey will collect basic demographic information, prior pollution avoidance behavior and beliefs about government effectiveness, and health information. We will then randomize respondents into the treatment groups, measure outcomes, and complete the survey with tests for survey effects and attention. We plan to

[1] Additionally, our paper also relates to the literature on how information can be a powerful tool in moving outcomes on political engagement and preferences, for example, Baysan (2022).

follow up at the end of pollution season (around 2 months later) to test for persistent effects. We discuss key outcomes, treatment groups, hypotheses, and sampling in the remaining sections below.

Figure 1. Survey Experiment Overview

<table>
<tr><td></td><td colspan="4">Survey Experiment: Doorstep recruitment</td></tr>
<tr><td></td><td colspan="3">Treatment Groups</td><td>Control</td></tr>
<tr><td>1</td><td colspan="4">Demographics, Pollution Avoidance, Prior Beliefs, Characteristics</td></tr>
<tr><td>2</td><td>1:
Actual PM2.5 and standards
+ Health and Wellbeing effects</td><td>2:
Global and Local Policy success in Tackling Air Pollution</td><td>3:
Both</td><td>Placebo information</td></tr>
<tr><td>3</td><td colspan="4">Private WTP, Public demand, environmental advocacy actions, policy beliefs and preferences, posterior beliefs</td></tr>
<tr><td>4</td><td colspan="4">Survey effects, Attention measure</td></tr>
<tr><td>5</td><td colspan="4">[2 months]</td></tr>
<tr><td>6</td><td colspan="4">Short Follow-up to measure persistence: Private WTP, Public demand, environmental advocacy actions, policy beliefs and preferences, posterior beliefs, awareness</td></tr>
</table>

Outcomes

The main outcomes of the experiment are[2]:

1) <u>(Private Demand) Willingness to pay for indoor air quality (revealed):</u>
    a) WTP for measures that improve indoor air using a BDM module for air purifiers (Chowdhury et al., 2024)
2) <u>(Public Demand) Willingness to pay for outdoor air quality (stated and revealed):</u>
    a) stated WTP for a green tax for policies that minimize particulate emissions through clean energy transitions, electric public transport, incentivizing farmers to stop burning stubble (Jack et al., 2022) etc.
    b) willingness to donate part or all of the survey incentive to an NGO working towards improvements in ambient air quality (for example, by providing clean cookstoves to a neighboring slum).
3) <u>(Civic Engagement) Willingness to participate in environmental advocacy actions both, stated and revealed:</u>
    a) Willingness to sign a petition urging the local government to instate immediate actions to improve conditions of waste-pickers who contribute to garbage segregation which in turn reduces air pollution
    b) willingness to share a social media post about the same petition mentioned above
    c) willingness to join a WhatsApp group or messaging list where they can continue to receive more information aligned with their treatment arm.
    d) Intensity of motivation to educate others on air pollution issues
4) <u>Policy beliefs and governance preferences:</u>
    a) Preferences for hypothetical politicians based on the importance attributed to air pollution in their manifestos (vignettes)
    b) ranking of policy importance for air pollution relative to different issues
    c) preferences on private actions that can improve air quality (like garbage segregation, use of public transport, odd-even parking)

[2] Our draft survey instrument is included in Appendix B. Note that this survey instrument is a work in progress and is subject to changes based on inputs from our local partners.

d) Fatalism about government action

We will also conduct an incentivized post-intervention quiz relevant to the treatment assignment to ensure participants have an incentive to be attentive to the treatment. We will report a summary statistics on quiz performance across the treatment groups.

Other descriptive measures collected in the survey that allow us to test important heterogeneities as well as pick up any potential surveying effects are:

1) Current pollution exposure and avoidance behavior: Commuting, nature of work (outdoor/indoor), responses to high pollution days
2) Prior beliefs on government effectiveness
3) Prior beliefs on health effects
4) Altruism, Reciprocity, Environmentalism, Social Desirability
5) Questions to detect survey effects and ensure data quality
    a) Are respondents more likely to report bad health unrelated to air pollution?
    b) Are respondents' policy preferences on non-air pollution-related issues affected?
    c) Attention

We will ask treatment respondents if they want to join a WhatsApp group to continue receiving updates on the air pollution levels and policy progress. The information intervention will continue through weekly digital communication for 2 more months for those who choose to join our WhatsApp groups, after which, we will conduct a short follow-up survey with our respondents to measure medium-term persistence in effects on respondents' beliefs and actions. Through this period, we will track which people have stayed in the group and whether they have been reading any messages. We will report both intent to treat and treatment on the treated outcomes for the treatment groups using follow-up data to account for the selection of those who choose to sign up for the WhatsApp updates. The follow-up survey will include outcome measure questions from our original survey.

Treatments

Figure 2.

	No Policy Success and Current Plans Info	Policy Success and Current Plans Info
No AQI and Health Info	Control Group	$Treat2_i$
AQI and Health Info	$Treat1_i$	$Treat1_i \times Treat2_i$

We provide the following randomized treatments in the survey:

1) **PM2.5 + Health and Well-being Information Intervention ("Info")**: Respondents in the Info group will receive information about air quality standards (in terms of PM2.5) and the comparison of current levels (today's outdoor PM2.5 and a real time measure of indoor PM2.5) to WHO standards (see Figure 3 for deviations from standards in two cities in India - Delhi and Mumbai), details on the serious health impacts of air pollution (on children and adults) beyond common symptoms like coughing and burning eyes and the monetary burden

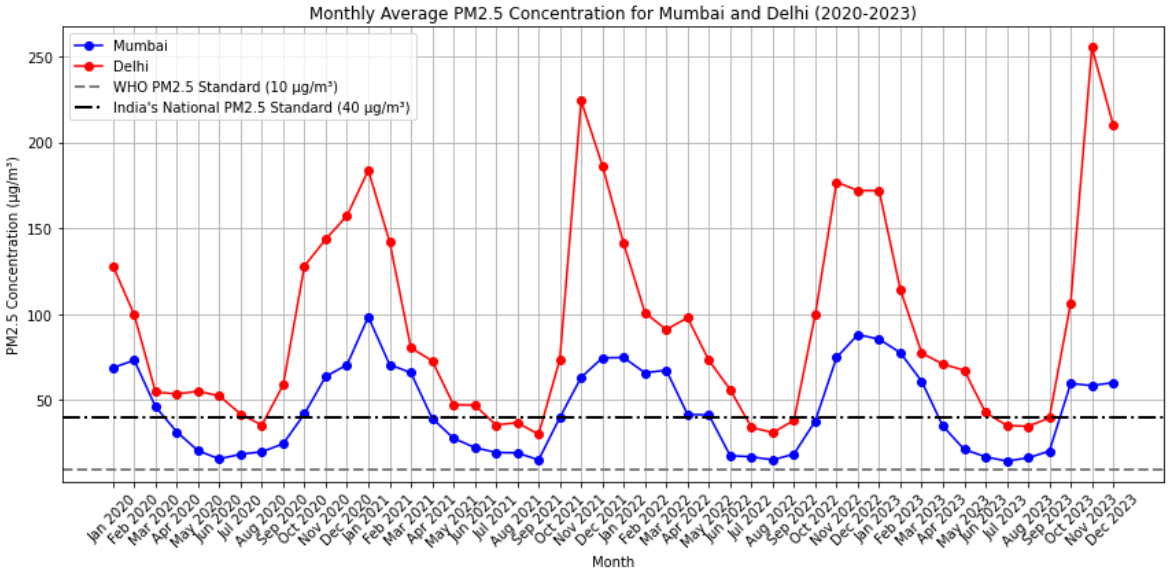
of air pollution in terms of income lost[3]. The idea of this treatment group is to highlight the adverse impacts of air pollution that may be personally relevant to the respondents' health and well-being. This will allow us to test whether merely providing information on the gravity of the problem is sufficient to influence the respondents' private and public demand, and civic engagement.

2) **State Effectiveness Intervention ("State")**: Respondents in the State group will receive information that emphasizes how the components of air pollution are largely a result of human activity that can be regulated with policies. It goes on to give examples on past successful policies and ongoing government actions to reduce air pollution to help people understand that effective governance can address air pollution. This messaging does not include anything on how harmful air pollution is, but more on how it can be resolved with policy interventions. This will allow us to test whether solely providing information to address faith in the government's ability to address the issue can influence private and public demand, and civic engagement.

3) **Combined Intervention (Info and State)**: A third treatment group will receive both the Info and State Treatments described above to address information gaps on the gravity of the negative impacts of air pollution on health and well-being as well as the ability of government policies to address them. This allows us to test for complementarities in both forms of messaging by comparing the effect of the combined arm to each individual arm.

4) **Control**: Control respondents will be treated with the provision of information about global climate change that takes a similar amount of time as receiving the Info treatment above.

Figure 3.



In order to enhance the effectiveness of our information treatment, we nudge and incentivize attention to ensure that respondents are not only exposed to important information but also actively engage

[3] This content has been designed in consultation with Chintan - a leading NGO working on solid waste management and air pollution issues that has been involved in the design and implementation of air pollution related public campaigns. They specifically highlighted that respondents are most responsive to information related to children and loss of income since these are (1) lesser known, and (2) strike a chord with this population.

with it (as recommended in Haaland, Roth, and Wolfhart, 2023). At the start of the intervention part of the survey, enumerators encourage participants to focus their attention on the critical information they are about to provide. This is complemented by a financial incentive tied to correctly answering a quiz question based on the content of the treatment intervention.

Our approach is grounded in established research demonstrating the effectiveness of information-based interventions in shaping beliefs and behaviors. For instance, Singh and Thachill (2023)'s research in New Delhi shows that personalizing the costs of air pollution through information on indoor AQI increases the electoral salience of air pollution issues. This finding is aligned with our first treatment arm, which provides information on the health and well-being consequences of pollution in addition to current and standard PM2.5 values for indoor and outdoor air. Our second and third treatment arm will allow us to comment on the additive effect of information on trust in state effectiveness for air-pollution.

Several papers have relied on information in survey experiments as a way to elicit meaningful variation to study changes in actions and beliefs (see Haaland, Roth, and Wolfhart, 2023 for a review). Specific to climate policies and advocacy, Dechezleprêtre et al., 2022 use short educational videos to examine the effects of different types of information, including those documenting the impacts of climate change and the policy mechanisms that can mitigate these effects. They find that while information about the impacts of climate change influences privately costly outcomes, such as donations, support for climate policies increases when the videos focus on specific policy mechanisms for mitigation. Additionally, Page, Ruebeck, and Walsh, 2023 demonstrate that while information influencing people's beliefs about policy efficacy in a non-climate context does not impact climate advocacy, pairing this information with a fictional video about a citizen organizing a climate march following their dog's death from heat stroke leads to increased effects on both beliefs regarding government efficacy and engagement in climate advocacy. Tallent, Jan, and Sattelmayer, 2024 show that low-touch variations in survey experiments like pairing climate policies with hypothetical, symbolic policies that tax carbon-emitting actions of the rich improve support for climate-oriented policies that impose private costs. These studies collectively provide a strong basis that effectively communicated information on impacts of climate policies as well as on mitigation policies can be powerful in altering both stated and revealed preferences and advocacy actions regarding climate-related issues.

Hypotheses and Inference

Our empirical strategy will examine the effects of the Info and State treatments and their combination on the key outcomes. The basic form of the statistical models we will estimate is as follows:

$$Y_i = \alpha + \beta_1 Info_i + \beta_2 State_i + \beta_3 Info_i \times State_i + \delta X_i + \epsilon_i$$

Where:

- Y_i: Outcome of interest (e.g., WTP for indoor or ambient air quality)
- $Info_i, State_i$: Indicators for Information and State treatments
- X_i: Control variables (e.g., baseline characteristics, demographic variables)
- ϵ_i: Error term

The model will estimate treatment effects, β_1, β_2, β_3, on different outcome measures.

With three treatment indicators and four outcomes, we have--in principle--12 distinct single coefficient hypothesis tests to conduct. In the analysis section below, we discuss the multiple

hypotheses testing approach we'll use. Here, we'll highlight the key hypotheses tested by the basic models above for private WTP (outcome #1) and for the public demand outcomes (#2, #3, #4).

Private WTP

Hypothesis 1.1: $\beta_1 > 0$ would indicate that the average respondent increases their demand for indoor (private) air quality when treated with information about air pollution levels and the health effects of bad air quality. A nonzero coefficient here would suggest that the treatment either changes beliefs about air pollution or makes the problem of air quality more salient. To help disentangle these possibilities, we plan to leverage measurements of prior beliefs and education about air pollution and to examine whether the changes are persistent through the endline survey.

Hypothesis 1.2: $\beta_2 \neq 0$ would indicate that receiving information about state efficacy affects demand for indoor (private) air quality. A positive sign suggests crowd-in effects, where respondents who believe the government will take action also increase their private investments. A negative sign suggests crowd-out effects, where respondents reduce their private investments due to increased confidence in government intervention. A null effect would suggest that private and public demand decisions are separable.

Hypothesis 1.3: $\beta_3 \neq 0$ would indicate that receiving both governance information (state efficacy) and private information (health effects of air pollution) influences demand for indoor (private) air quality. A positive sign suggests that the combination of treatments reinforces demand for private air quality improvements, leading to a stronger crowd-in effect than governance or health information alone. A negative sign would suggest that combining the two types of information increases confidence in government action to the extent that individuals reduce private investments more than when receiving governance information alone. A null effect would indicate that providing both types of information together does not generate additional changes in private demand beyond their individual effects.

Public Demand

Hypothesis 2.1: $\beta_1 > 0$ for the public demand for outdoor air quality or related metrics (e.g., willingness to donate to an air quality NGO or sign a petition) would be consistent with an increase in demand for air quality. A null effect for this combined with a positive effect for β_1 on private WTP above would indicate that respondents don't believe government action is likely to substantially change air quality.

Hypothesis 2.2: $\beta_2 > 0$ would indicate that existing beliefs about state efficacy limit the expression of demand for public demand and advocacy. A null effect here could either indicate that respondents' priors were not altered by the treatment (testable using the baseline data) or that beliefs about state efficacy are not the limiting factor in the expression of demand for air quality.

Hypothesis 2.3: $\beta_3 > 0$ would indicate complementary effects of information about air quality and state efficacy. An estimate here suggests that both informational limitations and beliefs about the limited effectiveness of regulators hamper advocacy for state action.

Inference from comparing coefficients

The coefficients estimated in our statistical model allow us to test individual hypotheses and derive insights into how information treatments affect private and public willingness to pay (WTP) for clean air.

Private WTP

$\beta_3 > \beta_1 \geq 0$: This indicates that individuals are more likely to increase their private demand for clean air only when provided with both health information and evidence of government action. It implies that neither health awareness nor trust in state efficacy alone is sufficient to motivate private investments. Instead, the combined effect of recognizing personal stakes and trust in the government's action is necessary.

$\beta_1 > \beta_2$: A higher coefficient for health information compared to state efficacy suggests that individuals are motivated more by personal stakes like health risks and loss of income than by an intrinsic response on private actions to complement the government's investment in public solutions.

$\beta_3 > \beta_1 + \beta_2$: If the interaction term exceeds the sum of the individual effects, it signals that the combination of health and state efficacy information has a synergistic effect, significantly increasing private WTP. This finding would emphasize the need for integrated messaging to maximize impact on private investments.

Public Demand

$\beta_3 > \beta_1 \geq 0$: When combined information has a stronger effect than health information alone, it indicates that public demand is not merely a function of personal stakes but also requires trust in the government's ability to implement solutions. This result suggests that information on health and well-being impacts may raise awareness, but without a credible pathway for government action, individuals may not fully translate increased valuation into public demand.

$\beta_3 > \beta_2 \geq 0$:If combined information about health impacts and government action has a larger effect than state efficacy information alone, it suggests that trust in government effectiveness alone is insufficient to drive public demand. Instead, public demand increases only when individuals are also made aware of the health risks of air pollution.

$\beta_2 > \beta_1$: A higher effect of state efficacy information compared to health information suggests that public demand depends more on beliefs about the government's ability to address pollution than on personal health stakes. This may reflect a collective-action mindset, where individuals value public measures but remain skeptical of their feasibility.

$\beta_3 = \beta_2 > 0$: If the combined treatment does not surpass the effect of state efficacy information, it implies that addressing beliefs about government effectiveness alone is sufficient to increase public demand. This may be because respondents are already well-aware of the negative effects of air pollution on their health and well-being. This scenario highlights the importance of reducing skepticism about public interventions.

Heterogeneities and their expected effects on coefficients

To capture heterogeneous effects, we will extend the base model to include interaction terms and separate controls for the heterogeneous factors:

$$Y_i = \alpha + \beta_1 Info_i + \beta_2 State_i + \beta_3 Info_i \times State_i + \gamma Z_i + \phi_1 (Info_i \times Z_i)$$

$$+\phi_2 (State_i \times Z_i) + \phi_3 (Info_i \times State_i \times Z_i) + \delta X_i + \epsilon_i$$

Where:

- Z_i: Represents the heterogeneous factors

The interaction terms (ϕ_1, ϕ_2, ϕ_3) will allow us to estimate how the treatment effects differ based on these heterogeneous factors.

Current Pollution Exposure and Avoidance Behavior

Individuals exposed to high pollution levels, such as outdoor workers or commuters, are likely to have heightened sensitivity to health information, leading to a strong ϕ_1. This group may perceive the issue as urgent, driving higher private WTP when exposed to health information. However, their public demand (ϕ_2) may be constrained by skepticism about the government's ability to address systemic pollution. If both health and state efficacy information are provided (ϕ_3), individuals with direct pollution exposure may respond strongly due to the combined salience of personal health impacts and evidence of actionable public solutions. Comparatively, high levels of avoidance behaviors (e.g., current use of air purifiers) might diminish ϕ_1 and ϕ_3, as these individuals may feel less compelled to engage in public advocacy or invest in additional private measures.

Prior Beliefs on Government Effectiveness

Respondents with high initial trust in government effectiveness may exhibit muted responses to the state efficacy information ($\phi_2 \approx 0$), as their public demand is already high. In contrast, individuals with strong skepticism may exhibit little response to ϕ_1 in isolation but show substantial increases with information on government effectiveness($\phi_2 > 0$) or combined information ($\phi_3 > \phi_1, \phi_3 >= \phi_2$). This is because the combination reinforces both the severity of the issue and the credibility of government action. Moderate skeptics may drive the strongest relative effects for ϕ_3, as this group is more persuadable by incremental information on government action when paired with health salience.

Prior Beliefs on Health Effects

Individuals who are already well-informed about the health impacts of air pollution may show limited changes in ϕ_1, as the information confirms their existing beliefs. However, they may still exhibit increases in ϕ_2 and ϕ_3 if the intervention shifts their perception of government capacity to address pollution. By contrast, respondents with limited prior awareness of health impacts may show strong increases in ϕ_1, with $\phi_3 > \phi_2 > \phi_1$, as the combined intervention addresses both informational and trust-in-state gaps. These differences suggest that the marginal utility of each treatment depends on baseline knowledge.

Altruism, Reciprocity, Environmentalism, and Social Desirability

High levels of altruism or environmentalism are likely to amplify public demand (ϕ_2) and the effects of state efficacy information. For such individuals, ϕ_3 might approximate or slightly exceed ϕ_2, reflecting the additive nature of combined interventions. Conversely, individuals motivated by social desirability may show inflated responses across all coefficients, but their engagement may be short-lived or context-dependent. Low altruism or environmentalism may limit responses to public demand and advocacy (ϕ_2,ϕ_3) even if private WTP (ϕ_1) increases, resulting in ϕ_3 being dominated by ϕ_1. Reciprocity, driven by direct experiences of government support or community action, could similarly heighten public engagement (ϕ_2,ϕ_3).

Daily AQI Level

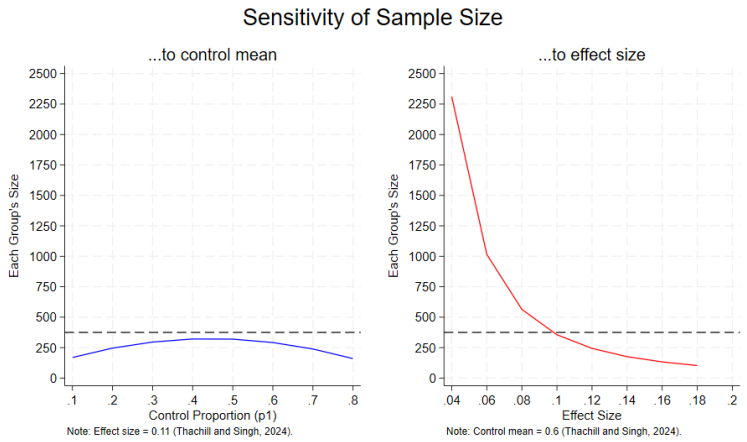
We will randomize in the field ensuring stratification by day which will generate variation across treatment groups on any given day. We will measure if treatment effects vary with the daily AQI (or PM2.5) level by comparing relatively better days with relatively worse days using above and below median AQI during the survey period. We expect that all treatment effects will be further intensified on days with higher AQI's as salience of air pollution will be much greater on those days. We especially expect this for β_1(and ϕ_1) since these arms will get specific numbers on AQI levels and comparisons. However, if people's experience of air pollution is a good indicator of their estimate on AQI levels, then this information may not have additive value.

Sample and Statistical Power

We use Singh and Thachill (2024)'s findings to run power calculations since their recruitment strategy and context are similar to ours. Singh and Thachill (2024) conducted a survey experiment where they embedded different question-framing experiments and also varied the timing of providing AQI values. Figure 4. visualizes the sensitivity of required group size to differences in the control mean (holding the effect size constant) and to differences in the effect size (holding the control mean constant).

60% of their control group supports increased taxation but when the tax is labeled for air pollution resolution, the treatment group's support increases by 11 percentage points. We would need a sample of 300 respondents in each group to pick up an effect of this magnitude between any two groups, requiring a sample size of 1200 respondents in total. A similar sample size would be required to pick up an effect of 15 percentage points on stating air pollution as the most important policy priority for the next round of elections. Based on estimates of survey efficiency from 3 days of field trials, we are aiming to survey 1500 respondents in total divided into our 4 treatment groups (375 in each represented by the dotted line in Figure 4) allowing us to pick up an MDE of 0.1 percentage points of support for increased taxation.

Figure 4.



Our partner NGO have experience in managing large-scale campaigns and have conducted either outreach programs or surveys or both to reach several 1000s of residents. We are confident in their

ability to help us achieve the sample size we need to statistically detect effects on changing beliefs and perceptions.

Our survey will cover a selected sample of those who consent to participate within different neighbourhoods. We employed a multi-pronged approach to identify areas suitable for conducting door-to-door household surveys. Our partner organization recommended several neighborhoods and we began by scoping these areas first. In addition, based on their prior experience conducting surveys in Delhi, our field team suggested other potential areas. Our goal was to cover neighborhoods across all directions of Delhi—north, south, east, and west. After shortlisting potential areas, the field monitor visited these locations for on-ground scoping. Our survey is conducted in both - gated communities where we received permission from RWA representatives, as well as in standalone residential neighbourhoods. Once we identify an area with the potential for decent resident participation, we will create teams of 4–6 surveyors, each led by one supervisor. Each supervisor is assigned specific blocks or lanes to ensure proper coordination and avoid any overlap.

Within a block, surveyors approach houses on the left side of the lane first and then move to the right side, skipping the house directly opposite the one they attempt on the left. In multi-storied apartment buildings, they attempt one flat per floor, alternating directions for each subsequent floor.

If a household member consents to participate in the survey, the surveyor requests the participation of the main decision-maker of the household who is present at the time. The survey team receives strict instructions to interview consenting adults only. In cases where households decline to participate, surveyors fill out a survey tracking form. The data collected in this form includes: Locality, complex name, and number, Geospatial coordinates, Name of the person (only if they agree to provide it), Reason for refusal, and Appointment date and time (if applicable).

Data

Data will be collected via a door-to-door survey experiment across different neighborhoods and types of residential communities. Pilot data collected during an earlier phase of the project using a mobile application helped us refine the recruitment and engagement strategy. Based on this, we transitioned to a door-to-door survey model, which promises better engagement and participation than a purely digital approach.

We will use structured survey questionnaires for the main component of data collection. We will ask if respondents are willing to join a WhatsApp group during the survey experiment. Once this is completed, depending on how many participants share their phone number with us and how much interest is generated to be part of a WhatsApp group we form, we will supplement with weekly digital communications via WhatsApp groups or SMSs to provide information on air quality. Data collection will conclude after reaching a sample of 1500 respondents or when time and funding constraints require it. The survey is expected to take around one month and the follow-up survey post-intervention will occur 2 months later.

We anticipate challenges such as not getting enough people to consent to the survey and attrition in the middle of the survey. To address this, we are working with a trusted NGO in Delhi that has completed door-to-door surveys in the past and will help us design a script to approach respondents and maximize consent approvals. We will offer financial incentives for survey completion to reduce the likelihood of attrition. We will hire experienced enumerators with good english-speaking skills who clarify the research focus of this endeavour so they are perceived as implementers of a research

project rather than as sales representatives. This approach aims to improve the likelihood of respondents' willingness to participate in the survey.

The survey timeline is as follows:

- Survey Experiment: January 25, 2025- February 28, 2025
- Continued Whatsapp engagement: March 2025 - April 2025
- Follow-up Survey: May 2025

3 Analytical Methods and Procedures

Our primary goal is to establish causal claims on how information interventions address health and well-being effects of air pollution and government effectiveness in resolving air pollution issues influence private and public demand for clean air. The underlying assumptions for these methods are random assignment and exogeneity of treatment assignment, ensuring comparability across treatment and control groups. Randomization will be at the individual level be stratified by day and neighborhood of the survey to maintain spatial and temporal uniformity across groups. We will use robust standard errors.

The key statistical methods to be employed are:

- Ordinary Least Squares (OLS) regression will be used to estimate treatment effects on outcome variables such as WTP values.
- Rank-ordered Logistic Regression will be applied to analyzing ranked data, such as policy preferences and WTP rank ordering of respondents between private and public air quality improvements.

Missing Values: Missing values may occur if a respondent refuses an answer. However, our questions are unlikely to address sensitive topics like income or politics, minimizing the chances of refusals. Missing values are expected primarily in follow-up survey data. If our main outcomes have several missing values, we will test whether missing reports are balanced between treatment and control. We will test whether our results remain unchanged between running the specification with missing values and with imputed missing values plus a fixed effect for imputation. If we find systematic missingness on key outcomes, we will use Lee bounds to estimate a range for the estimated effect size.

Outliers: Outliers will be defined as values that are above the 99th percentile of the outcome distribution in each city. We will analyze whether these outliers are genuine variations or if they result from data errors. If they represent data errors, we will winsorize these values to the 99th percentile. If they are genuine responses, we will keep them and conduct robustness checks using log-linear regressions, median regression, and the Approximate Maximum Influence Perturbation method (Broderick, Giordano, and Meager, 2023) to ensure our results are not influenced by extreme values.

Multiple Outcome and Multiple Hypothesis Testing

Given the study involves testing multiple hypotheses, we will adjust for false positives using the False Discovery Rate (FDR) approach to ensure robust inference across multiple tests.

Aggregation of Variables: Public demand, civic engagement, and policy beliefs are measured in multiple outcomes. For public demand, an index will be created by standardizing individual components (stated demand and revealed demand from donation quantity), averaging them, and applying multiple hypothesis testing (MHT) adjustments only at the index level... For civic engagement, we will look at the number of engagement actions that the respondent is willing to take using dummy variables for signing a petition, donating to NGOs, and joining our whatsapp group. We will use a Poisson regression for this outcome that counts the number of actions. The policy beliefs and preferences outcomes vary in nature, including rankings, voting choices, opinion intensities, and likelihoods of specific actions. We will convert all variables into meaningful, directionally consistent dummy variables, standardize them, and aggregate them as an unweighted average to create an index reflecting greater willingness to take action and engage with air pollution issues. Our survey will also combine questions to generate a fatalism index and pollution as a political priority index using responses to questions on the beliefs of the respondents.

4 Contributing to Development Economics

These findings contribute to the development economics literature by providing insights into how information interventions can overcome barriers to public good provision in developing countries. Specifically, our study will add to the limited understanding of how private and public preferences for clean air can be aligned. It also helps to identify effective strategies for converting private awareness into public action, advancing the field's understanding of environmental governance and collective action.

Our findings may challenge the existing narrative that willingness to pay for environmental improvements in low-income settings is low, showing instead that informational and motivational barriers, rather than low demand, explain the limited public action. Additionally, the identification of heterogeneities—based on the initial perception of government effectiveness, behavioral tendencies, and environmental circumstances—enriches our understanding of which conditions make populations most responsive to environmental initiatives.

5 Policy Implications

The Indian government launched the National Clean Air Program (NCAP) in 2019 which mandates cities to reduce outdoor concentrations of harmful particulate matter. Cities are focusing on policies like restricting older vehicles, expanding electric mobility, improving public transportation, managing solid waste, controlling construction dust, and enforcing cleaner industrial practices, however, significant enforcement gaps remain. We will work with our partner organization[4] to classify policies that are relevant for Delhi and incorporate them in our questions on willingness to participate/pay. Our partner organizations are invested in this survey since such data will enable them to generate policy briefs that can be presented to the relevant local/state bodies.

As part of the NCAP, cities have implemented or planned policies that require citizen cooperation. These include information and response portals like apps and websites where citizens can report violations; waste management policies on garbage segregation within households to reduce incineration emissions; and transport policies like expanding electric mobility, vehicle emission standards, phasing out older vehicles, and promoting public transport. Several cities have struggled in the implementation of these policies due to inconsistent public cooperation. Our partner organization in Delhi has a history of working closely with local and state governments on pollution

[4] We are currently in the process of signing an MoU with them.

issues and are committed to generating evidence that can address crucial policy decisions by presenting findings on citizen perceptions and preferences.

Disclosure

During the preparation of this work the author(s) used ChatGPT4.0 in order to improve clarity in language and to format references. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Appendices

Appendix A: Conceptual Model

In this section we present a stylized model that allows us to characterize the optimization problem of civic agents in our setting.

Utility Function

Let individuals derive utility from expected air quality, income, and remaining hours in the day. The Cobb-Douglas utility function can be written as:

$$U(A, y, t) = A^{\beta} y^{a} t^{b}$$

where A is the experienced air quality, y is income, and t is the remaining time. The parameters β, a,and b represent the elasticity of each input to the overall utility.

Experienced Air Quality (A)

Experienced air quality is a combination of indoor air quality (A_i) and outdoor (ambient) air quality (A_o). Assuming a Cobb-Douglas form, we can express A as:

$$A = {A_i}^{\alpha} {A_o}^{1-\alpha}$$

where, $0 < \alpha < 1$ captures the weight given to indoor air quality relative to ambient air quality.

$T \in [0,1]$, where:

- T =0: No trust in government effectiveness.
- T =1: Full trust in government effectiveness.

We now define the effective public demand (${A^*}_o$) as:

$${A^*}_o = T \cdot A_o$$

where ${A^*}_o$ represents the perceived effectiveness of public advocacy. If T is low, individuals do not perceive that their advocacy will significantly impact A_o.

Budget and Time Constraints

Individuals allocate their resources in two ways:

- Income (y) can be used to purchase private improvements to indoor air quality (A_i) at a cost of p_i per unit such that $y' = y - p_i A_i$
- Time (t) can be used for advocating for public improvements in ambient air quality (A_o), where each hour invested reduces time available by 1 such that $t' = 24 - h$, h is the time spent in public advocacy for air pollution.

Individual's Problem

The individual maximizes their utility subject to the budget and time constraints:

$$max_{\{A_i,h\}} \; U(A, y', t') = ({A_i}^{\alpha}(T \cdot A_o)^{1-\alpha})^{\beta}(y - p_i A_i)^{a}(24 - h)^{b}$$

To determine whether private demand and public demand are complements or substitutes, we need to examine the cross-partial derivative of utility with respect to A_i and h ($\frac{\partial^2 U}{\partial A_i \partial h}$).

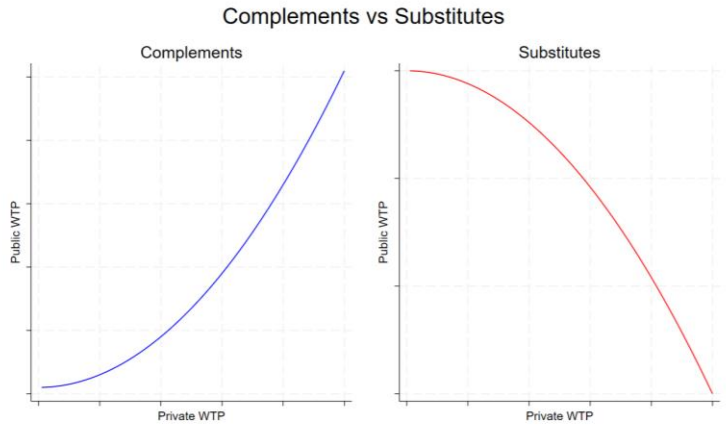
If $\frac{\partial^2 U}{\partial A_i \partial h}$>0, private and public demands are complements (both move in the same direction), but if $\frac{\partial^2 U}{\partial A_i \partial h}$<0, private and public demands are substitutes (more of one implies less of another).

Complements versus Substitutes

A secondary goal of this research involves establishing a suggestive relationship between indoor and outdoor air quality demand. We will use the measures of public and private WTP from the control

group to empirically detect the relationship between the two - whether they are complements or substitutes and observe the intensity of this relationship (see Figure 5). We will compare outcomes on public demand and advocacy actions between the treatment and control groups to test the effects of our information intervention. Moreover, we will also illustrate how the intervention changes the observed relationship between two WTPs.

Figure 5.



One crucial challenge is that we cannot make our private and public measures equivalent to one another to check if respondents' value changes proportionately for improvements indoors and outdoors, since it's difficult to compare WTP for indoor air to outdoor air dollar-for-dollar. Therefore, in addition to a raw comparison, we will also compare the ranks of our respondents within our sample for both measures. The rank-ordering allows us to standardize different ways of measuring WTP for indoor and ambient quality. These comparisons allow us to see if high private value is equivalent to public value or if private adaptations crowd out demand for public action such as in the case of clean drinking water (Greenstone and Hanna, 2014).

Effect of Information Interventions with Trust Factor

Complements Case

- Low Trust in Government:
    - Health Information alone will likely increase private demand, but public advocacy may not increase since individuals do not see the value in public action.
    - Government Effectiveness Information can increase trust, making public advocacy more effective. If T increases, both private and public demand will rise due to their complementary nature.
    - Combined Information (health + government effectiveness) will lead to increased trust and higher perceived benefits, thus raising both private and public demand.

Substitutes Case

- Low Trust in Government:
    - Health Information will increase private demand, but since A_i and A_o are substitutes, public advocacy will likely decrease.
    - Government Effectiveness Information can increase trust, thus raising public demand, while reducing private demand as individuals rely more on public action.

- Combined Information may create competing effects: health information may drive up private demand while reducing public advocacy, whereas government effectiveness information increases public advocacy and reduces private demand. The net effect will depend on which type of information is more influential for the individual.

Appendix B: Survey Instrument

Location and Contact			
GPS Location	Lat	Lon	
Apartment details	Complex Name	Number	
Mobile Number			
Demographics			
1	Gender	Woman	1
		Man	2
		Non-binary person	3
.2	Occupation	Text Entry	

3	Education (highest degree earned)	Less than 12th standard	1
		12th standard	2
		Undergraduate/bachelor's degree	3
		Diploma	4
		Graduate Degree	5
		Doctoral Degree	6
4	How many children (aged 15 years or under) reside in the same household as you?	Text Entry	
5	How many elderly people (aged 65 years or more) reside in the same household as you?	Text Entry	

Indoor Air Quality Beliefs and Awareness			
1	Currently, how do you think the air quality is in your home on a scale of 1 to 10 [with 1 being "extremely poor", 5 being "average" and 10 being "excellent air"]	[ ]	
2	Currently, how do you think the air quality is in your neighbourhood on a scale of 1 to 10 [with 1 being "extremely poor", 5 being "average" and 10 being "excellent air"]	[ ]	
3	Currently, how does the air quality in your home compare to your neighbourhood?	More polluted	1
		Same	2

		Less polluted	3
4	In the past 1 month, have you checked the air quality index from any source?	Yes	1
		No	2
5	If yes in 4, Which of these options best describes how often you check the Air Quality Index (AQI) reading?	Never	1
		Rarely	2
		Monthly	3
		Weekly	4
		Daily	5
7	Please rank the following from 1-4 based on what you think is the major cause of air pollution in your neighbourhood.	Motor vehicles	1
		Industrial activity	2

		Bad waste management	3
		Rural crop fires	4
		Others	5
8	"Air pollution can affect health beyond respiratory function like brain function, diabetes, and blood pressure" Do you…	Agree	1
		Disagree	2
		Don't know	99
9	"Air pollution can negatively affect economic growth and GDP" Do you…	Agree	1
		Disagree	2
		Don't know	99

Current Exposure and Pollution Avoidance Behaviour			
1	In the past 7 days, how many times did you see trash being burned in the open?	[ ]	

2	What actions (if any) did you take over the past year to protect yourself and your family from air pollution? *(open-ended question; tick all boxes that are mentioned)*	Avoid going out during those days.	1
		Keep the windows of the house closed.	2
		Wear a mask (indoor)	3
		Wear a mask (outdoor)	4
		Use air purifiers at home.	5
		Opening windows to ventilate	6
		Use exhaust fans above the cooking stove	7
		Use air conditioners	8
		Using fans	9
		Having plants indoors	10
		Keep home clean	11
		Did not send children to school	12
		Did not let children play outdoors	13
		Left the city for some days	14
		Used home remedies (e.g., consuming natural items believed to counter pollution effects).	15

		Reduce car use	16
		Other, specify: ___	17
		Nothing	0
		Don’t know	99
		Refused	88
3	How do you commute to work?	Two-Wheeler/Cycle	1
		Private Car	2
		Taxi/ Three-Wheeler	3
		Bus	4
		Metro	5
		Walk	6
		Work from home	7
		Not working	8
4	Does your work need you to spend time outdoors in the open sun (outside of your commute)?	Yes	1
		No	2

5	If yes, how many hours on a typical day are you outdoors in the open sun?	[__]	

Previous Engagement in Publicly demanding air pollution			
1	In the past 4 weeks, have you… a) Shared a post on any social media related to air pollution? b) Attended a public event related to air pollution (meeting, talk/lecture, rally)? c) Donated money to an organization doing work related to air pollution? d) Talked to a family member or friend about air pollution? e) Communicated with an official authority (directly or indirectly) about air pollution problems	Yes	1
		No	2

Beliefs on government effectiveness			
1	In the last 6 months, have you filed a complaint on an air pollution-related complaint-fling app?	Yes	1
		No	2

3	If yes., was appropriate action taken against your complaint by the concerned authorities up to your satisfaction?	Yes	1

		No	2
		Don't Know	3
4	Do you have confidence in the local government's effectiveness in providing clean air in your city?	Yes	1
		No	2
		Don't know	99

Altruism [A], Reciprocity [R], Environmentalism [E], Social desirability [SD] Beliefs			
1	Tell us how much you agree with the propositions below: **1.** [SD] I have never been irked when people expressed ideas very different from my own **2.** [SD] I sometimes try to get even rather than forgive and forget	Agree	1
		Disagree	2

	3. **4.** [A] We should all do our part to make sure clean air is available to one and all, even if it means making some sacrifices for ourselves 5. [R] There's no point in me doing anything to protect the environment if others aren't also making an effort. 6. [E] Protecting the environment should be given priority, even if it causes slower economic growth. 7.	Don't know	99

Intervention: We will now give you some important information for the next 3-4 minutes. At the end of this we will ask one question. If you answer it correctly, you will win an additional 100 rupees. We appreciate your attention and time.

Health Information: PM2.5 refers to tiny particles in the air that are so small they can't be seen with the naked eye. The ""PM"" stands for ""particulate matter,"" and the ""2.5"" means these particles are only 2.5 micrometers or smaller in size—about 30 times smaller than the width of a human hair!

Why is PM2.5 harmful? Because it's so small, PM2.5 can go deep into your lungs and even enter your bloodstream. It's especially dangerous for people living in cities or areas with poor air quality.

Q: The current outdoor PM2.5 reading: _____

Q; The current indoor PM2.5 reading in the house is: _____

AQI Category	AQI
Good	0 - 50
Satisfactory	51 - 100
Moderately polluted	101 - 200
Poor	201 - 300
Very poor	301 – 400
Severe	401 - 500

The recommended standard for indoor air quality (AQI) is **[], but your current indoor AQI is []**. For outdoor air, the standard is **[], while your current outdoor AQI is []**. Air pollution poses significant health risks, particularly for children. In India, exposure to polluted air is linked to low birth weight, stillbirth, preterm birth, developmental delays, growth failure, and increased risk of anemia. These health issues contribute to higher child mortality rates. Exposure to air pollution can significantly increase the risk of unexpected health issues- a 10 µg/m³ increase in $PM_{2.5}$ concentration is associated with a 5% increase in the likelihood of developing Type 2 diabetes. Long term exposure to PM2.5 is associated with 10-15% increased risk for heart diseases. Beyond health, air pollution adversely affects work productivity, not only through its effects on health, but also from its effects on productivity and brain function. In 2019, India experienced an estimated loss of 1.3 billion working days due to pollution-related illnesses, leading to an estimated loss of $95 billion in 2019, equivalent to 3% of the country's GDP.Economically, the impact is profound. Addressing air pollution is crucial for safeguarding public health, enhancing productivity, and promoting economic growth.

How does long term exposure to PM2.5 affect the likelihood of heart disease? Ans: [10-15%]

State Effectiveness Intervention: Air pollution is a complex mix of different substances, each affecting your health in different ways and coming from various sources. Sulfates and nitrates, which are major components of pollution, primarily come from burning fuels. Carbon and dust also contribute significantly, originating from fuel combustion, vehicle emissions, and construction activities. Effectively, the harmful components of air pollution are a result of human activity that can be regulated through effective policy. For example, a University of Chicago study found that policies that control congestion on the streets led to a 14-16% drop in air pollution levels compared to nearby areas like Gurgaon and Faridabad. Congestion pricing programs in cities like London and Singapore have led to a 10-20% reduction in CO2 emissions. Solid waste management initiatives in cities like Shanghai have also been successful in cutting down pollution from waste burning. In Delhi, the Graded Response Action Plan (GRAP) takes swift action to limit polluting activities based on AQI levels, such as halting coal-powered electricity generation, restricting construction activities, and imposing fines on waste burning. Furthermore, Delhi is expanding the use of CNG and electric buses to support cleaner transportation options which could reduce vehicular emissions to a great extent. These successful interventions demonstrate that policies targeting specific sources of pollution can lead to significant improvements in air quality and create healthier communities. Have you observed efforts to minimize pollution around you? 1 Yes 2 No

What is the reduction in CO2 emissions attributable to congestion pricing programs?

Ans: [10-20%]

Placebo: Safe Drinking Water Practices in Delhi

Access to clean and safe drinking water is crucial for public health, particularly in ever-growing cities like Delhi. The rapid urbanization and industrialization in Delhi have led to significant challenges in ensuring safe water supply for its residents. Contaminants such as bacteria, heavy metals, and harmful chemicals can find their way into drinking water through inadequate filtration, poor sanitation practices, and pollution of water sources. According to a recent report, **25% of tubewells** in Delhi fail to meet water quality standards, raising serious health concerns. These issues are exacerbated by poor water management and inadequate monitoring. The Delhi Jal Board, responsible for the water supply and sanitation in the city, has been actively working to improve water treatment and distribution systems. However, challenges remain, particularly in densely populated areas and during peak demand periods.

Regular water quality monitoring and safe water practices, such as using water purifiers, boiling water, and ensuring proper storage, can help reduce the risk of waterborne diseases. Safe drinking water is essential for avoiding health issues like dysentery, cholera, and other waterborne illnesses, which are a major concern in urban areas.

Have you noticed any efforts to improve the safety of drinking water in your area?

1. Yes
2. No

What percentage of tubewells in Delhi are found to be unsafe for drinking?
Ans: [25%]

Now we will talk about the issue of air pollution in Delhi.

WTP for clean indoor air

"Thank you for participating in the survey and answering the questions so far. Now, we would like to play an activity with you. You can win a chance to get an air purifier at a discounted price.. Please note that we are not affiliated with any air purifier company, and this activity is purely for the purpose of the research study. The current market price of a high quality HEPA-14 air purifier in Delhi can range starts close to 10,000 INR"

"An air purifier is an electronic device that improves indoor air quality by removing impurities and pollutants from the air within your home. HEPA 14 filters are among the highest efficiency particulate air (HEPA) filters, capable of capturing at least 99.995% of airborne particles as small as 0.3 micron. Before starting the procedure, I would like to explain the method that we are going to follow for this sale. Please follow carefully."

"At first, you will choose the maximum amount you are willing to pay for this air purifier. As I have already said, the market price of this air purifier is 9900 INR, but you can tell us exactly at which price you will be willing to purchase this purifier that you are able to pay. Please make sure that you have the ability to pay the price you are willing to buy the purifier at. Please remember, you will not be able to change your mind later."

"After that, we will conduct a lottery, and the program on our tablet will draw a lottery price for you. That price is completely random and not related to the bid price you mentioned. If the price that the tablet draws is lower than or equal to the price that you are willing to pay (bid price), you will be able to purchase the air purifier at the lower lottery price (the price that the tablet drew for you). Again, please remember that you do not have to pay right away, you can pay when the product is delivered. "

"However, if the lottery price (the price that the tablet drew for you) is higher than the price that you are willing to pay (bid price) for the purifier, you will not be able to buy the air purifier from us. Therefore, it is in your interest to register a bid at the maximum possible price at which you value the air purifier, not a rupee lower. "

"As I mentioned earlier, please remember you will not be able to change your price after the lottery. Therefore, please carefully decide the price you are willing to and have the ability to pay for the device."

Do you understand the procedure? 1 Yes 2 No

[If the respondent does not understand the procedure, the enumerator will explain it to them again.]

1	The market price of this **Air Purifier** is 8000 INR. Would you be willing to buy this at 8000 INR? Remember, if you value the air purifier at 8000 INR, you should bid 8000	Yes	1
		No	2

	INR; if the lottery price is 8000 INR, and your bid is lower than 8000 INR, you will not be able to purchase the plastic container box; however, if the lottery price is lower than 8000 INR, you will be able to purchase the product at the lower lottery price (not at 8000 INR). Therefore, it is in your interest to register a bid at the maximum possible price at which you value the air purifier, not a rupee lower. *[If the respondent says yes then 8000 INR will be considered as their willingness to pay.]* **For respondents who say no:** Ask: "*Would you be willing to pay 8000 INR for this **Air Purifier**? [Remember that if you decide on a lower bid price and the lottery price is higher than that, you will lose the chance to buy this **Air Purifier**.* It is alright if you do not have the money at this moment. You can pay us the amount when we deliver the **Purifier**.*]"* If the respondent still says **no**, gradually decrease the amount by 1000 INR and continuously remind them that if the lottery price comes higher than the bid price amount they have stated, they will not be able to purchase the **Air Purifier, and if the lottery price is lower than the bid price, they only need to pay the lottery price**. e.g., if they say no to 6000 INR, the enumerator should say "Ok, to confirm, if the lottery price is higher than 6000 INR you understand you will not be able to purchase an air purifier from us; however, if the lottery price is lower than 6000 INR, you will be able to purchase an air purifier at that lower price???? Therefore, it is in your interest to register a bid at the maximum possible price at which you value the air purifier, not a rupee lower.". Continue this till 1000 INR or till the respondent says "yes". After asking for 1000 INR, then directly jump to ask for the last price as 100 INR. If the answer is still no, ask the respondent if they want to pay any other price below 100. It can be 0 to 99 rupees. Also, remind them again that they can lose the	Not Sure	999
		Refuse to answer	888

	chance to buy the purifier if the lottery price is higher. Record the highest price the respondent is willing to pay (even if 0).		
You have mentioned that you are willing to pay {maximum stated price} INR. Please make sure you have the ability to pay {maximum stated price} INR to buy this **Air Purifier.** It is alright if you do not have the money at this moment. You can pay us the amount when we deliver the **Purifier**. Now we will look at the lottery result and see what price comes for you.			
2	**If the generated price is more than what the respondent is willing to pay:** The price you have drawn is higher than what you were willing to pay, so we can not sell you any **Air Purifier** today. **If the generated price is less than what the respondent is willing to pay:** Congratulations! You can purchase the air purifier for ${random_value} INR! Thank you for your patience. We will share your name and phone number with the seller to proceed with the delivery process of the purifier. Once the information is shared, the seller will complete the delivery to you promptly. Can you confirm if this is okay for you?	[Max WTP for an air purifier]	

WTP for Clean Outdoor Air			
1	The current average AQI in Delhi is X. Imagine a green tax proposal that would reduce the average AQI to X/2. The green tax would be used to fund projects like transitions to clean energy infrastructure, electric public transport, and incentives to farmers to minimize stubble burning. It requires you to	Yes	1
		No	2
		Not Sure	999

	pay 1000* Rupees per year Would you vote for an initiative to pay such a green tax? [* subject to change]	Refuse to answer	888
	If yes, would you be willing to pay +200 rupees per year towards the green tax? [If the respondent says yes again, keep going with +200 until they say no] If no, would you be willing to pay -200 rupees per year towards the green tax? [If the respondent says no again, keep going with -200 until they say yes]	[Max WTP for outdoor air]	
3	As you know, we will be giving you 200 Rs as a reward for completing this survey. We want to take this opportunity to tell you about Chintan, an NGO that works on solid waste management solutions. Waste burning is a major contributor to particulate emissions in your city. National Environmental Engineering Research Institute (NEERI) estimates that open waste burning contributes to 5-11% of PM10 and PM2.5 concentrations in Delhi. Chintan manages over 30 tons of solid and electronic waste every day in the Delhi region by doorstep collection, segregation, recycling and composting, and also trains and builds capacity to replicate their model across public and private service providers. Therefore this NGOs work is crucial and important to limit pollution of ambient air. Here is a flyer about their work. Would you like to give up a part of your reward to support their efforts?	Yes How much? [__]	1
		No	2

Governance preferences			
1	Imagine that you were voting for candidates in the state election. Here are the two candidates who are running against each other. They each allocate a certain percentage	Candidate 1	1
		Candidate 2	2

	of the city budget to the following issues in their manifesto: Candidate 1 ● Subsidized electricity (45%) ● Improvement in air quality (30%) ● Garbage and waste disposal management (25%) Candidate 2 ● Garbage and waste disposal management (45%) ● Subsidized electricity (30%) ● Improvement in air quality (25%) From this information, please indicate which candidate you would vote for in the state election.		

Willingness to participate in environmental advocacy actions			
1	Waste-pickers play a crucial role in managing garbage by sorting through waste and recycling valuable materials like plastics, metals, and paper. By doing so, they help reduce the amount of waste that gets burned in incinerators, which lowers air pollution and promotes a cleaner environment. A Delhi-based NGO is gathering signatures for a petition calling on the government to ensure safety, well-being, and dignity for the city's waste pickers. (Enumerator: clarify if the respondent asks for more information - "They must be given access to protective equipment like masks and shields, priority access to quality	Yes	1
		No	2
		Later	3

	healthcare, and compensatory payment for their work.") Would you like to sign this petition today? [link]		
2	Would you be willing to share this poster about the petition on any social media platform of your choosing now?  	Yes	1
		No	2
		Later	32
2	How motivated are you to educate others about the causes and effects of air pollution, as well as ways to mitigate it, to create a broader awareness and impact?	Not Motivated at All	1
		Slightly Motivated	2
		Moderately Motivated	3
		Very Motivated	4
		Extremely Motivated	5

5		Yes	1

	Would you be willing to join our WhatsApp group or messaging list where you can continue to receive information on <Intervention Arm: (i) alerts on high pollution days (ii) more information on adverse effects on health, (iii) more information on government actions to curb air pollution.>	No	2

Policy Ranking			
1	In your opinion, what are the three main problems in the world today? select any three)	Social problems (poverty, discrimination	1
		Health problems (diseases)	2
		Environmental degradation due to pollution	3
		Climate change	4
		Tensions between countries	5
		Economic problems (unemployment, inflation, crisis)	6
		Personal security (crime, theft)	7
2	How likely are you to support promoting use of EVs through tax cuts and higher cess on private car ownership and increasing the VAT on petrol/diesel? (answer for both together)	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5

		Extremely likely	6
3	How likely are you to support implementing stronger fines for garbage burning? (Currently, Fines can range from ₹5,000 to ₹25,000 per incident depending on the severity and enforcement policies of local authorities.)	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5
		Extremely likely	6
5	How likely are you to install a rooftop solar electricity setup?	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5
		Extremely likely	6
6	How likely are you to support the ban on older vehicles with low-efficiency engines (BS-3 petrol and BS-4 diesel vehicles in the national capital.) ?	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5

		Extremely likely	6
7	How likely are you to support enforcing fines for not segregating garbage into wet and dry? (Currently, fines usually range from ₹200 to ₹500 for households.)	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5
		Extremely likely	6
8	How likely are you to support a congestion tax charged on the outskirts during peak demand times?	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5
		Extremely likely	6
9	How likely are you to use public electric buses?	Extremely unlikely	1
		Unlikely	2
		Somewhat unlikely	3
		Somewhat likely	4
		Likely	5

		Extremely likely	6
10	Would you support imposition of green taxes if they are used to ensure enforcement to reduce actions that cause air pollution as well as mitigation policies like water guns, dust vacuums, and waste management services?	Yes	1
		No	2
		Don't know	99

Fatalism and Knowledge			
1	Do you agree with the statement "There is really no way individual behavior can solve the problems of air pollution."? (Predetermination)	Strongly Disagree	1
		Disagree	2
		Neutral	3
		Agree	4
		Strongly Agree	5

Survey effects test			
1	In the past 4 weeks, have you or any other adult in your household experienced the following? Please check all that apply.	1. Headaches 2. Dizziness 3. Increased fatigue 4. Coughing or wheezing 5. Shortness of breath / chest tightness 6. Burning eyes 7. Fever 8. Runny nose 9. Vision impairment 10. Skin rashes 11. Joint pain 12. Numbness or tingling in the hands 13. Stomach Ache or diarrhea 14. Nausea 15. Toothaches	

		16. Hearing impairment 99. Other 0. None of the above 999. Does not know 888. Refuse to answer	

2	Do you think the government is responsible for providing clean air?	Yes	1
		No	2
		Don't know	99
3	Do you think the government is responsible for keeping inflation low?	Yes	1
		No	2
		Don't know	99
Attention			
1	I will read you a number of digits. Afterwards, you repeat them in the reverse order as I said. For example, if I say 3-0-5, you say 5-0-3. Let's begin: 1. 1-5-6 2. 4-7-2 3. 5-8-3-1 4. 8-0-1-9	1. Pass/Fail 2. Pass/Fail 3. Pass/Fail 4. Pass/Fail	

Administrative information

Funding: We previously received pilot funding from the King Climate Action Initiative (KCAI-22-00568) in September 2022 and research funding from UBC (CIDER Small Grant #173). The pilot funding was used to design, build and field test a mobile application that would serve as an interface between respondents and the research team in administering both the intervention and incentivized surveys. We have designed extensive survey questions and information campaigns that are suitable for this app. While our attempts to recruit a sample using social media were successful, we concluded that a purely digital interface was not sufficient for continued engagement in survey responses. We are now designing this door-to-door survey experiment along with WhatsApp groups for continued engagement. Remnant funds from the pilot funding will be used for this study. We have also applied for additional funding to replicate our survey in other settings.

Institutional Review Board (ethics approval): This study has received ethics approval from UCSD, UBC, and IFMR. Amendments to existing IRB approvals are currently ongoing to accommodate the latest design and survey instrument.

Declaration of interest: There are no conflicts of interest of any author pertaining to this study.

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