Dual Misbeliefs and Technology Adoption: Evidence from Air Purifiers in Bangladesh*

Ashfaqul Chowdhury IGC
Teevrat Garg UC San Diego
Maulik Jagnani Tufts
Martin Mattsson NUS

This version: March 20, 2025

Abstract

Dhaka, Bangladesh, consistently ranks as one of the world's most polluted cities, yet fewer than 1% of middle-class households own an air purifier. Why don't these households, who can afford air purifiers, adopt them despite the extremely high levels of air pollution? We find that while indoor air is nearly as polluted as outdoor air, households believe indoor air is much cleaner. Furthermore, although air purifiers are highly effective at removing pollutants, households are uncertain about their effectiveness. Consistent with these misbeliefs, the average willingness to pay for an air purifier is less than a tenth of its retail cost. To address these misconceptions, we conducted a multi-phase field experiment by providing air monitors and purifiers to households. Those receiving air monitors realized that their indoor air was more polluted than those without monitors, but this did not increase their willingness to pay for purifiers. Similarly, providing air purifiers reduced uncertainty about their effectiveness, yet households seldom used them—even when compensated for electricity costs. However, households that received both monitors and purifiers significantly increased both their usage and valuation of the purifiers. A second experiment finds that these increases happen because people can see proof that indoor air quality is poor and that the purifier works when their monitor shows pollution numbers dropping after turning it on. Our findings suggest that correcting misperceptions about both the severity of the problem and the effectiveness of the solution is necessary to boost the adoption and use of preventive health technologies.

JEL Codes: D12, D83, I12, O12, O13, Q53

Keywords: technology adoption, beliefs, air pollution, air purifier

*Chowdhury: ashfaqul.chowdhury@theigc.org, Garg: teevrat@ucsd.edu, Jagnani: maulik.jagnani@tufts.edu and Mattsson: martin.mattsson@nus.edu.sg. We thank the International Growth Center, JPAL's King Climate Action Initiative (KCAI), and the Ministry of Education, Singapore (AcRF Tier 1 FY2022-FRC2-006) for generous research funding. We are extremely grateful to Shirsha Songshoptak and Zamir Ticknor for excellent research assistance and to Mehrab Ali, Sadia Chowdhury, Merina Mou, and the entire field team at ARCED Foundation for implementing the experiment. We thank Emily Breza, Siddharth George, Lorenz Goette, Johannes Haushofer, Kelsey Jack, Craig McIntosh, Ivan Png, and Yogita Shamdasani for helpful feedback. This study received IRB approval from Dhaka University, National University of Singapore, Tufts University, and the University of California San Diego. This experiment was pre-registered on AEA Social Science Registry as AEARCTR-0012194. The authors have no conflicts of interest to declare.

1 Introduction

High levels of ambient air pollution impose severe economic and welfare costs, especially in low-income countries (Oliva, Alexianu and Nasir, 2019). Over five million people die annually from exposure to ambient air pollution, with South Asia alone accounting for 1.4 million deaths per year (World Health Organisation, 2019; GBD Risk Factors, 2024). Despite persistently high pollution levels, demand for technologies like air purifiers that can improve indoor air quality remains remarkably low—even among households that can afford them (Greenstone and Jack, 2015; Greenstone, Lee and Sahai, 2021). For instance, fewer than 1% of the middle-class households we contacted in Dhaka, Bangladesh—which consistently ranks among the world's most polluted cities (IQAir, 2024)—own an air purifier. Why don't households that can afford air purifiers adopt them despite extremely high ambient air pollution levels?

We ran two field experiments that reveal that households hold inaccurate beliefs about the severity of indoor air pollution and the effectiveness of air purifiers. Correcting both misconceptions is necessary to increase the adoption and use of these devices.

Our descriptive statistics paint a bleak picture of the state of indoor air pollution (IAP) in Dhaka and reveal significant misconceptions among households regarding its severity and the effectiveness of air purifiers. First, using IAP monitors we installed in households, we show that during the winter months, IAP is staggeringly high, with an hourly average of 133 $\mu g/m^3$, which is 9 times higher than the WHO's 24-hour average guideline of 15 $\mu g/m^3$. Importantly, indoor air can be nearly as polluted as outdoor air, with an average indoor to outdoor ratio of 0.8. However, while over 70% of households believe that ambient air pollution (AAP) is a serious problem, they greatly underestimate the severity of indoor pollution, with the same percentage reporting that indoor air pollution is not a serious issue. Second, we find that households are uncertain about and significantly underestimate the effectiveness of air purifiers in removing indoor pollution. Fewer than half of the households had formed an opinion on purifier effectiveness, and less than a third believed that purifiers removed more than 25% of air pollution from the rooms where they were used, which contrasts sharply with the actual effectiveness of air purifiers—80% in controlled conditions and 50% in real-world household environments. Consequently, households have an extremely low willingness to pay (WTP) for air purifiers; the average household WTP was USD 12.2, or 8.4% of the retail cost of air purifiers.

To correct these misconceptions, we conducted a multi-phase field experiment providing air monitors and purifiers to households. In November 2023, we recruited 1,008 households from three large housing associations. Eligibility required a functioning WiFi connection and no existing air purifier—criteria met by 99% of interested households. These are middle-income households with an average annual household income above US$6,000; 34% own an air conditioner, which costs at least twice as much as an air purifier and consumes substantially more electricity.

Immediately following recruitment, in November, we conducted a short Phase 1 survey on

perceptions of indoor and outdoor air quality. Then, 512 randomly selected households received an IAP monitor displaying real-time PM2.5 levels along with a chart that categorized these levels from "good" to "hazardous." These monitors recorded and transmitted minute-by-minute data on indoor PM2.5 levels.[1] In January 2024, two months later, we conducted the Phase 2 survey, gathering information on household beliefs about AAP and IAP and perceptions of air purifiers' benefits. We used a modified Becker-DeGroot-Marschak (BDM) mechanism to elicit households' willingness to pay for air purifiers. Before the elicitation, we informed households about the air purifier's purpose in removing indoor air pollution. Subsequently, we randomly provided 345 households with a free air purifier. Each purifier was connected to a WiFi-enabled smart plug, allowing us to collect minute-by-minute usage data. We further randomly assigned these purifier-owning households to receive either no electricity compensation, compensation paid daily, or compensation paid monthly. In March 2024, we conducted the Phase 3 survey, collecting endline data on perceptions of air purifier benefits, households' willingness to pay for an additional purifier, and their willingness to accept (WTA) cash to sell back their existing purifiers.

We report three sets of findings. First, households that were provided with an air monitor believe that the air in their homes is more polluted and more likely to increase health risks to adults and children compared to households who were not provided an air monitor. However, importantly, access to IAP monitors did not increase households' willingness to pay for an air purifier, even though they were informed about its purpose in removing indoor air pollution before elicitation.

Second, households that were provided with an air purifier are less uncertain about its effectiveness compared to households who were not provided an air purifier. However, households did not seem to value the devices, as they rarely used them—even when we compensated them for the electricity costs of operating them. Specifically, even with compensation, nearly two out of three households used the air purifier for less than 30 minutes per day.

Third, households that received both monitors and purifiers not only increased their usage but also their valuation of the purifiers. We show that these households dramatically increased both self-reported and directly measured air purifier use relative to households that received only the purifier. Data from smart plugs indicate that monitors increased purifier use by 270%, equivalent to an additional 74 minutes per day. Moreover, households that received both monitors and purifiers increased the price they were willing to accept to sell back the air purifiers by 26%, compared to households that received only the purifier. Lastly, households provided with both a monitor and a purifier increased their WTP between Phase 2 and Phase 3 for a second purifier by 52.7%, although this estimate is underpowered. In contrast, households that received only a purifier saw a much smaller and statistically insignificant 11.7% increase in WTP for a second

[1] Among households receiving an IAP monitor, half were randomly assigned to an "attention" treatment, receiving a small incentive to correctly report monitor readings and corresponding hazard levels from an information card we provided.

purifier. Similarly, households that received only a monitor exhibited a small and statistically insignificant 8.1% increase in WTP for the first air purifier.

We conducted a second experiment with 2,400 households from four other housing associations in the same neighborhood to investigate what drives the increased use and valuation when combining monitors and purifiers. We wanted to determine whether this effect occurs because households separately recognize both poor indoor air quality and purifier effectiveness, or because the monitor demonstrates the immediate drop in pollution levels when a purifier is activated. We randomly assigned households to six treatment arms: a pure control group; a group offered a 12-month interest-free loan to purchase a purifier; and four groups that received brief one-time demonstrations - one with just the purifier turned on for 10 minutes; one with just the monitor turned on for 5 minutes; one with the monitor turned on for 5 minutes and the purifier turned on for 5 minutes separately; and one with the monitor turned on for 5 minutes followed by activating the purifier for 5 minutes while the monitor remained on.[2]

Our findings replicate results from the first experiment while also revealing additional insights. First, access to credit had no impact on households' beliefs or WTP for air purifiers. Second, households exposed only to air monitors recognized their indoor air was more polluted but did not increase their WTP for purifiers. Third, households who only experienced air purifiers became more certain about purifier effectiveness but showed no increase in WTP. Fourth, households exposed to both devices separately (monitor first, then purifier) recognized both indoor pollution severity and purifier effectiveness, yet still showed no increase in WTP. Fifth, households who experienced both devices simultaneously displayed a dramatic pattern tied directly to observable results: while all households recognized their indoor air was polluted regardless of purifier performance, those witnessing larger pollution ($>$70%) drops were twice as likely to rate purifiers as effective compared to groups who only saw the purifier demonstration.[3] Households seeing minimal improvement were no more likely to consider purifiers effective. Importantly, their willingness to pay varied dramatically based on observed results – households witnessing drops exceeding 90% increased their WTP by 20% compared to the control group, while those seeing minimal improvement decreased their WTP by 25%.[4] Overall, these results demonstrate that purifier valuation increases when people can directly observe both that their indoor air qual-

[2]Our controlled tests in January 2024 reveal that air pollution levels decline almost immediately once an air purifier is turned on.

[3]This variation in air purifier effectiveness wasn't experimental but depends on numerous factors during the demonstration: adherence to protocol, room characteristics, ventilation, pollution levels, purifier placement, and timing. Importantly, this variation showed no correlation with household demographics (age and education) or pre-intervention beliefs about pollution and purifier effectiveness.

[4]Findings four and five can be reconciled in two ways. Under a rational Bayesian framework (Augenblick and Rabin, 2021), sequential exposure ('Both Separately') generated smaller belief movements and uncertainty reductions, insufficient to change WTP. In contrast, simultaneous exposure ('Both Together') provided immediate, clearer evidence, resulting in larger belief updates and uncertainty reductions, significantly increasing WTP. Alternatively, non-Bayesian biases (e.g., anchoring on priors) prevented adequate uncertainty reduction during sequential exposure, whereas simultaneous exposure enabled immediate integration of evidence, aligning beliefs with reduced uncertainty and raising valuation.

ity is poor and that the purifier effectively reduces pollution levels in real-time.

In theory, individuals must form accurate beliefs about both the severity of the problem a technology addresses and the technology's effectiveness in mitigating it to make informed adoption decisions. However, little is known empirically about how these beliefs form and to what extent they influence the reluctance to invest in preventive health technologies (Kremer, Rao and Schilbach, 2019). We are the first to experimentally demonstrate how inaccurate beliefs about both the severity of a problem and the effectiveness of a solution contribute to the low adoption and limited use of a preventive health technology. We further show that beliefs about solution effectiveness change more dramatically when people witness the solution's impact in real-time - and only when they simultaneously observe both problem severity and the solution's immediate impact do we see meaningful changes in adoption behavior. This result contributes to a large development economics literature that explores the underadoption of seemingly beneficial technologies in areas such as agriculture, health, and firms in lower-income countries (for reviews, see Dupas, 2011, 2014; Magruder, 2018; Verhoogen, 2023). It also contributes to a growing literature in environmental economics that examines why the marginal willingness to pay for environmental quality improvements (MWTPE)—such as clean air and water—is so low in developing countries (Greenstone and Jack, 2015).[5]

To the best of our knowledge, only three prior studies have experimentally examined the underadoption of protective technologies against ambient air pollution.[6] Two of these studies focus on the impact of simple information provision regarding either the health effects of air pollution or air quality forecasts on the adoption of pollution masks by low-SES individuals in India and Pakistan (Baylis et al., 2024; Ahmad et al., 2023). Both found that information increased demand for these masks. On the other hand, Greenstone, Lee and Sahai (2021)—similar to a part of our design—deployed IAP monitors in Delhi households across the SES spectrum during peak winter air pollution and, consistent with our findings, found no impact on demand for air purifier rentals. This contrasts with non-experimental evidence from China, where air purifiers are popular household appliances used to mitigate the effects of severe air pollution (Ito and Zhang, 2020). In fact, Barwick et al. (2024) show that access to pollution information, due to the establishment

[5]Our results also contribute to emerging research on environmental belief formation. Patel (2023) documents how Bangladeshi farmers update their salinity beliefs substantially more from experiencing salient saltwater floods than from subtle irrigation intrusion. Similarly, we find mere exposure to extremely poor indoor air quality doesn't lead to accurate perceptions, perhaps because it lacks salience. Middle-class families who live in apartments can skew their perceptions of indoor versus outdoor air quality because they can create a strong barrier against most outside elements simply by closing doors and windows. Only verifiable evidence from indoor air quality monitors effectively updates these beliefs. However, unlike that study, where simply providing soil salinity information increases WTP for salinity-tolerant seed varieties, we find that merely providing indoor air quality information via monitors has no effect on WTP for air purifiers as households are also uncertain about purifier effectiveness.

[6]This stands in stark contrast to the extensive literature on the adoption and use of other protective environmental technologies in developing countries, such as improved cook stoves or water filters (e.g., Jalan and Somanathan, 2008; Ashraf, Jack and Kamenica, 2013; Madajewicz et al., 2007; Kremer et al., 2011; Ashraf, Berry and Shapiro, 2010; Guiteras et al., 2016; Berry, Fischer and Guiteras, 2020; Mobarak et al., 2012; Miller and Mobarak, 2013; Levine et al., 2018; Pattanayak et al., 2019; Berkouwer and Dean, 2022).

of monitoring stations, led to a notable reduction in health risks associated with air pollution, primarily due to heightened use of preventive measures such as masks and air purifiers.[7]

Our result offers one explanation that reconciles these seemingly disparate findings. In South Asia, people generally have accurate beliefs about the protective effects of face masks but lack fully accurate beliefs about the health effects of air pollution or about AAP levels. In this context, providing information about AAP levels or its health impacts leads to increased adoption of face masks. Similarly, in China, while beliefs about the effectiveness of air purifiers are accurate, beliefs about AAP and IAP levels were inaccurate. Therefore, the establishment of monitoring stations—which provided reliable information about AAP (and perhaps consequently IAP) levels—led to an increase in the adoption of face masks and air purifiers. In South Asia, however, while households are more aware of outdoor pollution,[8] they greatly underestimate the severity of indoor pollution and the effectiveness of air purifiers. Therefore, to shift from the equilibrium with incorrect perceptions to one with correct perceptions, a sufficient number of households must change their beliefs about both IAP levels and purifier effectiveness.[9]

Indeed, our study shows that exposure to IAP monitors corrects misconceptions about indoor air pollution levels, and exposure to air purifiers corrects beliefs about their effectiveness. However, exposure to either device alone does not increase the perceived value of air purifiers. It is only when individuals simultaneously observe both the indoor air pollution levels through monitors and the purifier's immediate impact on pollution levels that we observe increased adoption and use of air purifiers. In other words, our results indicate that measured MWTPE can be significantly reduced when multiple critical pieces of information—such as IAP levels and the effectiveness of air purifiers—are missing.

2 Experiment 1

2.1 Research Design and Data Collection

We conduct our study in the Mirpur area of Dhaka, Bangladesh, a city notorious for its severe air pollution. Even compared to Los Angeles—the city with the most polluted air in the US—Dhaka's levels stand out as exceedingly high (Figure 1). During the study months of December through March, PM2.5 levels routinely exceed 10 times the WHO's 24-hour safe limit of 15 $\mu g/m^3$. If Dhaka were to meet WHO air pollution guidelines, life expectancy there could increase by 8.1

[7] Our study is also related to the literature on the effects of air quality alerts, which shows that these can reduce acute diseases and healthcare utilization (e.g. Neidell, 2009; Anderson, Hyun and Lee, 2022), as well as to research on the effects of revealing indoor air pollution in Europe on household avoidance behavior (e.g. Metcalfe and Roth, 2025; Sater et al., 2021; Baquié et al., 2024).

[8] Our descriptive statistics suggest that while middle-class Bangladeshi households are more aware of outdoor pollution relative to indoor pollution, a significant number still underestimate the severity of AAP.

[9] In our model, there exist two equilibria: one where beliefs about both IAP and the effectiveness of air purifiers are inaccurate, and another where beliefs about both are accurate.

years (AQLI, 2023).

We enrolled 1,008 households in Mirpur, housed in apartment blocks managed by three large housing associations that granted permission for our experiment.[10] Appendix Figure A.1 shows a map of our study area. We selected this population for two main reasons.

First, middle-income apartment blocks represent a common form of housing in urban South Asia, making this group somewhat representative of a substantial demographic. Moreover, their economic status suggests that purchasing an air purifier would not constitute an overwhelming financial burden. The retail price of the air purifier used in our experiment is less than 30% of the monthly household income. 34% of the households in our sample own an air conditioner; air conditioners typically cost at least two to three times as much as an air purifier and consume substantially more electricity.

Second, finer particulate matter such as PM2.5 can penetrate buildings easily (Ozkaynak et al., 1996; Vette et al., 2001), making exposure difficult to avoid. Unlike many slum dwellers, middle-class families living in apartments can create a stronger barrier against most outside elements by simply closing their windows and doors. This ability may skew their perceptions of indoor versus outdoor air quality, influencing their demand for—and usage of air purifiers.[11]

During the preliminary Phase 1 survey, we asked three screening questions. Specifically, we inquired whether the household had a Wi-Fi connection, whether they owned an air purifier, and whether they were interested in acquiring an air purifier and/or air monitor for their household. All households had a Wi-Fi connection, and fewer than 1% of the households we contacted owned an air purifier. However, only 58% of households expressed interest in an air purifier and/or air monitor. Although excluding households that responded "no" makes our sample less representative of the overall population, it allows us to focus on a group more likely to adopt and use air purifiers. This group is crucial for policymakers, as they are significantly impacted by measures designed to boost air purifier adoption and use.[12] Lastly, to reduce potential information spillovers between households, we sampled only one household per floor in each building.

Figure 2 offers a visual representation of our research methodology. This diagram illustrates the structure of our study, which includes four distinct randomized interventions, each designed to investigate different parts of our research questions.

[10] Approximately 180,000 people reside in the three housing associations, which are all located within a 2 square kilometer area. Each association comprises multiple multi-storey buildings ranging from 3 to 5 storeys, with several apartment units on each floor.

[11] Furthermore, we conducted our experiment during winter, a period when PM2.5 levels are very high but when households are more likely to keep windows closed for comfort; the average daily minimum temperatures in Dhaka are 15°C in December, 14°C in January, and 17°C in February.

[12] Examples of such measures include cutting taxes and import duties or government recommendations to use air purifiers, akin to the promotion of hand-washing and other preventive health actions.

2.1.1 Phase 1 Survey

After screening households and obtaining consent, we conducted a short survey from November 12 to November 30, 2023. The survey included questions about the age and education of the household head, beliefs about health risks from air pollution, and perceptions of indoor and outdoor air quality. After completing the survey, households tossed a digital coin on the survey tablet, and a subset were randomly selected to receive an (indoor) air quality monitor. Amongst these households, we further randomized a subset to receive an attention treatment, where they were incentivized to read the monitor at least once per week. See Appendix A.1 for more information about how the survey data was processed.

Treatment 1: Air quality monitors: We provided 512 randomly selected households with air quality monitors that use optical signatures to measure levels of indoor PM2.5 levels (Figure A.2). These monitors have a small display screen that reports PM2.5 in standard units of micro grams per cubic meter ($\mu g/m^3$). Along with these monitors, households received a chart (in English and Bengali) categorizing PM2.5 levels into six levels: good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy, and hazardous (Figure A.3). The chart also shows the health risks associated with these air pollution levels in terms of increased likelihood of heart disease, stroke, and lung cancer in adults, and respiratory issues in children under 5.[13] Once randomly selected households received a monitor, the field team helped set up the monitor and connect it to Wi-Fi, ensuring that data was being transmitted before leaving the household.

Each household with an air monitor received a small daily incentive of BDT 15 (USD 0.14) if their monitor transmitted data for at least 16 hours. To mitigate any risk of incentive-driven effects, households without air monitors received the same payment, matched randomly with a household in the treatment group (Cefala et al., 2024). For uniformity in data collection, we suggested placing the air monitors in the bedroom of the household head.

Treatment 2: Air quality attention incentives: Among the 512 households receiving an air pollution monitor, 255 were randomized to receive an attention treatment. In this treatment, they earned a weekly reward of BDT 30 (USD 0.28) for accurately reporting their home's air quality category and the associated increased disease risk via a WhatsApp message. The remaining 257 households received a payment equal to that of a randomly selected household in the attention group. This approach ensures balanced payouts between the treatment and control groups.

[13] The hazard ratings were adapted from the US EPA's air quality dial found on www.airnow.gov. The health risks were adapted from Apte et al. (2015).

2.1.2 Phase 2 Survey

We conducted the Phase 2 survey from January 5 to February 4, 2024, approximately two months after the Phase 1 survey.[14] The Phase 2 survey collected information on household beliefs about air pollution and its health impacts, as well as perceptions of the benefits of air purifiers. We also employed a modified Becker-DeGroot-Marschak (BDM) mechanism to elicit willingness to pay for air purifiers (Berry, Fischer and Guiteras, 2020; Berkouwer and Dean, 2022). We included questions about sleep, mood, willingness to engage in solving the collective action problem of air pollution, and questions about labor supply. We also collected data on health bio-markers—specifically blood pressure and blood oxygen levels—of household members who slept in the bedroom of the household head.

Attrition: We experienced 17% attrition between Phase 1 and Phase 2; of our Phase 1 sample of 1008 households, 832 households consented to the Phase 2 survey.[15] We regress whether or not a household left the sample in Phase 2 on the monitor and attention treatment to see if treatment is correlated with attrition (Table A.1). Although coefficients on both treatments are statistically insignificant, the magnitude on the monitor treatment is negative and sizable. Attrition in the non-monitor group was 19.6% whereas attrition in the monitor group was 15.2%. There was no differential attrition between households receiving the monitor with or without the attention treatment. We test for balance in the unattrited groups for both monitor (Table A.2) and attention treatments (Table A.3). Reassuringly, we find that balance on observables collected during the Phase 1 survey is maintained in the unattrited sample.

Treatment 3: Air purifiers: From our unattrited sample of 832 households, we randomly selected 345 households to receive air purifiers. The model of air purifier used in the experiment is the "Squair Air Purifier" from Smart Air (see Figure A.4 for a picture).[16] At the time of the experiment, the retail price in Bangladesh was BDT 17,000 (approximately USD 150). The randomization was conducted as part of the BDM willingness to pay elicitation.[17] Treatment households were randomly selected to have a 'draw price' set at zero, ensuring that they will receive an

[14] A small number of surveys were rescheduled and completed by March 12, 2024; however, the average time between the Phase 1 and Phase 2 survey was 61 days.

[15] Of the 176 households who did not consent to the Phase 2 survey, 79 were randomized to receive monitors and 97 were randomized to not receive monitors. Of the 79 who were selected to receive monitors, 34 immediately refused to allow monitor to be installed at the end of the Phase 1 survey. The remaining 45 households allowed monitors to be installed; 22 of them returned the monitor before the Phase 2 survey, 14 stopped using the monitor but did not return it and 9 of them are still using the monitor but did not consent to either the Phase 2 or Phase 3 survey.

[16] For more details on the air purifier, see: https://smartairfilters.com/en/product/sqair-air-purifier/.

[17] In a BDM exercise, households are asked to report the amount they would be willing to pay for an air purifier in decreasing increments of 1000 Taka, starting at the market price of 17,000 Taka. Once a household declares a price they would be willing to pay, a random draw price is selected. If the drawn price is below what the household said they would pay, the household receives the air purifiers at the draw price. Otherwise no transaction takes place.

air purifier while control households were given a 'draw price' equal to the market price.[18] We encouraged households to place these air purifiers in the bedroom of the household head. We attached smart sockets to each of the air purifiers so we could directly measure air purifier use (Figure A.5).

Treatment 4: Electricity Compensation: We randomly assigned the 345 households equipped with air purifiers to one of three groups: two groups received compensation for the electricity used by the air purifiers, while one control group did not receive any compensation. Each of the two treatment groups consisted of 106 households, while the control group had 133 households. The compensation for the treatment groups was equal to the electricity cost incurred by the air purifier, tracked via the smart socket.[19] All households received their first payment one week after our visit to build trust. After this initial payment, households in the first treatment group received daily payments, whereas those in the second group received monthly payments.[20]

2.1.3 Phase 3 Survey

We conducted the Phase 3 survey from February 23 to March 31, 2024, approximately seven weeks after the Phase 2 survey.[21] In the Phase 3 survey, we collected endline data, including beliefs about purifier effectiveness, households' willingness to pay for an additional air purifier and their willingness to accept cash to sell back purifiers they already had. We repeated many questions from the Phase 2 survey to observe the purifiers' effects on responses. We also collected health bio-markers.

Attrition: Of the 832 households surveyed in Phase 2, 784 consented to participate in the Phase 3 survey representing a low attrition rate of 5.8%. However, we find differential attrition by purifier treatment (Table A.4). Of the 48 households who left our study, 7 were in the purifier group and the rest were in the non-purifier group. The 7 attrited households in the purifier group refused entry during the Phase 3 survey and retained their purifiers after ceasing all contact with the study team. 5 of these 7 households kept their smart plugs connected for a few weeks, allowing us to collect data on purifier usage. Of the 41 attrited households in the non-purifier group, 37 refused consent, while 4 left the area. Importantly, we test for differential attrition and find that the

[18] Only one control household stated a willingness to pay equal to the market price.

[19] To avoid households using different devices in the smart socket we used a small amount of glue, attaching the air purifier plug in the smart socket. Furthermore, we only compensated for electricity usage within the range of wattage used by the air purifier.

[20] There is progressive electricity pricing in Dhaka, with prices being higher for users consuming more electricity. We base our compensation on the highest marginal price of electricity, 13 BDT (0.12 USD) per kwh. This means that no household is under-compensated for their electricity use, but households that used small amounts of electricity overall were slightly over-compensated compared to their true marginal cost of electricity.

[21] A small number of surveys were rescheduled and completed by April 20, 2024; however, the average time between the Phase 2 and Phase 3 survey was 48 days.

unattrited treatment and control groups are balanced in terms of observables collected during the Phase 2 survey (Table A.5). The differences between non-purifier and purifier households in the unattrited sample are small and statistically insignificant. One exception is household income, where purifier households report having 10% lower monthly income on average but this estimate is very noisy. We also observe no differences in willingness to pay or perceptions of air quality and its effects, suggesting that differential attrition did not undermine the integrity of the random assignment. Furthermore, we replicate all results from Experiment 1 in Experiment 2, where there was no differential attrition.

Incentives to Use Air Purifiers: In a departure from the pre-analysis plan, we re-randomized the 338 unattrited households in the purifier group, after the endline survey, to receive larger incentives for increasing usage of air purifiers. This was done to assign a monetary value to other treatments aimed at driving increased air purifier usage. We randomized households with purifiers into three groups. The first group received no additional incentives for increasing their usage of air purifiers. A second group was incentivized with 5 BDT per hour of use, and a third group received 10 BDT per hour. These incentives, provided from April 1 to April 30, 2024, were considerably larger than the compensation for electricity costs, which for running the purifier on medium speed are approximately BDT 0.24 per hour. Thus, the incentive treatment payments were 20-40 times greater per hour of use than the electricity compensation. Put another way, households in the two incentivized groups that operated their purifiers continuously throughout the 30-day intervention could earn between 3,600 and 7,200 Taka, amounting to a significant 6% and 12% of the average monthly household income in our sample, respectively.[22]

2.1.4 Other Data Sources

In addition to data from the three surveys, we collected data from three other sources. First, we collected continuous minute-by-household level indoor air pollution data from households equipped with air monitors. Second, we installed outdoor air pollution monitors in the study regions. Third, we recorded continuous minute-by-household level air purifier usage data, which was collected via the smart sockets connected to the air purifiers.

Indoor Air Pollution: In Phase 1, we installed air pollution monitors in a random subset of our sample. These monitors are designed to record and push to the server minute-by-minute data on PM2.5, PM10, temperature, and humidity.[23] We incentivized households to keep the air moni-

[22] We included this treatment after receiving additional funding that was not available when we initially wrote and posted the pre-analysis plan.

[23] We used Qingping Lite monitors, a model that has performed well in tests in other highly polluted environments: https://smartairfilters.com/en/blog/how-accurate-are-qingping-qp-pm2-5-air-quality-monitors/.

tors on by providing BDT 10 for each day that the device was turned on for more than 16 hours. Despite this incentive, 8% of households refused to install the monitor. Overall, we received data from 61% of the potential hour-by-household observations among those with monitors installed. We winsorize the data at the 1st and 99th percentiles. See Appendix A.2 for more details about attrition in the monitor data.

Outdoor Air Pollution: We installed two outdoor air pollution monitors to cover all three housing associations, providing us minute-by-minute data on PM2.5 and PM10. [24] We winsorize the data at the 1st and 99th percentiles. Appendix A.3 shows that the indoor and outdoor monitors do not substantially differ in their pollution measurements when placed in the same room.

Air Purifier Use: Each air purifier was connected and glued to a smart plug. The smart plugs were connected to WiFi and recorded electricity usage of the connected device, pushing data to the server every minute on how many watts were used. Figure A.6 shows that the smart plugs' recorded electricity usage aligns with the manufacturer's labeling of the air purifier's wattage at various speeds. We classify electricity usage between 3 and 60 watts as indicative of the purifier being in use.

2.2 Descriptive and Stylized Facts

Our descriptive statistics paint a bleak picture of the state of indoor air pollution in Dhaka and reveal significant misconceptions among households regarding its severity and the effectiveness of air purifiers.

2.2.1 Both outdoor and indoor air pollution levels are alarmingly high, but households believe indoor air is much less polluted than outdoor air

At our study sites, average ambient PM2.5 levels were 178 $\mu g/m^3$ from November 2023 to March 2024, the period between Phase 1 and Phase 3, roughly 12 times the WHO's 24-hour safe limit of 15 $\mu g/m^3$. Importantly, indoor air pollution levels are also alarmingly high. The average indoor air pollution during our study period was 133 $\mu g/m^3$, or 9 times the WHO's 24-hour recommendation. Figure 3a shows the average indoor air pollution readings in households without air purifiers, alongside outdoor air pollution levels by time of day, clearly showing that indoor air pollution never meets WHO standards at any time of day. We estimate the ratio of indoor air pollution to ambient (outdoor) air pollution to be 0.78.[25]

[24] We used AirVisual Outdoor monitors by IQair. For more information, see www.iqair.com/products/air-quality-monitors/airvisual-outdoor-2-pm.

[25] This is smaller than Saha et al. (2025) who estimate an indoor to outdoor ratio of 0.97 during the winter season, using data from 17 households in Dhaka.

Data collected from the Phase 1 survey at the study's outset suggest that while the modal household accurately perceived outdoor air pollution as exceedingly high, rating it 10 on a scale of 10 (Figure 3b),[26] they perceived indoor air quality as better than moderately polluted, rating it 4 on a scale of 10. In Figure 3c, we display the distribution of households' perceptions of indoor versus outdoor air pollution. The overwhelming majority of households believe their indoor to outdoor ratio is 0.5 or lower, indicating a significant underestimation of indoor air pollution's extent.

2.2.2 Air purifiers are very effective in filtering polluted indoor air but households are uncertain about their effectiveness

Although our air purifiers are factory-tested, we conducted our own controlled tests in January 2024 by closing the doors and windows in a room at our field office in Dhaka. Figure 4a presents the results from these tests. When the air purifiers were turned on, air pollution levels declined from 150 $\mu g/m^3$ to 25 $\mu g/m^3$ within 30 minutes—an 80% decrease in PM2.5 levels. Importantly, when turned off—even with doors and windows closed—air pollution levels began to increase immediately, gradually returning to the levels observed without air purifiers. This highlights how PM2.5 can easily penetrate buildings.

We also analyzed real-world patterns of indoor air quality when households in our study turned on their air purifiers (Figure 4b). While this analysis is not causal—since the decision to turn on an air purifier is endogenous—we used random matching with households who did not receive an air purifier to create a "matched control" group. The levels of indoor air pollution in households with purifiers turned on remained alarmingly high (approximately 100 $\mu g/m^3$) but were significantly lower than those in the matched control group (approximately 160 $\mu g/m^3$)—a 40% decrease in PM2.5 levels.[27]

However, we find that demand for air purifiers is low. First, as we noted earlier, in our screening of households to be included in the sample we excluded those who already had an air purifier; only 15 of the 1,841 households – less than 1% – reported having an air purifier. Second, we elicit households' willingness to pay for air purifiers in the Phase 2 survey. In the control (non-monitor) group, we find an average household willingness of BDT 1,431 (USD 12.17) or 8.4% of their retail cost. In fact, no household in our sample was willing to pay the retail price (Figure 4c). This is consistent with Greenstone, Lee and Sahai (2021), who found no demand for air purifier rentals among middle-income households in urban Delhi. Third, low adoption rates for air purifiers may partially stem from uncertainty about their effectiveness. In the control group, fewer than half of the households had formed an opinion on purifier effectiveness, and

[26] This even though a majority of households do not regularly check outdoor air pollution levels (Appendix Figure A.7); nearly 83% rarely or never monitor these levels, and only 8% do so daily.

[27] The smaller effect on air pollution may be due to the air purifiers often being used on the lowest setting or because doors or windows in the room were open.

less than a third believed that purifiers removed more than 25% of air pollution from the room where they were used (Figure 4d).

2.3 Households with monitors correctly update their beliefs about indoor air quality, but do not increase their willingness to pay for purifier

In this section, we examine the effects of providing air pollution monitors on beliefs about indoor air quality and willingness to pay for air purifier. We find that despite monitors increasing perceptions of indoor air pollution levels, they do not affect willingness to pay for air purifiers.

Econometric specification. We begin our experimental analysis by examining how monitors, provided at the end of the Phase 1 survey, influenced households' perceptions of air pollution and willingness to pay for air purifiers by the time of the Phase 2 survey. We estimate the following regression specification:

$$Y_i = \alpha + \beta_1 \times Monitor_i + \beta_2 \times \mathbf{X}_i + \varepsilon_i \tag{1}$$

where Y_i represents either the belief of household i regarding the severity of indoor air pollution levels in the Phase 2 survey or the WTP for household i at the time of the Phase 2 survey, determined through a modified Becker-DeGroot-Marschak (BDM) mechanism. The term $Monitor_i$ indicates whether a household was randomly selected to receive an air quality monitor, while $\mathbf{X}_i$ includes $Attention_i$, which denotes whether the household was given both a monitor and an incentive to report their air quality monitor readings, thereby increasing their attention to the indoor air pollution levels.[28] We also control for baseline beliefs ($BeliefPhase1_i$) elicited in the Phase 1 survey before randomization when examining the effects on perceptions of air pollution. Standard errors are clustered at the household level.

We use three questions to capture perceptions of air pollution. First, households were asked to rate indoor air pollution on a scale from 0 to 10, where 10 corresponds to 'extremely polluted' and 0 to 'not polluted at all.' Second, we asked them to rate outdoor air pollution on the same scale. Finally, households rated indoor air quality relative to outdoor air quality on a scale from 0 to 10, where 10 indicates 'Indoor is equally polluted as outdoor' (implying an indoor to outdoor ratio of 1), 5 suggests 'Indoor is half as bad as outdoor' (implying an indoor to outdoor ratio of 0.5), and 0 implies there is almost no indoor air pollution.

Results. We present these results in Table 1. Figure A.8 presents the corresponding shifts in the underlying distribution. We find that the monitor treatment significantly increases households' perception of the poor quality of indoor air, with the estimate showing an increase of 0.479 points

[28] We present and discuss these results in Section XX.

or slightly over 10% (Columns 1-2). In contrast, monitors have no effect on perceptions of outdoor air pollution (Columns 3-4). Furthermore, Columns 5-6 show that the air monitors help reduce the misconception that indoor air quality is substantially better than outdoor air quality, increasing the perceived indoor to outdoor air pollution ratio from 0.43 in the control group to 0.47 among households with monitors.[29] Collectively, our results indicate that while monitors effectively update households' beliefs about the severity of indoor air pollution, they do not alter perceptions of outdoor air pollution, given that the typical household already recognizes its high levels.[30]

In the Phase 2 survey data, before households had any practical experience with air purifiers, we observed a low willingness to pay for air purifiers (8.4% of cost), even though the households are within an income segment where such a purchase would not be overwhelming. We did not find a significant treatment effect of monitors on willingness to pay for an air purifier during the Phase 2 survey (Table A.7).[31]

The null effect of air pollution monitors on WTP for air purifiers during the Phase 2 survey contrasts with our finding that monitors correctly increased households' perceptions of indoor air pollution levels and associated risk of illness in adults and children. These seemingly contradictory results suggest that simply providing information from air pollution monitors is not enough to boost adoption of air purifiers among middle-income households. For instance, although the monitor treatment may lead households to update their beliefs about indoor air pollution and its health effects, they might still doubt the effectiveness of air purifiers as a strategy to reduce pollution.

2.4 Households with purifiers are less uncertain about their effectiveness but rarely used them even when compensated for electricity costs

Next, we estimate the impact of receiving an air purifier on opinion formation regarding their effectiveness and on perceptions of their effectiveness. In our Phase 3 survey, we asked households how effective they believe commercially available air purifiers in Dhaka are at removing

[29] These specifications focus only on Phase 2 data. In Table XX, we examine the effects of the monitor treatment on households' perception of indoor air quality in Phase 3. These impacts are smaller than those observed in Phase 2, likely because we inquire about perceptions of *current* indoor air quality, and indoor air pollution levels during Phase 2 were XX $\mu g/m^3$ compared to XX $\mu g/m^3$ in Phase 3.

[30] We also examine the effect of air pollution monitors on perceived health risks from indoor air pollution, including lung cancer and stroke in adults, and acute respiratory infections in children, with risk perceptions ranging from 'no effect' to 'more than quadrupling.' We report results in Table A.6. We find that monitors increase households' perceptions of the health risks from indoor air pollution during the Phase 2 survey for adults and children by 7.3% (Column 1) and 5.6% (Column 2), respectively. In contrast, we fail to find evidence that monitors increase households' perceptions of the health risks from indoor air pollution during the Phase 3 survey (Table XX). As before, this is likely because we inquire about perceptions of the health risks from *current* indoor air quality levels, and indoor air pollution levels during Phase 2 were XX $\mu g/m^3$ compared to XX $\mu g/m^3$ in Phase 3.

[31] Furthermore, after re-estimating the impact on WTP by assigning zero willingness to pay to attrited households, we found no meaningful deviations in our estimates (Table XX).

air pollution from a room. The response options were "remove no air pollution", "remove only a quarter of the air pollution", "remove half of the air pollution", "remove three-quarters of the air pollution" and "remove almost all air pollution". We coded these responses into four binary variables. Each variable takes the value of 1 if a household believes the air purifier removed at least some, more than a quarter, more than half, or more than three-quarters of the air pollution, respectively, and 0 otherwise. Households were also given the option to select 'don't know.' Given the substantial number of households that chose this response, we created a binary variable 'has opinion.' This variable is set to 1 if the household selected any of the specific effectiveness options instead of 'don't know,' and 0 otherwise.

Econometric specification. We estimate the following regression specification:

$$Y_i = \alpha + \beta_1 \times Monitor_i + \beta_2 \times Purifier_i + \beta_3 \times Monitor_i * Purifier_i + \beta_4 \times \mathbf{X}_i + \varepsilon_i \quad (2)$$

where Y_i represents the binary variables described above for household i at the time of the Phase 3 survey. The term $Purifier_i$ indicates whether a household was randomly selected to receive an air purifier, while $\mathbf{X}_i$ includes $Attention_i$ and the interaction term between $Attention_i$ and $Purifier_i$. Standard errors are clustered at the household level.

Results. We report these results in Table 2. Figure A.9 presents the corresponding shift in the distribution of air purifier perceptions. In Column 1, we demonstrate that households provided with an air purifier in the Phase 2 survey—and thus having prior experience with one—are 28 percentage points more likely to have an opinion about air purifier effectiveness. This represents a 68% increase in the likelihood of forming an opinion. Interestingly, we also find that households provided with a monitor in the Phase 1 survey are 9 percentage points (22%) more likely to form an opinion about air purifier effectiveness. However, having both the purifier and monitor does not further influence opinion formation.[32]

In Columns 2-5, we report the effects of providing households with an air purifier during the Phase 2 survey on perceptions of their effectiveness. We find that these households are 28 percentage points (72.90%) more likely to perceive air purifiers as effective, 31 percentage points (97.46%) more likely to believe they are more than 25% effective, 28 percentage points (121.05%) more likely to think they are more than 50% effective, and 13 percentage points (180.82%) more likely to consider them more than 75% effective. Conversely, households provided with a monitor in the Phase 1 survey are 9 percentage points (24.74%) more likely to perceive air purifiers as effective, 10 percentage points (33.02%) more likely to perceive them as more than 25% effective,

[32]This is despite the fact that receiving an air purifier increases monitor use by 8.8 percentage points, or 16% (Table XX).

and 9 percentage points (38.16%) more likely to view them as more than 50% effective. However, there is no significant effect on the perception that air purifiers are more than 75% effective among those provided with a monitor. Again, we find no evidence that having both the purifier and monitor significantly alters households' perceptions of air purifiers' effectiveness, with one exception: households provided with both an air purifier and a monitor are 10 percentage points (132.88%) more likely to perceive that air purifiers are more than 75% effective, although this result is not statistically significant (p-value = 0.14).

2.4.1 Households rarely use their air purifier

In the preliminary Phase 1 survey, we asked control households (households that did not receive a monitor) how often they would use an air purifier during the winter months if they owned one (Figure A.10). 58% of households said they would use the air purifiers continuously when at home, nearly 23% indicated they would use them at least once per day, and another 9% would use them a few times a week. In contrast, fewer than 9% of households stated they would never use the air purifiers. These proportions remained more or less consistent through the Phase 2 survey.

However, households' projected use of air purifiers far exceeds their actual usage. Figure 5 shows the number of minutes an air purifier is used at the household-day level among households that were randomly selected to receive air purifiers but were not chosen to receive a monitor or electricity compensation for air purifier use. Most households, on most days, do not use the air purifier at all, with 80% of household-days seeing no air purifier usage. Household-level data paint an even starker image. More than 3 out of 4 households use an air purifier for less than 30 minutes daily on average, and only 5% of households use the purifier for more than 81 minutes in a day.

While the self-reported usage is lower than the predicted usage of the air purifiers, it is substantially above the actual usage as measured by the smart plugs. In the Phase 3 survey, the average household claim to use the air purifier for at least 30 minutes per day for more than five days in the previous week. However, using the smart plug data we can confirm that on average households used the air purifier for more than 30 minutes only 1 day per week.[33]

Electricity costs do not explain low air purifier use. We also examine whether electricity costs — approximately BDT 0.24 per hour of use — can explain low usage of air purifiers. Households that received an air purifier were randomized into three groups: those receiving no compensation, those receiving daily compensation, and those receiving monthly compensation.

[33]Discrepancies between self-reported and objective measures of health technology usage are quite common. For example, a similar magnitude of discrepancy was found in the usage of face masks during the COVID-19 pandemic in Kenya (Jakubowski et al., 2021). Furthermore, we will demonstrate that this discrepancy is consistent across both treatment and control groups; specifically, the impact of the monitor on air purifier use was similar when assessed through both self-reported and objective measures.

Econometric specification. We estimate the following regression specification:

$$Use_{it} = \alpha + \beta_1 \times Compensation_i + \beta_2 \times DailyCompensation_i + \tau_t + \varepsilon_{it} \quad (3)$$

where $Compensation_i$ signifies whether the household receives any compensation (daily or monthly) for the electricity cost, and $DailyCompensation_i$ indicates daily compensation. Our null hypothesis is that compensating for electricity costs has no effect, $\beta_1 = 0$, and the frequency of compensation (daily or otherwise) does not matter, $\beta_2 = 0$.

We included two compensation approaches to explore whether 'present bias' – the tendency to prioritize immediate benefits over future gains – influences air purifier usage. Given that present-biased individuals might be less likely to use the purifiers due to their reluctance to wait for long-term benefits, we hypothesize that air purifier usage will be higher in the daily compensation group compared to the monthly compensation group.

Results. We report these results in Figure 5 and Table 3. Receiving compensation does increase air purifier use, although the effect is not always precisely measured. Incentives increase use by 14 minutes per day, roughly 26% higher than the mean usage of households that receive no incentive. Providing the incentive on a daily basis further amplifies this effect by 9 minutes, although this estimates is also imprecise. Recall that the first payment to all households was made at the end of the first week to establish uniform trust across the two compensation groups. Therefore, the modest additional effect of daily compensation is unlikely to be attributable to households' trust in receiving payments. Overall, while these estimates suggest that electricity costs and present-bias could play some role in explaining the low use of air purifiers, these effects are relatively small compared to the significant impact of receiving air pollution monitors, which dramatically increase air purifier use.

2.5 Households with both air monitors and purifiers increased both usage and valuation of purifiers

Next, we analyze how air pollution monitors affect different measures of air purifier use—both self-reported in surveys and actual use recorded by smart plugs.

Self-reported use. We asked households in the Phase 2 and 3 surveys how often they would use air purifiers during the months of December through February if they owned one.[34] We convert this question into a binary variable for above and below median projected use. Since over half of respondents said they would use the air purifier all the time when home, this effectively creates a binary variable for whether or not the household would use it constantly while at home.

[34]Response options were (a) all the time when home, (b) at least once per week, (c) a few times per week, (d) once per week, (e) once per month, (f) very rarely, (g) never, (h) don't know or (i) refused.

Econometric specification. We estimate following regression specification:

$$\begin{aligned} SelfUse_i =& \alpha + \beta_1 \times Monitor_i + \beta_2 \times Attention_i + \\ & \gamma_1 SelfUsePhase1_i + \varepsilon_i \end{aligned} \tag{4}$$

where $SelfUse_i$ represents the projected self-reported use or actual self-reported use of household i in the Phase 2 and Phase 3 surveys, respectively. We control for projected use reported during the Phase 1 survey ($SelfUsePhase1_i$) before randomization. Standard errors are clustered at the household level.

Results. We report the effects of the monitor treatment on this outcome in Table A.8. Column 1 indicates that monitors increase the proportion of households stating they would use air purifiers all the time by 19.5 percentage points, or 35.4%, in the Phase 2 survey. In Phase 3 survey, we asked households how many days in the past week they had used air purifiers. In Column 2, we show that households in the monitor group reported using air purifiers for at least 30 minutes on an extra half day, compared to a control group average of 5 days. Finally, at Phase 3 we asked an ex-post version of the question presented in Column 1 – how often households used air purifiers – using the same options as in Column 1. We show that the monitor treatment increased the likelihood of households self-reporting air purifier usage as "all the time when home" by 14.4 percentage points, or nearly 60% (Column 3).

Use recorded by smart plugs. We also estimate the effect of air pollution monitors on an objective measure of air purifier use, based on continuous minute-by-minute data from the smartplugs that we attached to the air purifiers.

Econometric specification. We estimate the following regression specification:

$$Use_{it} = \alpha + \beta_1 \times Monitor_i + \beta_2 \times Attention_i + \tau_t + \varepsilon_{it} \tag{5}$$

where Use_{it} indicates whether household i used the air purifier during date or week t and τ_t represents date or week fixed effects. Standard errors are clustered at the household level.

Results. We report these results in Table 4 and Figure 6. As discussed earlier, unlike the self-reported data, the smart plugs data show extremely low use of air purifiers: the average control household used an air purifier for just over 33 minutes a day. However, providing households with an air monitor increases the time that the air purifier is running by 74 minutes per day. This is a massive 225% treatment effect.[35]

[35]Of the originally intended 372 households, 309 remained in our sample. Including these households and imputing their air purifier usage as zero yields quantitatively equivalent estimates with similar statistical power (Table XX).

Next, using data from the smart plugs, we constructed a weekly measure of air purifier usage similar to the self-reported measure: the number of days per week the purifier was used for more than 30 minutes. This metric was generated for all intervention weeks and specifically for the week preceding the Phase 3 survey (Columns 2 and 3). We found that households in the monitor group reported using air purifiers for at least 30 minutes on an additional half-day, compared to an average of 1 day in the control group. The absolute increase is qualitatively and quantitatively consistent with increases estimated using self-reported data. This consistency is reassuring and suggests that, although discrepancies exist between self-reported and objective measures of air purifier use, they are consistent across both treatment and control groups.

2.5.1 The value of the information provided by the monitor is equivalent to an hourly incentive of BDT 4.2 to use the air purifier

To assess the value of the information from air pollution monitors in promoting air purifier use, we randomized additional incentives at the conclusion of our planned study, from April 1, 2024 to April 30, 2024. Specifically, we randomized households that had received an air purifier into three groups: (a) a control group, (b) a group that received an incentive of BDT 5 for each hour of air purifier use, and (c) a group that received an incentive of BDT 10 for each hour of air purifier use. These incentives significantly exceed the electricity costs (roughly BDT 0.24 per hour) associated with operating the air purifiers.

Econometric specification. We estimate the following regression specification:

$$Use_{it} = \alpha + \beta_1 \times AnyIncentive_i + \beta_2 \times BDT10Incentive_i + \tau_t + \varepsilon_{it} \tag{6}$$

where $AnyIncentive_i$ indicates whether the household was offered at least a 5 BDT per hour incentive, and $BDT10Incentive_i$ indicates if the household was offered the larger incentive of 10 BDT per hour of air purifier use. Standard errors are clustered at the household level.

Results. We report these results in Table A.9. Column 1 shows that providing households with at least 5 BDT per hour increases air purifier usage by 7.83 percentage points (113 minutes per day), compared to a 4.78 percentage point increase (69 minutes per day) from providing a monitor. Column 2 breaks down these estimates further; we find that the BDT 5 per hour incentive increased air purifier use by 5.7 percentage points (82 minutes per day), roughly equal to the effect of providing a monitor. These effects are substantial: the 5 BDT per hour incentive increases usage by over 500% relative to the control mean, while the increase from monitors is just under 500%. This treatment allows us to quantify the value of the indoor air quality information provided by monitors in promoting air purifier use. Figure 5 visually compares the effects of monitors and incentives on air purifier usage. Assuming a linear increase in usage from a zero

incentive to a 5 BDT incentive, the effective incentive equivalent to the monitor's impact would be BDT 4.2 per hour. Paying this hourly incentive based on the usage rates observed would amount to 0.3% of the average monthly income each month.

2.5.2 Effects of Monitor on Adoption of Air Purifiers

We elicited revealed preference measures for willingness to pay (WTP) for air purifiers at the end of both the Phase 2 and 3 surveys. At the end of Phase 2, we employed a modified BDM mechanism, as previously explained. During the Phase 3 survey, we conducted exercises to gauge willingness to pay for an additional air purifier and willingness to accept (WTA) payments for households considering selling back their existing air purifiers.

We report five main findings: First, despite monitors increasing both perceptions of indoor air pollution levels and air purifier use, they do not affect WTP for air purifiers at the time of the Phase 2 survey. This suggests an additional or different binding constraint on raising WTP for air purifiers. Second, owning an air purifier not only leads to opinion formation among households but also enhances their perception of the purifier's effectiveness. Third, the price at which households are willing to sell back their air purifiers after using them is, on average, ten times higher than their initial WTP, suggesting a substantial valuation increase after usage. Fourth, monitors increase the price that purifier-owning households are willing to accept to sell their purifier. Fifth, monitors increase WTP for an additional, second purifier during the Phase 3 survey among purifier-owning households, but do not increase WTP for a first purifier among non-purifier owning households.

Information about indoor pollution levels and practical experience with purifiers increases their valuation In this section, we examine: (a) the impact of monitor provision on the willingness to accept (WTA) selling back purifiers among households that received an air purifier in Phase 2, (b) the effect of monitor provision on the willingness to pay (WTP) for an air purifier among households that did not receive one in Phase 2, and (c) the differences between the impact of purifier provision alone and the combined impact of monitor and purifier provision on the willingness to pay for a second purifier among households that received their first purifier in Phase 3.[36]

Before we estimate these effects, it is important to note that the price at which households are willing to sell back their air purifiers after using them is, on average, ten times higher than their initial (Phase 2) WTP, suggesting a substantial valuation increase after usage. This difference may be influenced by an endowment effect from loss aversion, although such effects are

[36] Recall that we cannot test the effects of air purifiers on WTA since only households that had already received an air purifier from us were eligible for the WTA exercise. Similarly, we cannot capture the willingness to pay for their first air purifier among households that received one in Phase 2. For these households, we can only elicit willingness to pay for a second air purifier.

typically much lower. Brown et al. (2024) finds that, across numerous studies, the average loss aversion coefficient is 2.0, with coefficients above 5 being extremely rare. Furthermore, Tunçel and Hammitt (2014) observes that the WTP/WTA gap tends to be smaller in studies using incentive-compatible elicitation mechanisms. Therefore, the substantial difference between WTP and WTA suggests that experience with an air purifier significantly enhances its valuation by households.

Econometric specifications. To examine the impact of monitor provision on the willingness to accept selling back purifiers among households that received an air purifier in Phase 2, we estimate the following regression specification:

$$WTA_i = \alpha + \beta_1 \times Monitor_i + \beta_2 \times \mathbf{X}_i + \varepsilon_i \tag{7}$$

where WTA_i represents the WTA for household i at the time of the Phase 3 survey, determined through a modified Becker-DeGroot-Marschak (BDM) mechanism. We restrict the sample to households that were randomly assigned to receive an air purifier in Phase 2. Standard errors are clustered at the household level.

To examine the effect of monitor provision on the willingness to pay (WTP) for an air purifier among households that did not receive one in Phase 2, and the differences between the impact of purifier provision alone and the combined impact of monitor and purifier provision on the willingness to pay for a second purifier among households that received their first purifier in Phase 3, we estimate the following regression specification:

$$\begin{aligned} WTP_{it} = \alpha &+ \beta_1 \times Monitor_i + \beta_2 \times Purifier_i + \beta_3 \times Phase3_t \\ &+ \beta_4 \times Monitor_i * Purifier_i \\ &+ \beta_5 \times Monitor_i * Phase3_t + \beta_6 \times Purifier_i * Phase3_t \\ &+ \beta_7 \times Monitor_i * Purifier_i * Phase3_t + \beta_8 \times \mathbf{X}_i + \varepsilon_{it} \end{aligned} \tag{8}$$

where WTP_i represents the WTP for household i at the time of the Phase 2 or Phase 3 survey, determined through a modified Becker-DeGroot-Marschak (BDM) mechanism. Standard errors are clustered at the household level. β_5 captures the change in the willingness to pay for an air purifier between Phase 2 and Phase 3 among households that received a monitor but not an air purifier. β_6 captures the change in the willingness to pay for an air purifier between Phase 2 and Phase 3 among households that received one in Phase 2. β_7 captures the change in the willingness to pay for an air purifier between Phase 2 and Phase 3 among households that received an air purifier (in Phase 2) and a monitor (in Phase 1).

Results. We report these results in Table 5. First, we estimate Equation 7: we find that possession of a monitor increases the willingness to accept by BDT 3,839.3, which is 26% above the

control mean (Column 1) among households that received an air purifier. Specifically, while the control group's mean WTA is approximately BDT 14,500—below the retail price—households that received both a purifier and a monitor placed a higher valuation on the purifiers, exceeding the retail price of BDT 17,000.

In Table A.10, we present estimates from Equation 8. While these estimates are statistically insignificant, the magnitude of the point estimates is still informative. We find that households receiving both a monitor and a purifier increased their valuation of the purifier between Phase 2 and Phase 3 by BDT 556.96, which is 40% of the control mean, although the p-value is 0.28. In contrast, households that received only the purifier did not show a similar increase in valuation, with a point estimate of just BDT 72.07. Likewise, households that received only a monitor observed no significant increase in valuation of the air purifier, with a point estimate of BDT 21.06.

Overall, as outlined below, our findings align with a straightforward model where air purifier adoption hinges on beliefs about both indoor air pollution (the problem) and the effectiveness of purifiers (the solution). Practical experience with purifiers, alongside heightened awareness of indoor air pollution levels, are essential factors in boosting air purifier adoption.

3 Experiment 2

3.1 Research Design and Data Collection

We conducted a second experiment with 2,400 households from four additional housing associations in the Mirpur neighborhood of Dhaka between November 2024 and January 2025. This experiment aimed to investigate the key mechanism behind our first experiment's finding that combining monitors and purifiers significantly increased both device usage and valuation. Specifically, we wanted to determine whether this effect occurs because households separately recognize both poor indoor air quality and purifier effectiveness, or because the monitor provides immediate visual proof of the purifier's impact when activated. As shown in Figure A.13, these housing associations were located near those in our first experiment.

Before implementing any treatments, our survey collected baseline information including household demographics (age and education of the household head), beliefs about health risks from air pollution, perceptions of indoor and outdoor air quality, and views on air purifier effectiveness. We then randomly assigned households to six treatment arms:

1. Control: A pure control group receiving no intervention
2. Credit Only: A group offered a 12-month interest-free loan to purchase a purifier
3. Purifier Only: A group experiencing a 10-minute demonstration of just the air purifier
4. Monitor Only: A group experiencing a 5-minute demonstration of just the air quality monitor

5. Both (Separately): A group where the monitor was turned on for 5 minutes and then the purifier for 5 minutes as distinct demonstrations

6. Both (Together): A group where the monitor was turned on for 5 minutes followed by activating the purifier for 5 minutes while the monitor remained on, allowing households to observe pollution levels dropping in real-time

For all households in treatment groups involving the air quality monitor, our enumerators recorded the displayed pollution levels. After observing substantial variation in purifier effectiveness in the 'Both (Together)' group, we modified our data collection protocol a quarter of the way through the survey. For this group, enumerators began recording air quality levels both before and after the purifier was activated to precisely measure the change in pollution levels each household observed. Figure 7 shows the variation in air purifier effectiveness. Of course, this variation is not experimental but depends on numerous factors during the demonstration: environmental conditions (room size, ceiling height, indoor and outdoor pollution levels, humidity, temperature); structural elements (number of windows and doors, whether they're open or closed, air circulation patterns, apartment location); placement factors (purifier position, distance from monitor); and circumstantial variables (protocol adherence by enumerators, time of day, date, number of people present, ongoing activities like cooking or smoking). However, reassuringly, we find that this variation in air purifier effectiveness is not correlated with household characteristics such as the household head's education and age, or with pre-intervention beliefs about air pollution, health risks, or purifier effectiveness (Table A.11).

After administering these treatments, we repeated our questions about health risk beliefs, air quality perceptions, and views on purifier effectiveness to measure how each intervention affected these outcomes. We then employed a modified Becker-DeGroot-Marschak (BDM) mechanism to elicit households' willingness to pay for air purifiers, using the same methodology as in our first experiment to ensure comparability of results.

Table A.12 confirms our successful randomization, demonstrating balance across all but one pre-treatment variables between the different treatment groups. We also verified balance across most pre-treatment variables when comparing all households in all treatment groups except for the 'Both (Together)' group, where we included only households once enumerators began recording air quality levels both before and after purifier activation (on December 8) (Table A.13). Unsurprisingly, IAP levels are higher for the 'Both (Together)' group since AAP (and consequently IAP) levels increased after December 7. Lastly, we conducted a balance test to confirm there are no systematic differences in pre-treatment variables across treatment groups for households surveyed after December 7 (Table A.14).

3.2 Purifier valuation increases when people see pollution levels drop on monitors after activating purifiers

Our findings replicate results from the first experiment while also revealing two additional insights: (i) access to credit has no impact on households' WTP for air purifiers; (ii) purifier valuation increases when people can directly observe both that their indoor air quality is poor and that the purifier effectively reduces pollution levels in real-time.

Econometric specification. We estimate the following regression specification:

$$\begin{aligned} Y_i = &\alpha + \beta_1 \times PurifierOnly_i + \beta_2 \times MonitorOnly_i + \\ &\beta_3 \times Both(Separately)_i + \beta_4 \times Both(Together)_i + \\ &\beta_5 \times CreditOnly_i + \beta_6 \times \mathbf{X}_i + \varepsilon_i \end{aligned} \tag{9}$$

where Y_i represents either the belief of household i regarding the severity of indoor air pollution levels or air purifier effectiveness or the WTP for household i, determined through the modified Becker-DeGroot-Marschak (BDM) mechanism like in Experiment 1. Similarly, both perceptions of air pollution and air purifier effectiveness are measured using the same survey questions as in Experiment 1.

Results. We present these results in Tables 6 and 7.[37] First, access to credit had no impact on households' beliefs or WTP for air purifiers. This result perhaps isn't surprising, as this sample resembles the one from Experiment 1: residents of middle-income apartment blocks with 36% owning air conditioners, which cost at least twice as much as air purifiers. Yet, this finding stands in stark contrast to the impact of credit on technology adoption seen with energy-efficient charcoal cookstoves in Nairobi (Berkouwer and Dean, 2022).

Second, households exposed only to air monitors recognized their indoor air was more polluted but did not increase their WTP for purifiers.[38] Third, households who only experienced air purifiers became more certain about purifier effectiveness but showed no increase in WTP. Fourth, households exposed to both devices separately (monitor first, then purifier) recognized both indoor pollution severity and purifier effectiveness, yet still showed no increase in WTP.

Fifth, households who experienced both devices simultaneously displayed a dramatic pattern tied directly to observable results: while all households recognized their indoor air was polluted regardless of purifier performance, those witnessing larger pollution (>70%) drops were twice as likely to rate purifiers as effective compared to groups who only saw the purifier demonstration

[37] These tables exclude the 101 observations from the 'Both (Together)' group for which we did not collect IAP readings both before and after air purifier activation. Tables A.15 and A.16 show entirely consistent results for the full sample of 2,400 households.

[38] Consistent with Experiment 1, we also find that households exposed to a monitor are more likely to believe that indoor air pollution carries health risks, although these estimates are not always statistically significant (Tables A.17 and A.18).

or saw the purifier and monitor demonstration separately. Moreover, households seeing minimal improvement are no more likely to consider purifiers effective. Similarly, their willingness to pay varied dramatically based on observed results – households witnessing drops exceeding 90% increased their WTP by 20% compared to the control group, while those seeing minimal improvement decreased their WTP by 25%.[39]

Findings four and five can be reconciled in two complementary ways. Under a rational Bayesian framework, the difference arises solely due to the magnitude of belief movements and uncertainty reductions (Augenblick and Rabin, 2021). For households in the 'Both (Separately)' group, beliefs about purifier effectiveness shifted modestly, and uncertainty reductions were correspondingly smaller, leaving WTP unchanged. For households in the 'Both (Together)' group, clearer, more direct evidence resulted in substantially larger belief movements and uncertainty reductions, especially for those who observed larger PM2.5 drops, significantly increasing WTP. Alternatively, a non-Bayesian interpretation suggests that sequential exposure led households to update beliefs without fully reducing uncertainty due to cognitive biases or informational processing constraints (e.g., anchoring on priors), thus limiting changes in valuation. Simultaneous exposure, however, allowed households to immediately integrate evidence, aligning belief movements with uncertainty reductions more closely and driving substantial increases in WTP.

Overall, these results demonstrate that purifier valuation increases when people can directly observe both that their indoor air quality is poor and that the purifier effectively reduces pollution levels in real-time.

4 A Simple Model for Valuation of Preventative Health Technologies

We present a simple model illustrating how households value preventative health technologies based on their beliefs about the severity of the underlying problem and the technology's effectiveness. We focus on indoor air pollution (IAP) and air purifiers, though this model applies to other technologies characterized by similarly invisible risks and uncertain effectiveness.

We start from a household utility function:

$$U = Income - Purifier \times p_{purifier} - PerceivedIAP \times (1 - PerceivedPE \times Purifier) \quad (10)$$

Here, $Purifier$ is a binary indicator equal to 1 if the household purchases the purifier, and 0 otherwise; $p_{purifier}$ is the purifier price; $PerceivedIAP$ represents the household's belief about indoor air pollution relative to an acceptable pollution level; if the household perceives pollution below this threshold, $PerceivedIAP = 0$. Finally, $PerceivedPE$ represents the household's belief

[39] We find similar estimates when we restrict the sample to households surveyed after December 7 (Tables A.19 and A.20).

about the share of pollution removed by the purifier.

A household's willingness to pay (WTP) for a purifier, derived from equation 10, is the price at which a household is indifferent about purchasing an air purifier:

$$WTP = PerceivedIAP \times PerceivedPE \tag{11}$$

This formulation generates an "O-ring" valuation structure (Kremer, 1993), meaning valuation collapses to zero if either perceived pollution or effectiveness is zero.

Households also make ongoing decisions about using a purifier based on the marginal cost (MC_t) at time t, including electricity costs, noise, and psychic costs. Usage occurs if:

$$MC_t \leq PerceivedIAP_t \times PerceivedPE \tag{12}$$

We assume that a household i without an air monitor adopts the community-average belief about IAP:

$$PerceivedIAP_i = \overline{PerceivedIAP}_i \tag{13}$$

A household updates beliefs about purifier effectiveness *only if* it has access to an air monitor and can directly observe reductions in pollution:

$$PerceivedPE_i = \begin{cases} PE, & \text{if household owns purifier } \textbf{and} \text{ monitor} \\ \overline{PerceivedPE}_i, & \text{otherwise} \end{cases} \tag{14}$$

Given these assumptions, there are two possible equilibria:

Good Equilibrium (High Adoption):

$$p_{purifier} \leq \overline{PerceivedIAP}_i \times \overline{PerceivedPE}_i = \overline{PerceivedIAP}_i \times PE \tag{15}$$

Here, most households correctly believe IAP is severe and purifiers are effective. Even households without direct experience default to correct community beliefs and purchase purifiers.

Bad Equilibrium (Low Adoption):

$$p_{purifier} > \overline{PerceivedIAP}_i \times \overline{PerceivedPE}_i \tag{16}$$

In this scenario, households underestimate either IAP severity, purifier effectiveness, or both. Households receiving only purifiers without monitors do not update beliefs about effectiveness, thus remaining at low valuations:

$$WTP_i = PerceivedIAP_i \times \overline{PerceivedPE}_i \tag{17}$$

Consequently, neither correcting beliefs about IAP severity nor providing purifiers alone significantly increases valuation or usage. To shift the community from a "bad" equilibrium to the "good" equilibrium, it becomes necessary to simultaneously provide air monitors and purifiers to sufficiently many households or implement coordinated campaigns providing observable evidence of both the severity of pollution and purifier effectiveness.

This model is applicable beyond air purifiers in contexts where households face health or environmental risks that are invisible or difficult to directly perceive, and where belief updating about the effectiveness of preventive technologies requires complementary monitoring devices. Examples include water purification technologies targeting invisible chemical contaminants like arsenic, which require water-quality tests to confirm both contamination levels and filter efficacy; noise-canceling systems for chronic noise pollution, which depend on noise-level monitors to prove effectiveness; and home energy-efficiency upgrades (such as insulation), where energy-use monitors or measured utility savings are required to update household beliefs.

5 Conclusion

Dhaka, Bangladesh, consistently ranks as one of the world's most polluted cities, yet fewer than 1% of middle-class households own an air purifier. Why don't these households, who can afford air purifiers, adopt them despite the extremely high levels of air pollution? We find that while indoor air is nearly as polluted as outdoor air, households believe indoor air is much cleaner. Furthermore, although air purifiers are highly effective at removing pollutants, households are uncertain about their effectiveness. Consistent with these misbeliefs, the average willingness to pay for an air purifier is less than a tenth of its retail cost. To address these misconceptions, we conducted a multi-phase field experiment by providing air monitors and purifiers to households. Those receiving air monitors realized that their indoor air was more polluted than those without monitors, but this did not increase their willingness to pay for purifiers. Similarly, providing air purifiers reduced uncertainty about their effectiveness, yet households seldom used them—even when compensated for electricity costs. However, households that received both monitors and purifiers significantly increased both their usage and valuation of the purifiers. A second experiment finds that these increases happen because people can see proof that indoor air quality is poor and that the purifier works when their monitor shows pollution numbers dropping after turning it on. Our findings suggest that correcting misperceptions about both the severity of the problem and the effectiveness of the solution is necessary to boost the adoption and use of preventive health technologies.

References

Ahmad, Husnain F, Matthew Gibson, Fatiq Nadeem, Sanval Nasim, and Arman Rezaee. 2023. "Forecasts: Consumption, production, and behavioral responses." *Mimeo*.

Anderson, Michael L, Minwoo Hyun, and Jaecheol Lee. 2022. "Bounds, Benefits, and Bad Air: Welfare Impacts of Pollution Alerts." National Bureau of Economic Research.

Apte, Joshua S, Julian D Marshall, Aaron J Cohen, and Michael Brauer. 2015. "Addressing global mortality from ambient PM2. 5." *Environmental science & technology*, 49(13): 8057–8066.

AQLI. 2023. "The Air Quality Life Index." Data set.

Ashraf, Nava, B. Kelsey Jack, and Emir Kamenica. 2013. "Information and subsidies: Complements or substitutes?" *Journal of Economic Behavior & Organization*, 88: 133–139.

Ashraf, Nava, James Berry, and Jesse M. Shapiro. 2010. "Can Higher Prices Stimulate Product Use? Evidence from a Field Experiment in Zambia." *American Economic Review*, 100(5): 2383–2413.

Augenblick, Ned, and Matthew Rabin. 2021. "Belief Movement, Uncertainty Reduction, and Rational Updating." *The Quarterly Journal of Economics*, 136(2): 933–985.

Baquié, Sandra, A. Patrick Behrer, Xinming Du, Alan Fuchs, and Natsuko K. Nozaki. 2024. "Know Thy Foe: Information Provision and Air Pollution in Tbilisi." World Bank Policy Research Working Paper 10852.

Barwick, Panle Jia, Shanjun Li, Liguo Lin, and Eric Yongchen Zou. 2024. "From fog to smog: The value of pollution information." *American Economic Review*, 114(5): 1338–1381.

Baylis, Patrick, Michael Greenstone, Kenneth Lee, and Harshil Sahai. 2024. "Is the Demand for Clean Air Too Low? Experimental Evidence from Delhi."

Berkouwer, Susanna B, and Joshua T Dean. 2022. "Credit, attention, and externalities in the adoption of energy efficient technologies by low-income households." *American Economic Review*, 112(10): 3291–3330.

Berry, James, Greg Fischer, and Raymond Guiteras. 2020. "Eliciting and utilizing willingness to pay: Evidence from field trials in Northern Ghana." *Journal of Political Economy*, 128(4): 1436–1473.

Brown, Alexander L, Taisuke Imai, Ferdinand M Vieider, and Colin F Camerer. 2024. "Meta-analysis of empirical estimates of loss aversion." *Journal of Economic Literature*, 62(2): 485–516.

Cefala, Luisa, Supreet Kaur, Heather Schofield, and Yogita Shamdasani. 2024. "Habit Formation in Labor Supply." Working Paper.

Dupas, Pascaline. 2011. "Health behavior in developing countries." *Annu. Rev. Econ.*, 3(1): 425–449.

Dupas, Pascaline. 2014. "Getting essential health products to their end users: Subsidize, but how much?" *Science*, 345: 1279–1281.

GBD Risk Factors. 2024. "Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021." *Lancet (London, England)*, 403(10440): 2162–2203.

Greenstone, Michael, and B Kelsey Jack. 2015. "Envirodevonomics: A research agenda for an emerging field." *Journal of Economic Literature*, 53(1): 5–42.

Greenstone, Michael, Kenneth Lee, and Harshil Sahai. 2021. "Indoor air quality, information, and socioeconomic status: Evidence from Delhi." Vol. 111, 420–424, American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203.

Guiteras, Raymond, David I. Levine, Thomas Polley, and Brian Quistorff. 2016. "Credit Constraints, Present Bias and Investment in Health: Evidence from Micropayments for Clean Water in Dhaka." *Mimeo*.

IQAir. 2024. "World's most polluted cities, 2017-2023."

Ito, Koichiro, and Shuang Zhang. 2020. "Willingness to pay for clean air: Evidence from air purifier markets in China." *Journal of Political Economy*, 128(5): 1627–1672.

Jakubowski, Aleksandra, Dennis Egger, Carolyne Nekesa, Layna Lowe, Michael Walker, and Edward Miguel. 2021. "Self-reported vs directly observed face mask use in Kenya." *JAMA Network Open*, 4(7): e2118830–e2118830.

Jalan, Jyotsna, and E. Somanathan. 2008. "The importance of being informed: Experimental evidence on demand for environmental quality." *Journal of Development Economics*, 87(1): 14–28.

Kremer, Michael. 1993. "The O-ring theory of economic development." *The quarterly journal of economics*, 108(3): 551–575.

Kremer, Michael, Gautam Rao, and Frank Schilbach. 2019. "Behavioral development economics." In *Handbook of Behavioral Economics: Applications and Foundations 1*. Vol. 2, 345–458. Elsevier.

Kremer, Michael, Jessica Leino, Edward Miguel, and Alix Peterson Zwane. 2011. "Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions." *The Quarterly Journal of Economics*, 126(1): 145–205.

Levine, David I, Theresa Beltramo, Garrick Blalock, Carolyn Cotterman, and Andrew M Simons. 2018. "What impedes efficient adoption of products? Evidence from randomized sales offers for fuel-efficient cookstoves in Uganda." *Journal of the European Economic Association*, 16(6): 1850–1880.

Madajewicz, Malgosia, Alexander Pfaff, Alexander van Geen, Joseph Graziano, Iftikhar Hussein, Hasina Momotaj, Roksana Sylvi, and Habibul Ahsan. 2007. "Can information alone change behavior? Response to arsenic contamination of groundwater in Bangladesh." *Journal of Development Economics*, 84(2): 731–754.

Magruder, Jeremy R. 2018. "An assessment of experimental evidence on agricultural technology adoption in developing countries." *Annual Review of Resource Economics*, 10(1): 299–316.

Metcalfe, Robert, and Sefi Roth. 2025. "Making the Invisible Visible: The Impacts of Revealing Indoor Air Pollution on Behavior and Welfare." Mimeo.

Miller, Grant, and A. Mushfiq Mobarak. 2013. "Gender Differences in Preferences, Intra-Household Externalities, and the Low Demand for Improved Cookstoves." *Mimeo*.

Mobarak, Ahmed Mushfiq, Puneet Dwivedi, Robert Bailis, Lynn Hildemann, and Grant Miller. 2012. "Low demand for nontraditional cookstove technologies." *Proceedings of the National Academy of Sciences*, 109(27): 10815–10820.

Neidell, Matthew. 2009. "Information, avoidance behavior, and health: the effect of ozone on asthma hospitalizations." *Journal of Human resources*, 44(2): 450–478.

Oliva, Paulina, Matei Alexianu, and Rania Nasir. 2019. "Suffocating prosperity: Air pollution and economic growth in developing countries." *International Growth Centre: Growth Brief*.

Ozkaynak, H., J. Xue, J. Spengler, L. Wallace, E. Pellizzari, and P. Jenkins. 1996. "Personal exposure to airborne particles and metals: Results from the Particle TEAM study in Riverside, California." *Journal of Exposure Analysis and Environmental Epidemiology*, 6(1): 57–78.

Patel, Dev. 2023. "Learning About a Warming World: Attention and Adaptation in Agriculture." *Working Paper*.

Pattanayak, Subhrendu K, Marc Jeuland, Jessica J Lewis, Faraz Usmani, Nina Brooks, Vasundhara Bhojvaid, Abhishek Kar, Lisa Lipinski, Laura Morrison, Omkar Patange, et al. 2019. "Experimental evidence on promotion of electric and improved biomass cookstoves." *Proceedings of the national Academy of Sciences*, 116(27): 13282–13287.

Saha, Provat K, Ahsan Habib, Dipika R Prapti, Talha Jubair, Abu U Zarrah, Chowdhury A Hossain, Sheikh M Rahman, Abdus Salam, Md Aynul Bari, and Julian D Marshall. 2025. "Characterizing indoor-outdoor PM2. 5 concentrations using low-cost sensor measurements in residential homes in Dhaka, Bangladesh." *Atmospheric Environment*, 342: 120945.

Sater, Abdel Rita, Mathieu Perona, Elise Huillery, and Coralie Chevallier. 2021. "The effectiveness of personalised versus generic information in changing behaviour: Evidence from an indoor air quality experiment." Mimeo.

Tunçel, Tuba, and James K Hammitt. 2014. "A new meta-analysis on the WTP/WTA disparity." *Journal of Environmental Economics and Management*, 68(1): 175–187.

van Donkelaar, Aaron, Melanie S Hammer, Liam Bindle, Michael Brauer, Jeffery R Brook, Michael J Garay, N Christina Hsu, Olga V Kalashnikova, Ralph A Kahn, Colin Lee, et al. 2021. "Monthly global estimates of fine particulate matter and their uncertainty." *Environmental Science & Technology*, 55(22): 15287–15300.

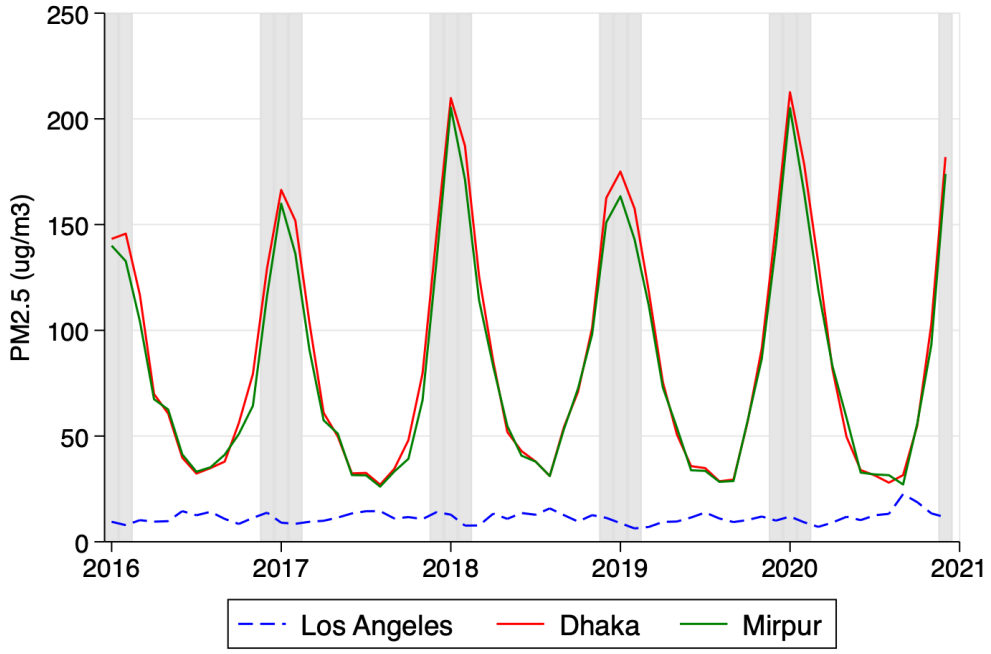
Verhoogen, Eric. 2023. "Firm-level upgrading in developing countries." *Journal of Economic Literature*, 61(4): 1410–1464.

Vette, Alan F., Anne W. Rea, Philip A. Lawless, Charles E. Rodes, Gary Evans, V. Ross Highsmith, and Linda Sheldon. 2001. "Characterization of Indoor-Outdoor Aerosol Concentration Relationships during the Fresno PM Exposure Studies." *Aerosol Science and Technology*, 34(1): 118–126.

World Health Organisation. 2019. "Air Pollution." 4(18).

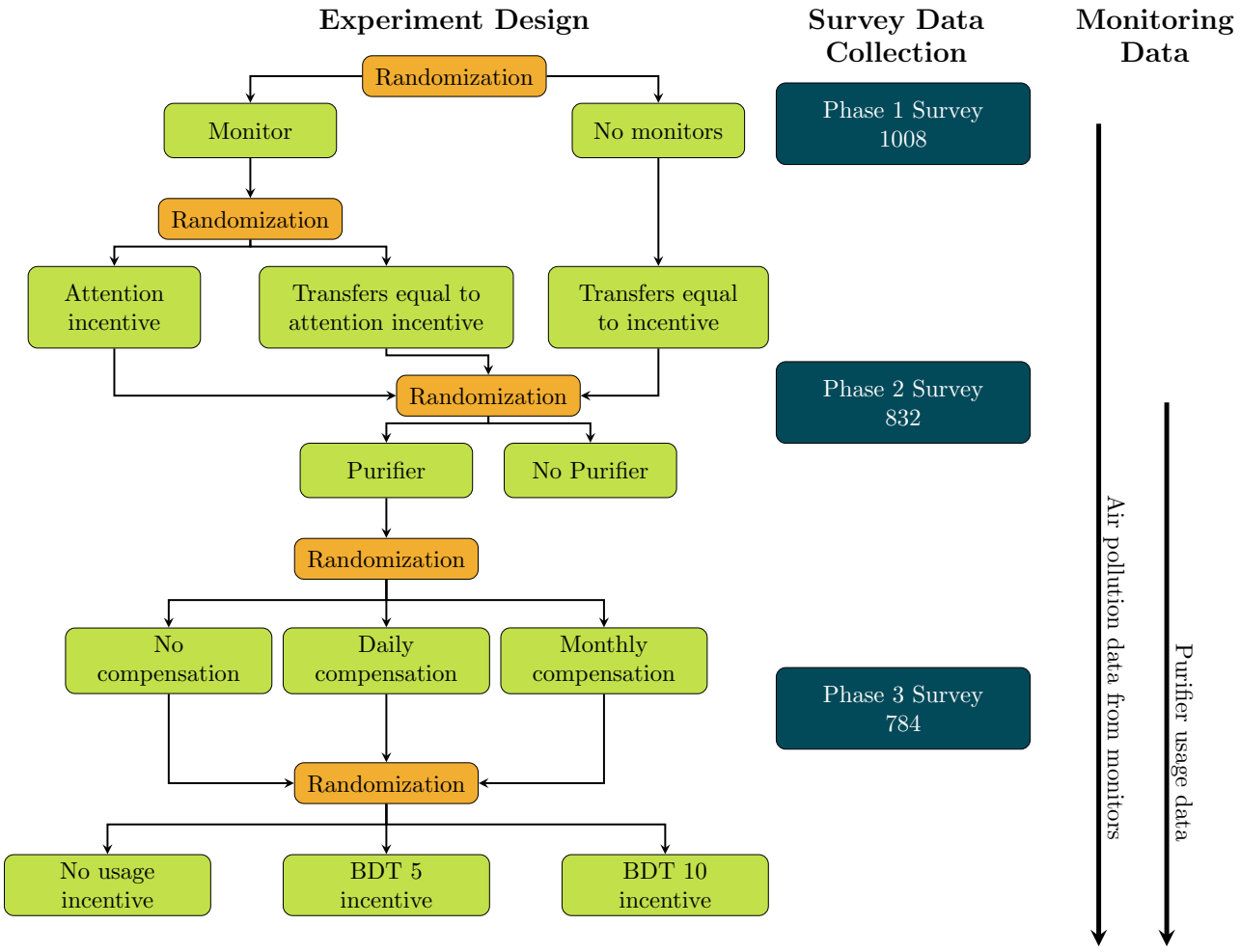
Figures

Figure 1: Air Pollution Levels in Dhaka 2016-2021



Notes: The figure shows monthly satellite-derived air pollution levels in Dhaka, Mirpur (the locality in Dhaka where the experiment is carried out), and Los Angeles (for reference). The months when most of the experiment took place are shaded in gray (December, January, and February). Data is from van Donkelaar et al. (2021).

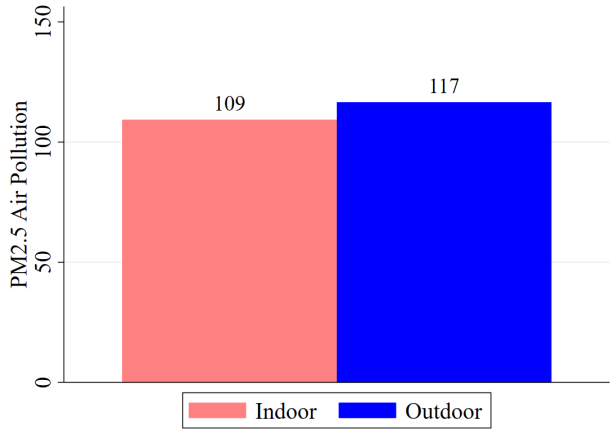
Figure 2: Visual representation of research design



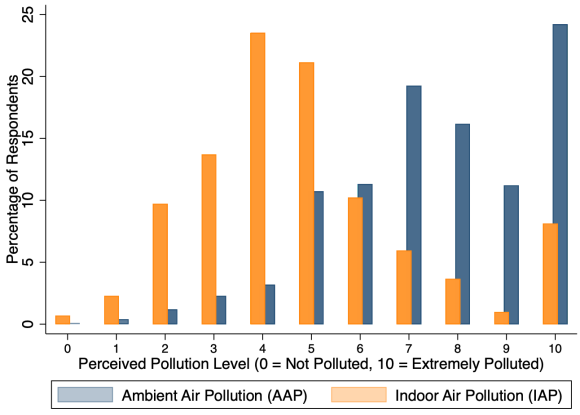
Notes: This figure shows the research design and data collection. We started the Phase 1 survey on 12 November 2023 and concluded it on 30 November 2023. We conducted the Phase 2 survey in December 2023 and January 2024 and the Phase 3 survey in March 2024.

Figure 3: Indoor vs. Outdoor Air Pollution: Reality and Phase 1 Perceptions

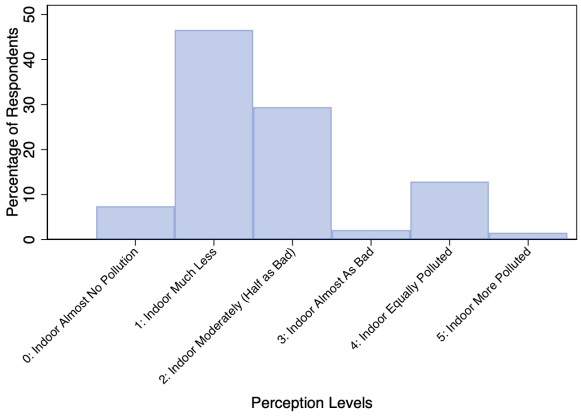
(a) Indoor vs. Outdoor Pollution



(b) Beliefs About Air Pollution



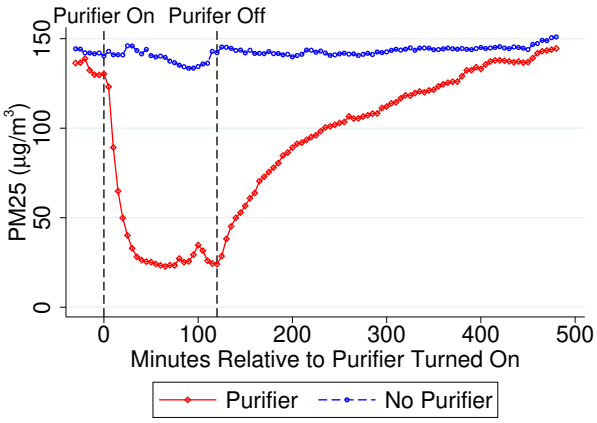
(c) Beliefs About Indoor-Outdoor Ratio



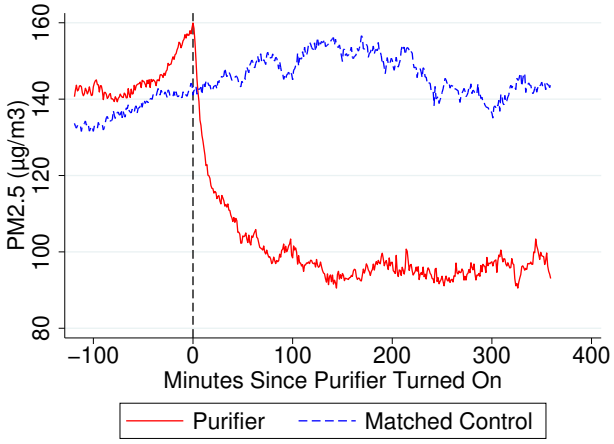
Notes: This figure provides descriptive statistics on actual and perceived air pollution levels. Panel (a) shows average indoor and ambient air pollution (measured in $\mu g/m^3$) immediately after the Phase 1 survey. Panel (b) shows beliefs the severity of indoor and ambient air pollution levels (Phase 1 survey) and Panel (c) shows households' beliefs about the relative severity of IAP and AAP during the phase 1 survey.

Figure 4: Air Purifier Effectiveness: Real Effects vs. Perceptions

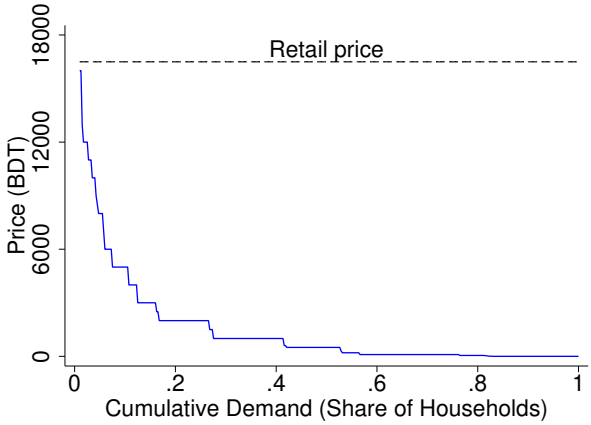
(a) Purifier Effectiveness: Controlled conditions



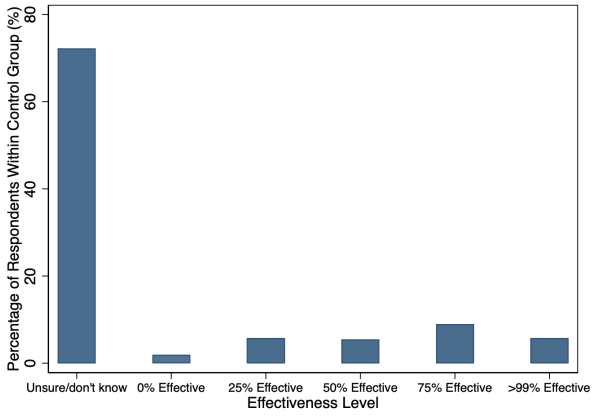
(b) Purifier Effectiveness: Treatment households



(c) Demand for purifiers (control)



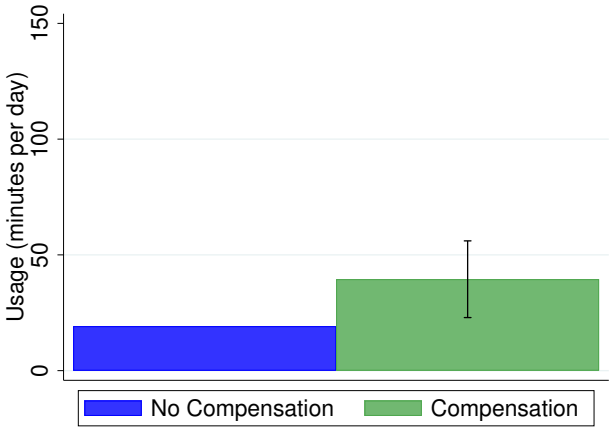
(d) Purifier effectiveness perceptions (control)



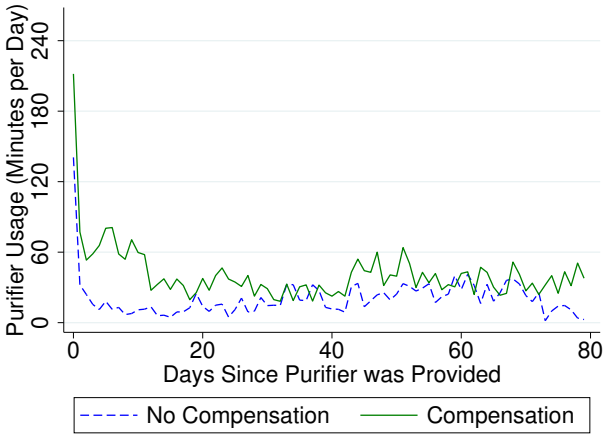
Notes: This figure describes the effectiveness of air purifiers, households' perception of their effectiveness, and households willingness to pay for purifiers. Panel (a) shows how air pollution changes after an air purifier. This experiment was carried out six times in a setting similar similar to the apartments of the subjects in the main experiment. The air purifier was used on the medium setting and doors and windows were closed. Panel (b) shows how air pollution changes after an air purifier is turned on by the households in the experiment. This is compared to the air pollution in a randomly chosen household in the control group (matched control). Panel (c) shows beliefs about purifier effectiveness at the time of the Phase 3 survey among households who had not used a purifier. Panel (d) shows households willingness to pay for a purifier at the time of the Phase 2 survey among households did not have a monitor.

Figure 5: Air Purifier Usage: Effect of Electricity Compensation Treatment (without Monitor)

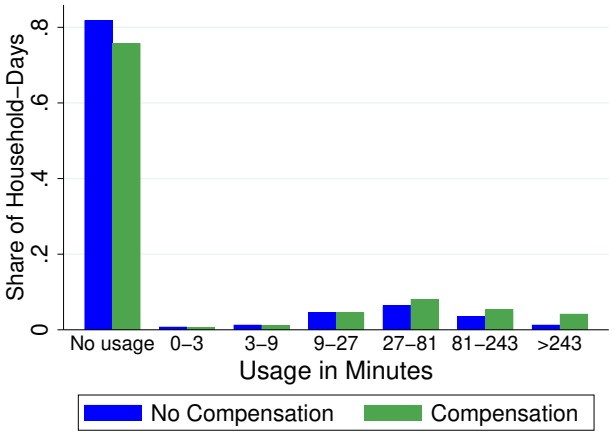
(a) Average Usage by Compensation Treatment



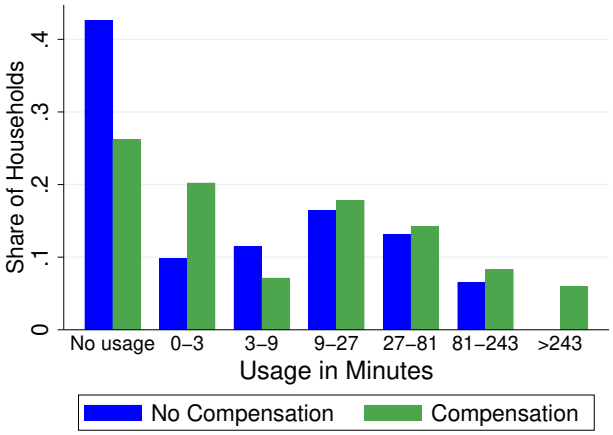
(b) Usage Over Time



(c) Household-Day Usage Distribution



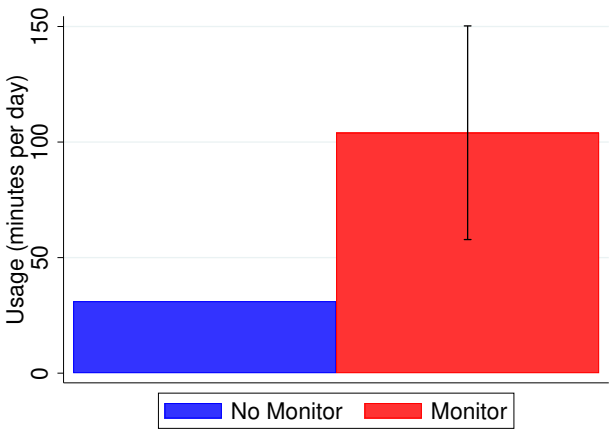
(d) Household Usage Distribution



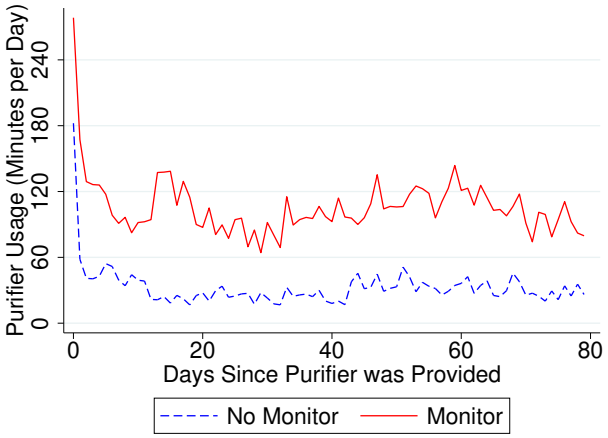
Notes: This Figures show the difference in purifier usage among households receiving electricity compensation, compared to those households not receiving electricity compensation. Only households without a monitor are included in the figure. Panel (a) compares the average minutes of purifier usage. The confidence interval is constructed using standard errors of the difference between the two means. Panel (b) shows the minutes of purifier usage over time. Panel (c) shows the distribution of minutes of purifier usage in a household on a particular day (i.e. each observation is a household on a specific day). Panel (d) shows the distribution of average minutes the purifier was used in a household per day (i.e. each observation is a household). In panels (c) and (d), each bin is three times wider than the previous bin. Data is from Phase 2 until the Phase 3 survey.

Figure 6: Differences in Air Purifier Use Between Purifier Households vs. Purifier + Monitor Households

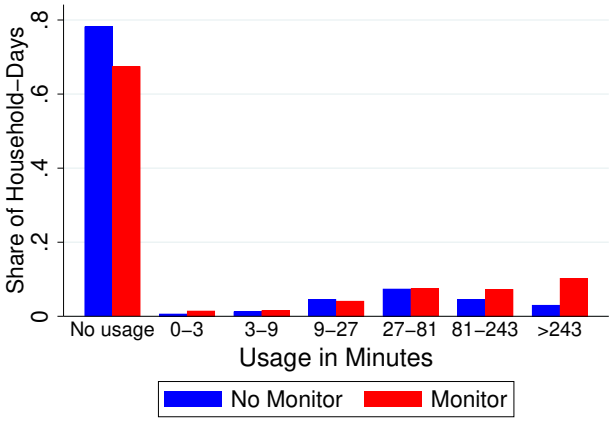
(a) Average Usage by Monitor Treatment



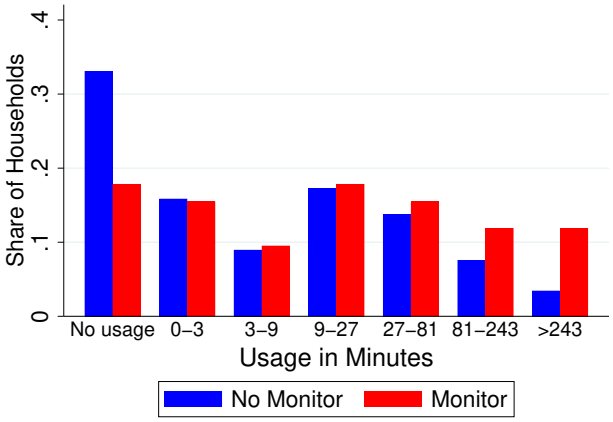
(b) Usage Over Time



(c) Household-Day Usage Distribution

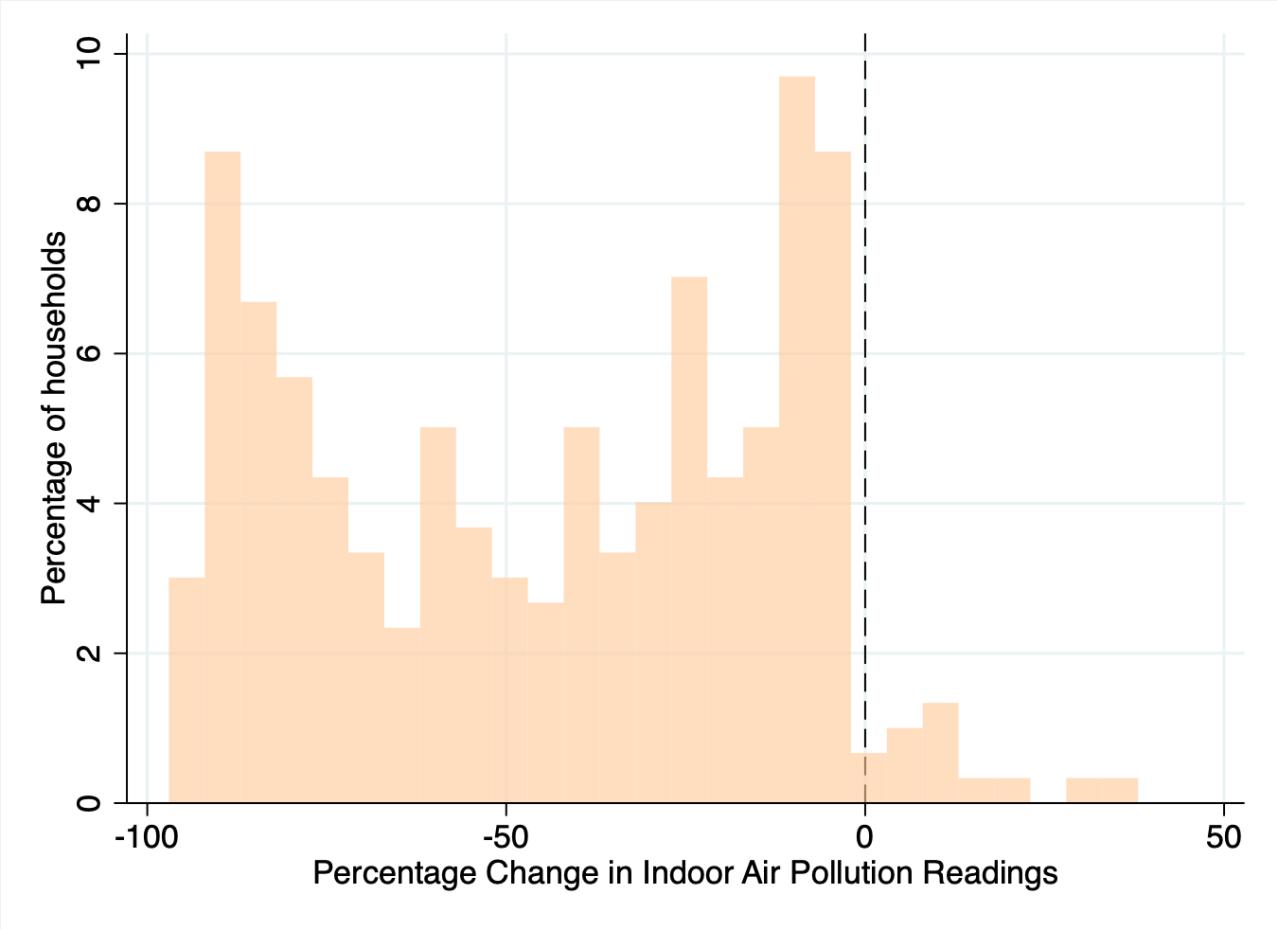


(d) Household Usage Distribution



Notes: This Figures show the difference in purifier usage among households reciving the monitor treatment (without the attention treatment), compared to those households not receiving the monitor treatment. Panel (a) compares the average minutes of purifier usage. The confidence interval is constructed using standard errors of the difference between the two means. Panel (b) shows the minutes of purifier usage over time. Panel (c) shows the distribution of minutes of purifier usage in a household on a particular day (i.e. each observation is a household on a specific day). Panel (d) shows the distribution of average minutes the purifier was used in a household per day (i.e. each observation is a household). In panels (c) and (d), each bin is three times wider than the previous bin. Data is from Phase 2 until the Phase 3 survey.

Figure 7: Experiment 2: Change in AQI from Purifier Use During Experiment (Percentage) for the Both (Together) Group



Notes: The figure shows the distribution of changes in indoor IAP recordings (percentages) during the demonstration for both (together) treatment arm. The second recordings in this group were initiated only after December 07, 2024 and so graph is based on 299 observations.

6 Tables

Table 1: Effect of Air Monitor on Household Perception of Indoor and Outdoor Air Quality: Phase 2

	(1) Beliefs about Severity of IAP	(2) Beliefs about Severity of AAP	(3) Beliefs about IAP Relative to AAP
Monitor	0.479***	0.0814	0.327*
	(0.149)	(0.162)	(0.175)
Observations	832	832	826
Clusters	832	832	826
Control mean	4.54	7.05	4.34
Sample	Phase 2	Phase 2	Phase 2
Phase 1 Controls	Y	Y	Y

Notes: This table shows the effect of air monitors and the attention treatment on households' perception of indoor and ambient air pollution. Column 1: "Beliefs about Severity of AAP" is households' response to: "How would you rate the current outdoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 2: "Beliefs about Severity of IAP" is households' response to: "How would you rate the current indoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 3: "Beliefs about IAP v. AAP" is households' response to: "How polluted do you believe the air in your home is compared to the air outdoors?" WTP is winsorized at the 99% level. Observations are at the household level.

Table 2: Effect of Air Purifiers on Perception of Purifier Effectiveness

	(1) Has Opinion	(2) $> 0\%$ effective	(3) $> 25\%$ effective	(4) $> 50\%$ effective	(5) $> 75\%$ effective
Monitor	0.090*	0.094*	0.104**	0.087*	-0.011
	(0.054)	(0.054)	(0.052)	(0.048)	(0.029)
Purifier	0.279***	0.277***	0.307***	0.276***	0.132***
	(0.051)	(0.052)	(0.051)	(0.050)	(0.039)
Purifier x Monitor	0.010	0.023	-0.046	-0.066	0.097
	(0.082)	(0.083)	(0.085)	(0.084)	(0.067)
Observations	784	784	784	784	784
Control mean	0.407	0.380	0.315	0.228	0.073

Notes: This table shows the effects of purifier, monitor, the interaction between the two on perception of air purifier effectiveness. We also control for the interaction of purifier and electricity incentive treatments (monthly or daily). The outcome is the response to a question asking how effective the household thinks regular air purifiers that can be bought in shops in Dhaka are at removing air pollution from the room in which they are being run. This variable ranges from 0 being completely ineffective to 1 being (almost) completely effective. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (5) are binary variables equal to 1 if the household said the purifier was more than 0%, 25%, 50% or 75% effective. Observations are at the household level during Phase 3 survey. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table 3: Effects of Compensation for Electricity Costs on Objective Air Purifier Use

	Minutes of Usage per Day		
	(1)	(2)	(3)
Any Compensation	18.75	14.43	19.86**
	(15.92)	(18.27)	(8.385)
Daily Compensation		8.825	
		(24.09)	
Time FE	Yes	Yes	Yes
Sample	Full	Full	Without monitor
Observations	22,896	22,896	10,708
Clusters	309	309	145
Control mean	53	53	19

Notes: This table shows the effect of providing compensation for the cost of the electricity used by the purifier. Each observation is at the day-by-household level among households with air purifiers. The outcome variable is the minutes of the day that the air purifier was turned on. Data is from the Phase 2 survey until 1 April 2024. Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table 4: Effect of Monitors on Objective Air Purifier Use Measured Using Smartplugs

	(1) Min per Day	(2) Days Used 30+ min	(3) Days Used 30+ min
Monitor	73.42***	0.609***	0.470*
	(23.56)	(0.233)	(0.275)
Time FE	Yes	Yes	Yes
Sample	All Days	All Weeks	Week Before Survey
Observations	22,896	3,552	308
Clusters	309.000	309.000	308.000
Control mean	31.110	1.077	0.958

Notes: This table shows the effect of providing monitors on purifier use. We control for if the household also receives the attention incentive. In column (1) observations are at the day-by-household level. In columns (2) and (3) observations are at the week-by-household level. Data is only from households with air purifiers. Data in columns (1) and (2) are from the dates between the Phase 2 survey and 1 April 2024. Data in column (3) is from the week before the Phase 3 survey. Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table 5: Effects of Monitors v. Monitors + Purifiers on WTA for Air Purifiers (Phase 3)

	(1) WTS
Monitor	3,993.34*
	(2,334.56)
Observations	305
Control mean	14469.00
Clusters	305

Notes: This table estimates the effect of monitors v. monitors + purifiers in the phase 3 survey elicitation of willingness to accept (in BDT) to return an air purifier back to the research team. Regression includes an indicator variable for subset of households who also received the attention treatment Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table 6: Experiment 2: Heterogeneity by Observed IAP Changes (Percentages)

	(1) Beliefs about Severity of AAP	(2) Beliefs about Severity of IAP	(3) Beliefs about IAP v. AAP	(4) WTP for Air Purifier
Purifier Only	-0.142	0.180	0.0450	199.3
	(0.169)	(0.153)	(0.156)	(220.4)
Monitor Only	0.492***	0.790***	0.662***	-250.4
	(0.163)	(0.153)	(0.157)	(210.3)
Both (Separately)	0.245	0.665***	0.375**	-168.9
	(0.168)	(0.155)	(0.159)	(208.5)
Both (Together)	0.548**	0.274	0.764***	-675.6**
	(0.244)	(0.230)	(0.245)	(296.8)
X % IAP Reduction	0.00391	0.0105**	0.000659	13.03***
	(0.00400)	(0.00413)	(0.00418)	(4.869)
Credit Only	-0.110	0.115	-0.0950	-213.9
	(0.169)	(0.161)	(0.163)	(219.0)
Observations	2299	2299	2299	2299
Control Mean	6.66	4.21	4.33	2699.55

Notes: This table shows the heterogeneous effects of the both (together) treatment arm by observed reductions in IAP (winsorized at the 99% level) by percentage of IAP reductions during the simultaneous demonstration of the purifier and the monitor. The regression omits 101 observations of the both (together) treatment arm collected on or before December 07, 2024 when we did not record the post-experiment IAP level. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. Column 1: "Beliefs about Severity of AAP" is households' response to: "How would you rate the current outdoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 2: "Beliefs about Severity of IAP" is households' response to: "How would you rate the current indoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 3: "Beliefs about IAP v. AAP" is households' response to: "How polluted do you believe the air in your home is compared to the air outdoors?" Column 4: "Willingness to Pay for Air Purifier" is the revealed valuation of an air purifier by the household during a BDM game measured in Bangladeshi Takas. WTP is winsorized at the 99% level. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table 7: Experiment 2: Heterogeneity by Observed IAP Changes (Percentages): Purifier Effectiveness

	(1) Has Opinion on Purifier Effectiveness	(2) Perceived Reduction: $> 0\%$	(3) Perceived Reduction: $> 25\%$	(4) Perceived Reduction: $> 50\%$	(5) Perceived Reduction: $> 75\%$
Purifier Only	0.118***	0.130***	0.120***	0.1000***	0.0675***
	(0.0350)	(0.0351)	(0.0344)	(0.0295)	(0.0184)
Monitor Only	0.00750	0.0150	0.0125	0.0325	0.0200
	(0.0354)	(0.0352)	(0.0337)	(0.0280)	(0.0154)
Both (Separately)	0.138***	0.135***	0.140***	0.0925***	0.0400**
	(0.0348)	(0.0351)	(0.0345)	(0.0293)	(0.0168)
Both (Together)	0.0309	0.0527	0.0255	0.0564	0.0200
	(0.0546)	(0.0547)	(0.0529)	(0.0452)	(0.0253)
X % IAP Reduction	0.00327***	0.00337***	0.00424***	0.00221***	0.00107**
	(0.000830)	(0.000841)	(0.000853)	(0.000801)	(0.000504)
Credit Only	-0.0200	-0.0250	-0.0375	-0.00500	0.0300*
	(0.0354)	(0.0351)	(0.0330)	(0.0269)	(0.0161)
Observations	2299	2299	2299	2299	2299
Control Mean	0.49	0.45	0.34	0.18	0.04

Notes: This table shows the heterogeneous effects of the both (together) treatment arm by observed reductions in IAP (winsorized at the 99% level) by percentage of IAP reductions during the simultaneous demonstration of the purifier and the monitor. The regression omits 101 observations of the both (together) treatment arm collected on or before December 07, 2024 when we did not record the post-experiment IAP level. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. The outcome is the response to a question asking how effective the household thinks regular air purifiers that can be bought in shops in Dhaka are at removing air pollution from the room in which they are being run. This variable ranges from 0 being completely ineffective to 1 being (almost) completely effective. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (5) are binary variables equal to 1 if the household said the purifier was more than 0%, 25%, 50% or 75% effective. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Appendix

A Data Collection and Cleaning

A.1 Survey Data

To ensure the reliability of our data and minimize the impact of outliers caused by misreporting or measurement errors, we 'winsorize' our data at the 1st and 99th percentiles. This means we adjust the most extreme values to the value at the 1st and 99th percentile values of that variable.

A.2 Missing Observations in Monitor Data

We provided a BDT 16 (USD 0.14) incentive for all households with air quality monitors to keep their monitors on for at least 16 hours per day. Appendix Table **??** shows that between the Phase 2 survey and April 1st monitors were turned on approximately 56% of the time. Column 1 of the table shows that having an air purifier increase the share of time that the air purifier was turned on by 9 percentage points. The attention incentives increased monitor usage by 3 percentage points but the difference is not statistically significant.

The imbalance between the missing monitor data in households with and without purifiers could cause the estimates of the effect of purifiers on air pollution in Appendix Table **??** to be biased. This would happen if households without purifiers were more likely to turn off their monitors during times when the air in their homes was more polluted than the sample average (causing our estimate of the effect of air purifiers to be biased towards zero) or when it was more polluted than the sample average (causing our estimate of the effect of air purifiers to be more negative than the true causal effect).

We have three approaches to reduce such a bias. First, we control for time-fixed effects. This means that we are only comparing treatment and control households within a certain hour of the data. If, for example, households without purifiers were more likely to turn off their monitors at times when air pollution is particularly bad across the whole sample, then this would not bias our results since we are controlling for fixed effects for each hour in our sample. However, if households without purifiers with consistently higher (or lower) air pollution are less likely to use the monitors that would still bias our estimate. Therefore, we also control for the average air pollution in the Phase 1 period, before air purifiers were provided. Finally, in columns 3 and 4 of Table **??** we also impute air pollution levels using the outdoor air pollution and the average indoor to outdoor ratio based on households without air purifiers. Reassuringly, this does not substantially change our estimates of the effect of the purifiers.

A.3 Validation of Air Quality Monitors

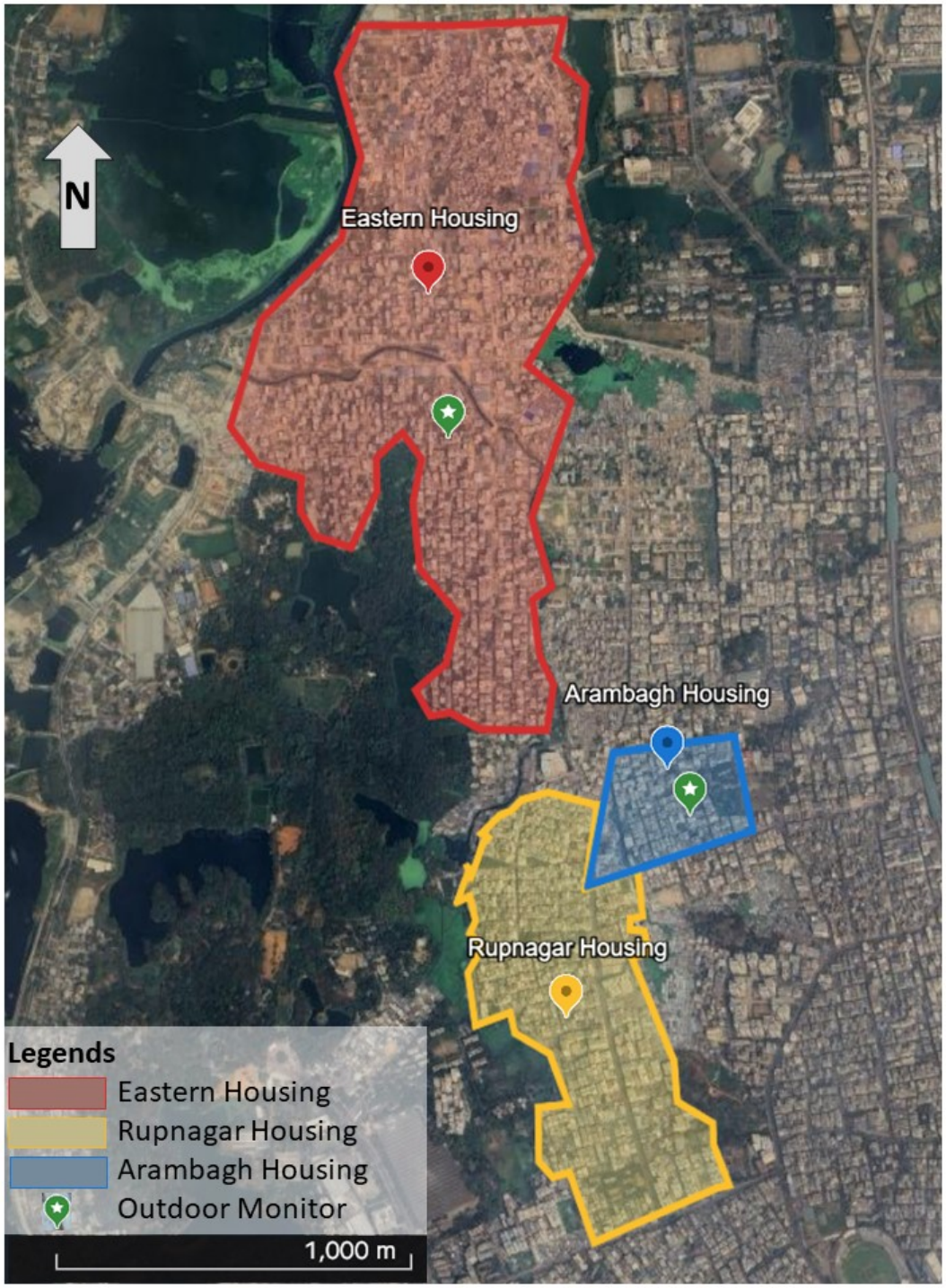
We used two models of air quality monitors for our data collection, one for indoor monitoring and one for outdoor monitoring. For indoor monitoring by the households we used Qingping Lite monitors. For outdoor monitoring we used IQAir AirVisual Outdoor monitors.

To validate the monitors and to ensure that differences between indoor and outdoor air pollution measures are not driven by differences in how the two models measures air pollution, we set up monitors in the same room over the span of a week and analyze differences in their readings. We used one outdoor monitor and three indoor monitors and compare their hourly average readings.

The average differences between the indoor and outdoor monitors' PM2.5 readings are 1.3 $\mu g/m^3$ or 2.2%. The correlation between the indoor and outdoor monitors readings is 0.96. Overall, this gives us confidence that the systematic differences in how the indoor and outdoor monitors measure pollution are small, especially compared to the hour to hour variations in air pollution.

B Figures

Figure A.1: Map of Study Area



Notes: This is a map of the three housing associations in which the study was conducted. All of the housing associations are located in the Mirpur area of Dhaka, Bangladesh.

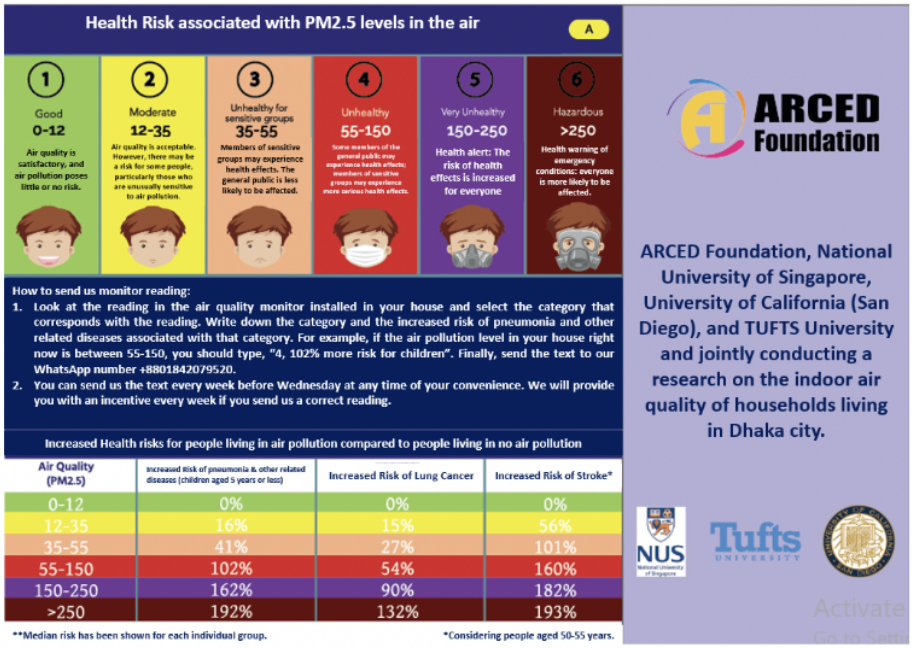
Figure A.2: Air Pollution Monitor



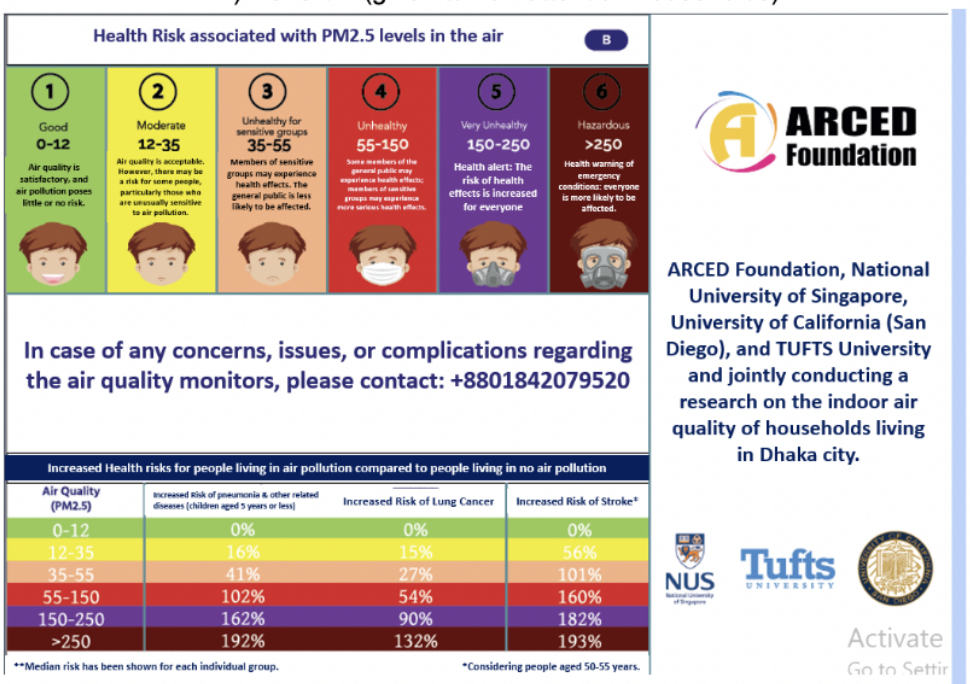
Notes: Image of the air quality monitor provided to the households in the monitor treatment group. For more details, see: https://www.qingping.co/air-monitor-lite/overview

Figure A.3: Air pollution information charts provided to households

A) Chart A (given to attention treatment households)



B) Chart B (given to non-attention households)



Notes: Images of the English translation of the information charts provided to households together with the air quality monitor.

Figure A.4: SQAir Purifer



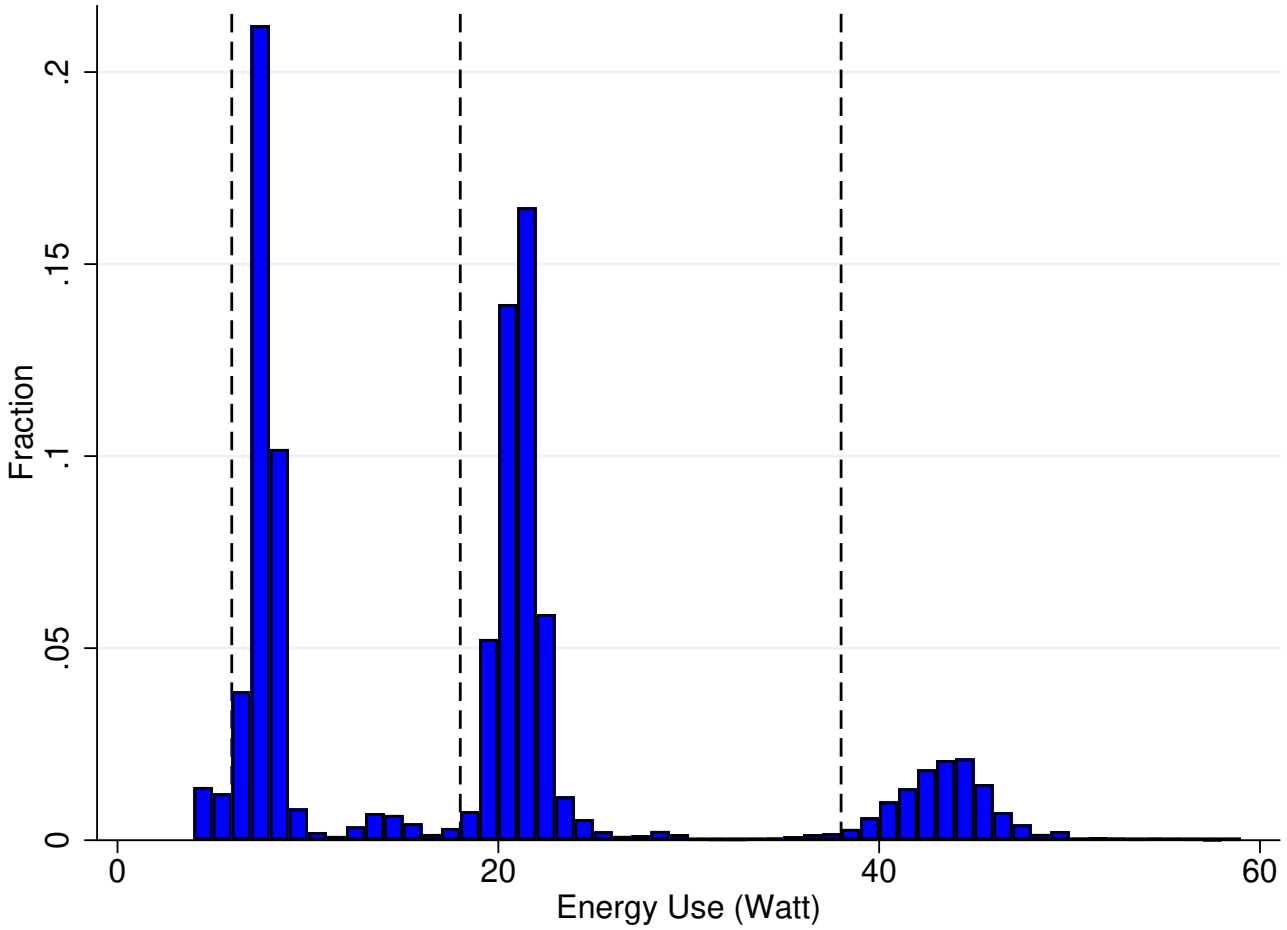
Notes: Image of the air purifier provided to the households in the air purifier treatment group. For more details, see: https://smartairfilters.com/en/product/sqair-air-purifier/

Figure A.5: Smart Plug/Socket



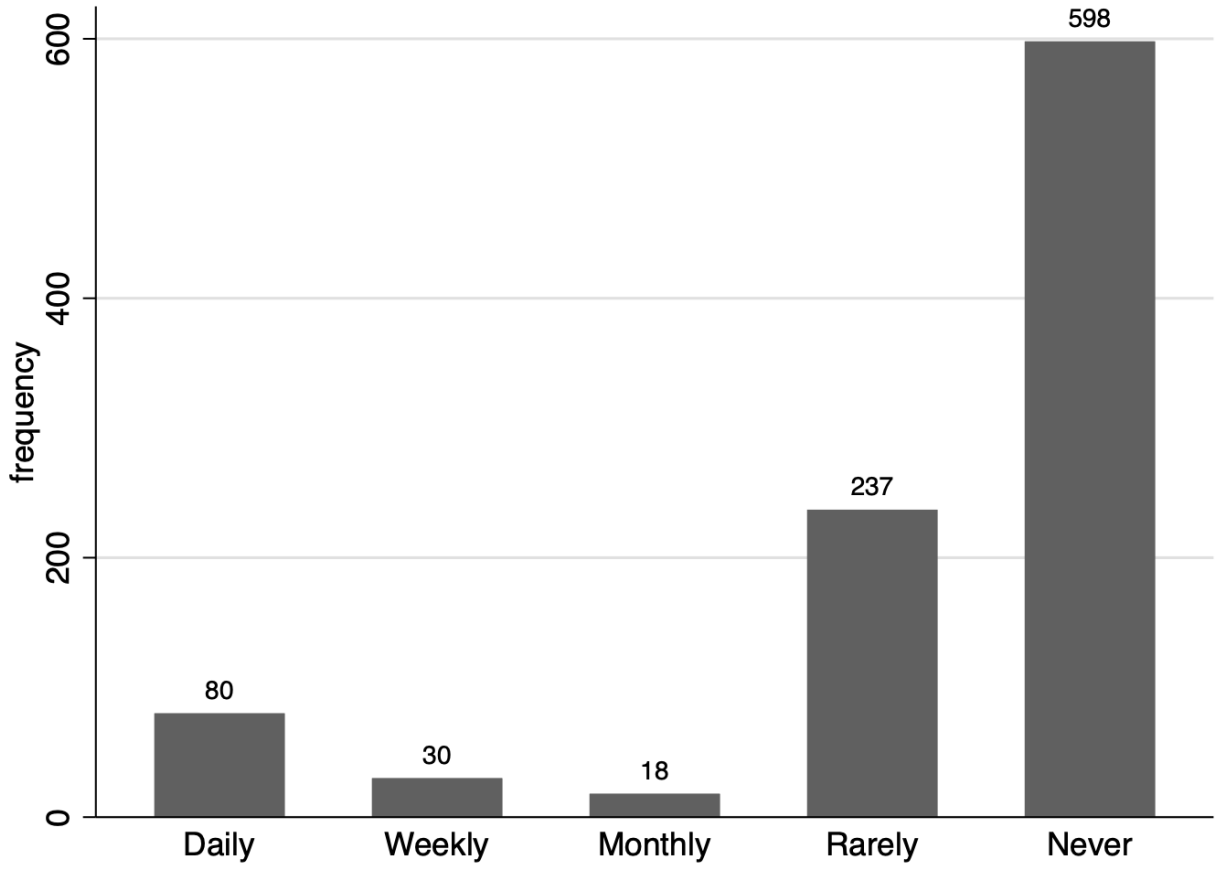
Notes: Image of the smart socket used to measure when the air purifier was used.

Figure A.6: Wattage used by Air Purifiers



Notes: The figure shows how much electricity each air purifier uses in watts. Each observation is a minute by household smart socket reading. We have only included observations where the air purifier is in use. The three vertical dashed lines represent the manufacturer's description of how much electricity the air purifier uses on the low, medium, and high settings.

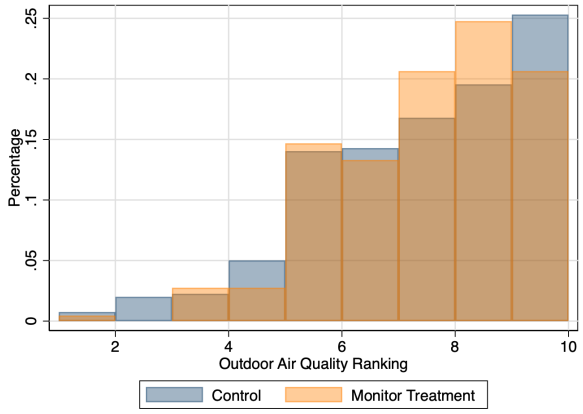
Figure A.7: Distribution of how often households reported checking outdoor air pollution levels (Phase 1 Survey)



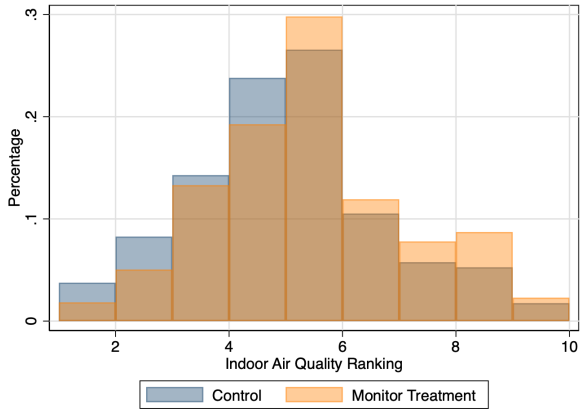
Notes: This histogram shows the distribution of responses in the Phase 1 survey to the the question "How often do you check or monitor outdoor air pollution levels?"

Figure A.8: Shifts in Perceptions and WTP with Monitor Treatment

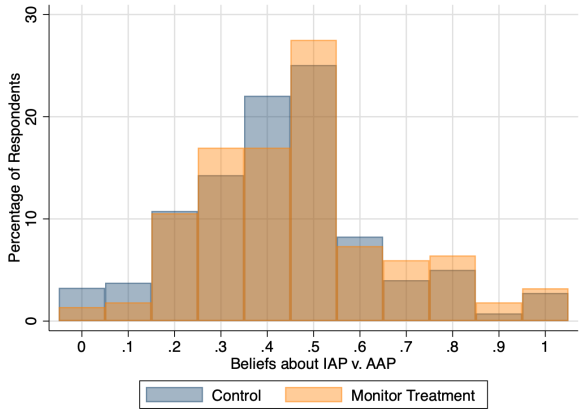
(a) Shift in ambient air pollution perceptions



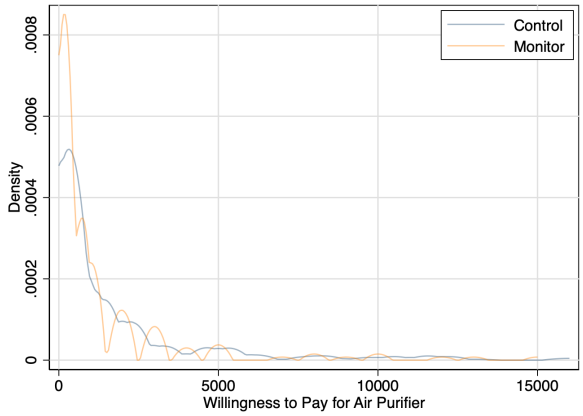
(b) Shift in indoor air pollution perceptions



(c) Shift in infiltration rate perceptions

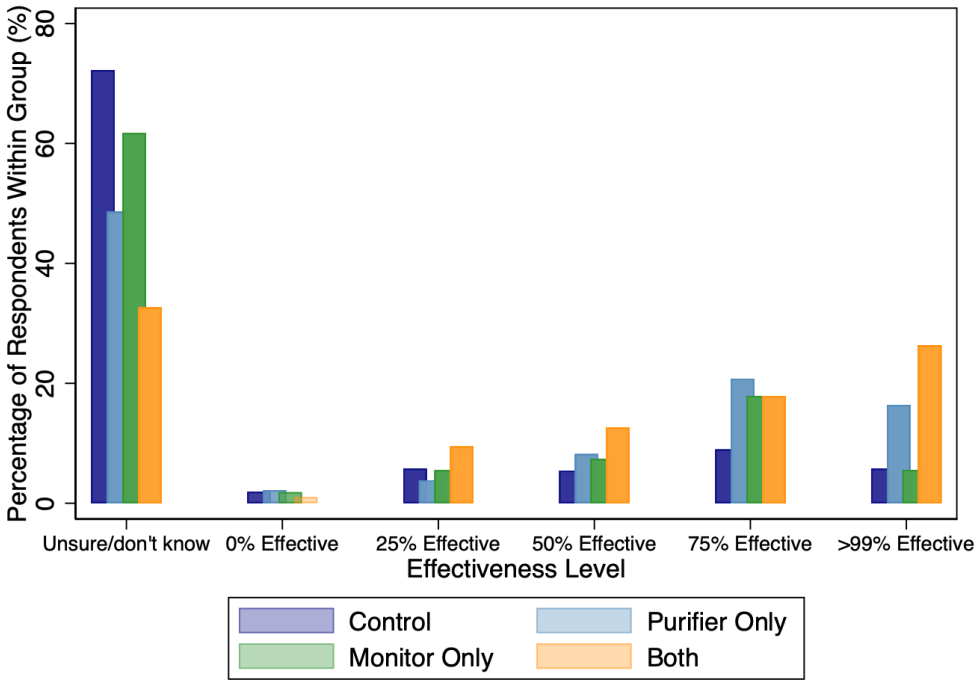


(d) No shift in WTP for purifier in Phase 2



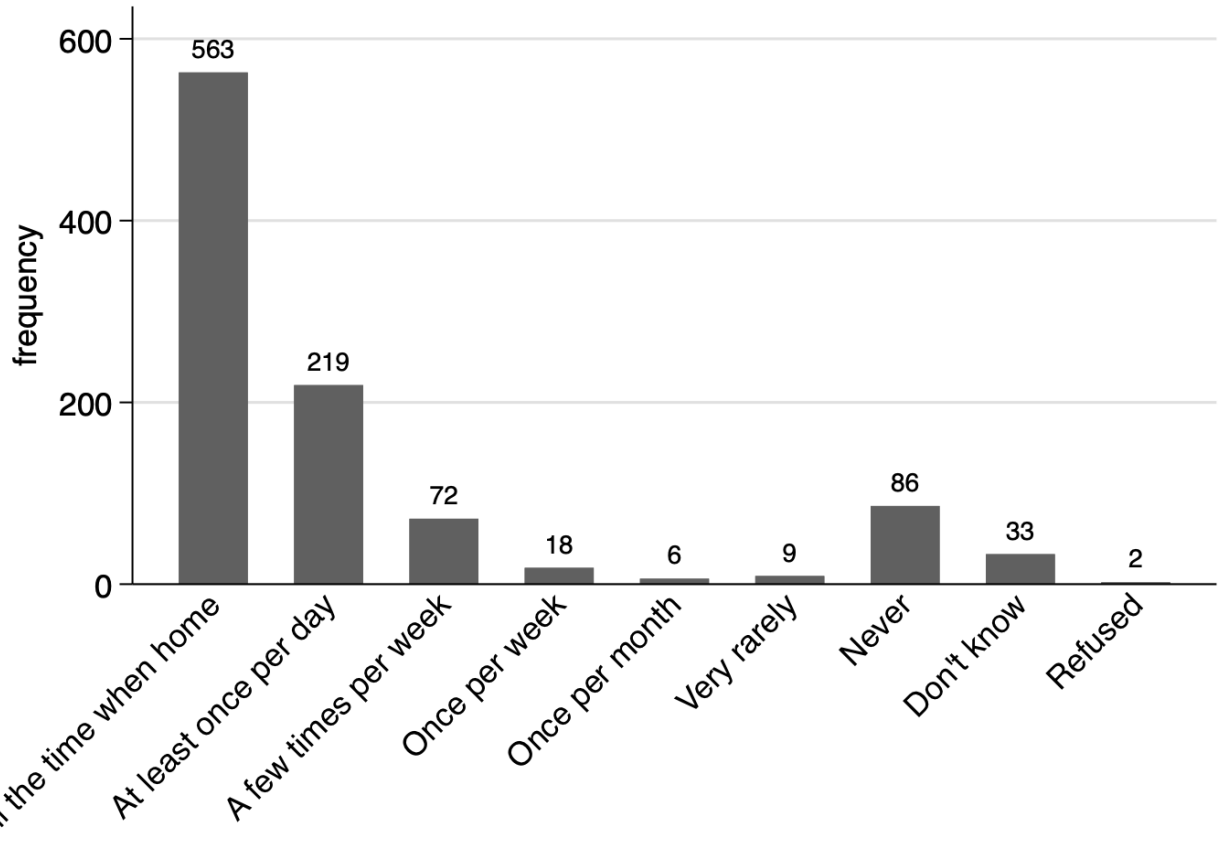
Notes: This figure describes the shifts in household beliefs during phase 2 survey with monitor treatment. Panel (a) shows the shift in beliefs about the severity of ambient air pollution with monitor treatment. Panel (b) shows the shift in beliefs about the severity of indoor air pollution with monitor treatment. Panel (c) shows the shift in beliefs about the ratio of indoor to ambient air pollution with monitor treatment. Panel (d) shows the density of a revealed preference measure for willingness to pay for air purifiers during phase 2 for households in the control group and monitor treatment group.

Figure A.9: Distribution of air purifier effectiveness perception for monitor and purifier group



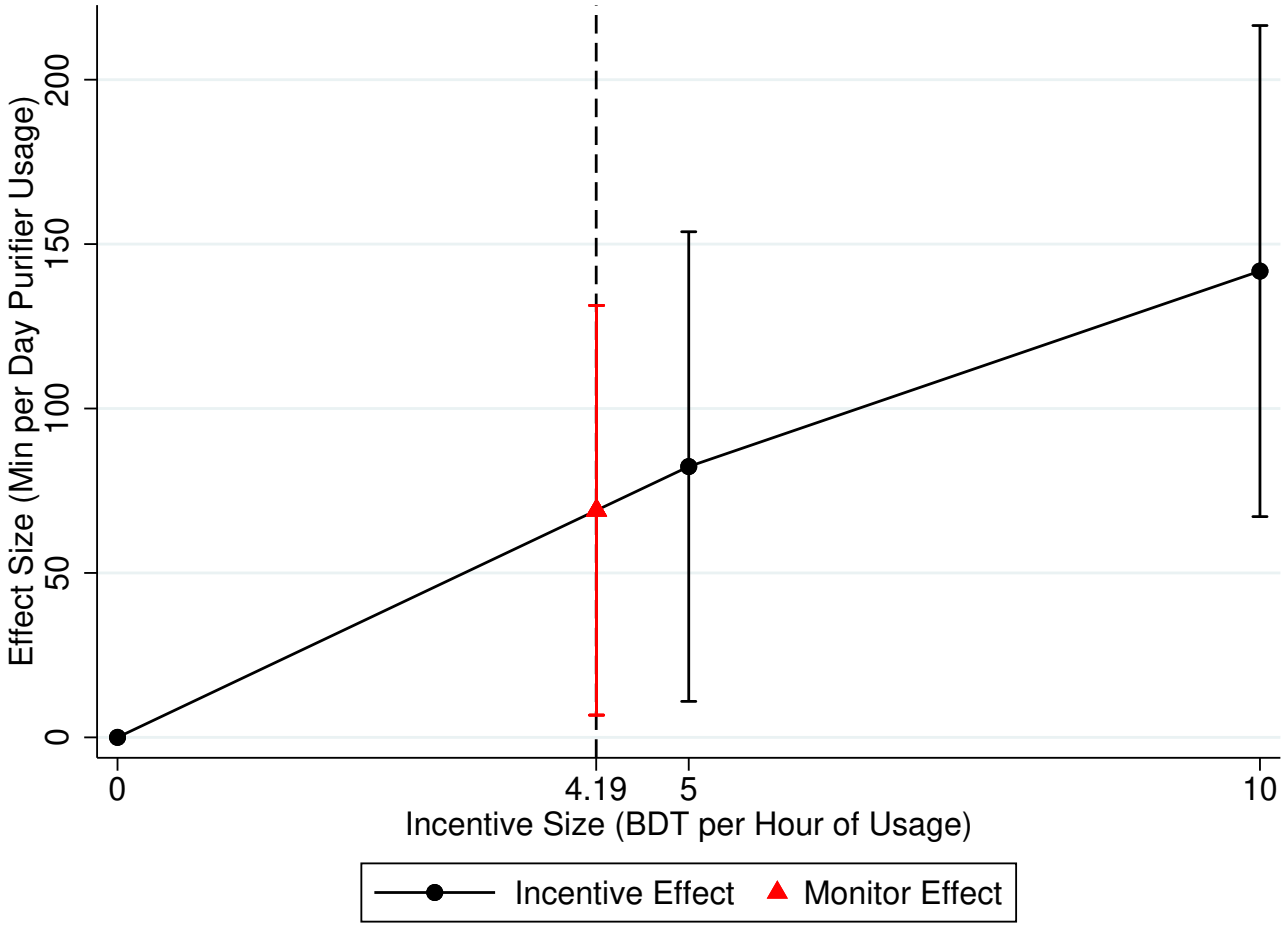
This figure shows the differences in beliefs (Phase 3 survey) about effectiveness of air purifiers for the following groups: control, monitor only, purifier only and both. The outcome is the response to a question asking how effective the household thinks regular air purifiers that can be bought in shops in Dhaka are at removing air pollution from the room in which they are being run. This variable ranges from 0 being completely ineffective to 1 being (almost) completely effective. Unsure/don't know: is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". 0% effective, 25% effective, 50% effective, 75% effective and >99$ effective are binary variables equal to 1 if the household said the purifier was at least 0%, 25%, 50%, 75% and 99% effective respectively. Observations are at the household level.

Figure A.10: Predicted Air Purifier Usage by Households in Phase 1 Survey



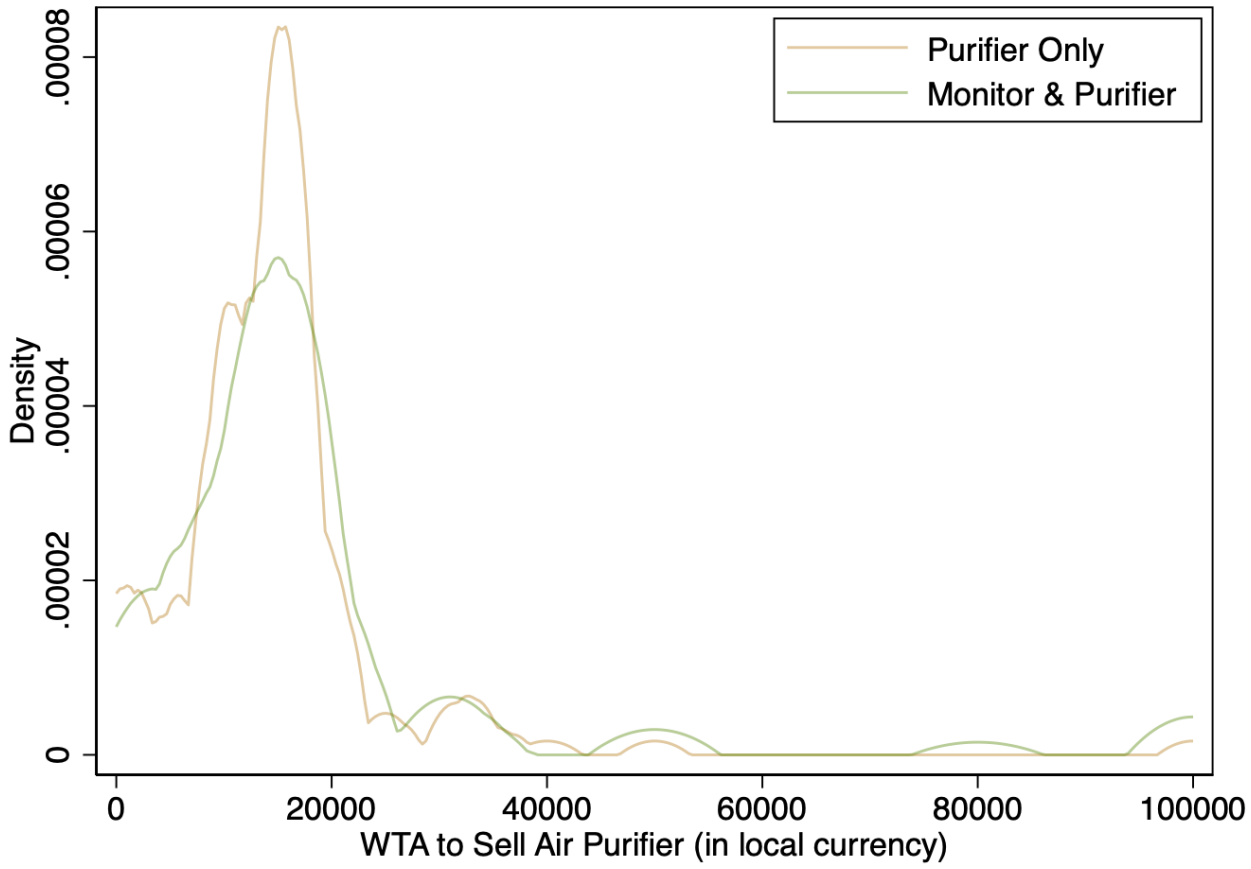
Notes: The question asked was: "If you owned an air purifier, how often would you use it during the winter months?"

Figure A.11: Effect of Monitor vs. Effect of Incentives on Purifier Usage



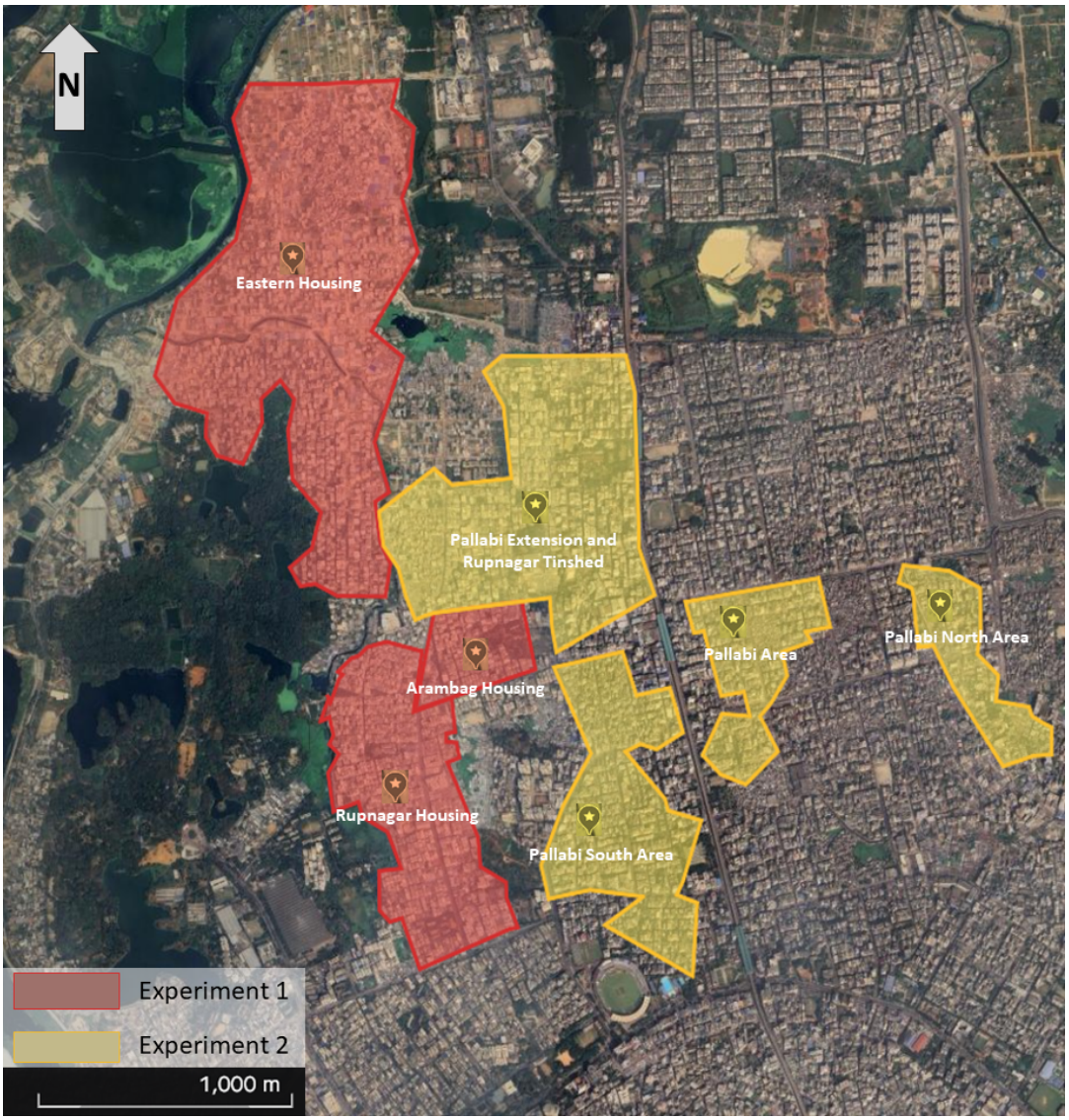
Notes: This figure compares the effect of the monitor treatment with the effect of the incentives to use the air purifier. We have placed the monitor treatment effect at BDT 4.2 on the x-axis as the monitor effect is equivalent to the linear interpolation of the incentive effect at BDT 4.2. Estimates are based on data from April 1 to April 30, 2024, the period of the incentive payments. 95% confidence intervals are based on standard errors clustered at the household level.

Figure A.12: Distribution of WTA in Phase 3 by monitor + purifiers vs. purifier group



Notes: This figure describes the density of a revealed preference measure for willingness to accept to sell an air purifiers during phase 3 for households in the purifier group by whether or not they also had a monitor.

Figure A.13: Experiment 2: Map of Study Area



Notes: This is a map of the four housing associations in which Experiment 2 was conducted. All of the housing associations are located in the Mirpur area of Dhaka, Bangladesh.

C Tables

Table A.1: Effect of Treatments on Attrition: Minibaseline to Baseline

	(1) Phase 2 Attrition
Monitor	-0.044
	(0.029)
Attention	0.005
	(0.034)
Observations	1,008
Control mean	0.196

Notes: This table shows the effects of treatment on attrition. The outcome variable is attrition at baseline, measured by the households who were not sampled (or did not consent) at either baseline. This variable is 1 if the household is in mini-baseline but NOT in baseline. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table A.2: Minibaseline to Baseline Balance Checks: Monitor Treatment [UnAttrited Group]

	Non-Monitor Households	Monitor Households	Diff
College Graduate	0.47	0.48	-0.00
Age	37.55	39.10	-1.55
Beliefs about Risk of Lung Cancer and Stroke from Air Pollution	1.65	1.63	0.02
Beliefs about Risk of ARI for Children from Air Pollution	1.74	1.72	0.02
Beliefs about Severity of AAP	7.38	7.58	-0.20
Beliefs about Severity of IAP	4.79	4.73	0.06
Beliefs about IAP Relative to AAP	3.56	3.50	0.06
Observations	399	433	832
Joint F-test	1.08	p-value	0.377

Notes: This table provides balance test on Phase 1 survey data for households unattrited by Phase 2 survey for the monitor and non-monitor groups. For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.3: Minibaseline to Baseline Balance Checks: Attention Treatment [UnAttrited Group]

	Non-Attention Households	Attention Households	Diff
College Graduate	0.47	0.48	-0.02
Age	37.59	40.63	-3.05*
Beliefs about Risk of Lung Cancer and Stroke from Air Pollution	1.65	1.61	0.04
Beliefs about Risk of ARI for Children from Air Pollution	1.75	1.69	0.06
Beliefs about IAP Relative to AAP	3.52	3.48	0.03
Beliefs about Severity of AAP	7.49	7.67	-0.19
Beliefs about Severity of IAP	4.65	4.80	-0.15
Observations	218	215	433
Joint F-test	1.11	p-value	0.359

Notes: This table provides balance test on Phase 1 survey data for households unattrited by Phase 2 survey for the attention and non-attention groups (monitor households only). For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.4: Effect of Treatments on Attrition: Phase 2 to Phase 3

	(1) Phase 3 Attrition
Purifier	-0.063***
	(0.024)
Pur X Monthly-Incentive	-0.010
	(0.035)
Pur X Daily-Incentive	-0.034
	(0.035)
Observations	832
Control mean	0.088

Notes: This table shows the effects of the purifier treatment as well as the purifier treatment interacted with monthly and daily electricity incentives on attrition. The outcome variable is attrition at endline. This variable is 1 if the household is in baseline but not in endline. Observations are at the household level, and this sample was restricted to be inclusive of only households that were sampled in baseline (832). For reference, out of 1008 households, 832 households were sampled at baseline, and then 784 were sampled at endline. In other words, 176 households attritioned at baseline, and 48 households attritioned at endline. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table A.5: Phase 2 to Phase 3: Purifier Treatment [Unattrited Group]

	Non-Purifier Households	Purifier Households	Diff
Monthly Income	65216.10	59024.14	6191.96
Education	14.20	14.62	-0.42
Age	43.71	44.37	-0.67
WTP	1379.53	1380.87	-1.33
HH Size	4.18	4.12	0.06
Beliefs about Risk of Lung Cancer and Stroke from Air Pollution	1.93	1.94	-0.01
Beliefs about Risk of ARI for Children from Air Pollution	2.16	2.24	-0.08
Donation	0.25	0.27	-0.03
Priority(SD)	0.00	0.04	-0.03
Beliefs about IAP Relative to AAP	4.48	4.50	-0.02
Beliefs about Severity of IAP	4.73	4.70	0.03
Beliefs about Severity of AAP	7.03	7.19	-0.16
Observations	472	302	774
Joint F-test	0.64	p-value	0.812

Notes: This table provides balance test on Phase 1 and 2 survey data for households unattrited by Phase 3 survey for the purifier and non-purifier groups. For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.6: Effects of Monitor and Attention Treatments on Beliefs of Health Risk

	(1) Beliefs about Risk of Lung Cancer and Stroke from Air Pollution	(2) Beliefs about Risk of ARI for Children from Air Pollution
Monitor	0.139**	0.121
	(0.0683)	(0.0843)
Survey FE	N	Y
Observations	767	795
Clusters	767	795
Control mean	1.885	2.160
Sample	Phase 2	Phase 2
Phase 1 Control	Y	Y

Notes: This table shows the effect of providing monitors and incentives for attention to air quality on people's beliefs regarding the harmfulness of current air pollution on increasing the risk of (1) lung cancer and stroke in adults and (2) acute respiratory issues for children. Each observation is at the household level. For column 1 the outcome variable is the perceived risk of lung cancer and stroke, categorized into various levels of increased risk ranging from "No effect" to "More than quadrupling". The outcome variable in columns 2 has the same categorization but relating

to the perceived risk of acute respiratory issues for children. Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.7: Effects of Air Monitors on Willingness to Pay for Air Purifiers (Phase 2)

	(1)
	WTP
Monitor	-245.2
	(190.3)
Survey FE	N
Observations	828
Clusters	828
Control mean	1,408.65
Sample	Phase 2

Notes: This table shows the effect of air monitors and incentives for attention to air quality information on willingness to pay (WTP) for air purifiers. The outcome variable is the WTP for household h determined through a modified Becker-DeGroot-Marschak (BDM) mechanism. Note that WTP is winsorized. Each observation is at the household level. Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.8: Effect of Monitor on Self-Reported Air Purifier Usage

	(1) Use All the Time: Phase 2	(2) Days used 30+ minutes	(3) HH Used All the Time
Monitor	0.195***	0.487	0.144**
	(0.040)	(0.335)	(0.064)
Observations	832	288	292
Control mean	.551	5.104	.244
Phase 1 Controls	Y	Y	Y

Notes: This table presents a regression analysis of air purifier usage and treatment effects. Column 1: question during Phase 2 survey was "If you owned an air purifier, how often would you use it during the winter months (December, January, and February)?" Response options were (a) all the time when home, (b) at least once per week, (c) a few times per week, (d) once per week, (e) once per month, (f) very rarely, (g) never, (h) don't know or (i) refused. We create a binary variable for above and below median self-projected use. Since over half of respondents picked (a), in practice, this creates a binary variable for whether or not the household said they would use it all the time when home. We control for the respondents answer during the Phase 1 survey. Column 2: during the endline survey households who had previously received an air purifier were asked "In the past 7 days, how many days did you use the air purifier for 30 minutes or more? (numerical answer between 0 and 7)?" We control for Phase 1 values of perceived use of air purifers. Column 3: During Phase 3 survey, households who received the air purifier were asked how often they used the air purifier. The response options were the same as Column 1. We follow the same procedure of creating a binary variable. We control for the respondents projected use reported during the Phase 1 survey.

Table A.9: Effects of Use Incentives and Air Monitor on Air Purifier Use

	(1) Minutes per Day	(2) Minutes per Day
Any Incentive	112.9***	82.35**
	(29.33)	(36.43)
Monitor	68.74**	69.06**
	(31.83)	(31.78)
BDT 10 Incentive		59.45
		(46.25)
Time FE	Yes	Yes
Observations	9,270	9,270
Clusters	309	309
Control mean	16	16

Notes: This table shows the effect of providing incentives for using the purifier and the effect of owning a monitor on purifier usage. The incentives were either BDT 5 per hour of use, or BDT 10 per hour of use. Each observation is at the day-by-household level among households with air purifiers. The outcome variable is the number of minutes that the air purifier was used on that day. Data is from 1 April 2024 until 30 April 2024, the period during which the incentives were provided. Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.10: Effects of Monitors, Purifiers and Monitors + Purifiers on WTP (Phase 3)

	(1)
	WTP
Monitor	-126.9
	(245.9)
Purifier	104.8
	(269.6)
Phase 3	92.76
	(177.0)
Purifier x Monitor	-313.4
	(391.5)
Monitor X Phase 3	21.06
	(304.9)
Purifier X Phase 3	72.07
	(345.1)
Monitor X Purifier X Phase 3	557.0
	(515.0)
Survey FE	Y
Observations	1,606
Clusters	841
Control mean	1,408.65
Sample	Phase 2+3

Notes: This table shows the effect of monitor treatment, purifier treatment and the combination of the two on willingness to pay for purifiers using BDM elicitations in phase 2 and phase 3 survey. The regression includes survey fixed effects and an indicator variable for subset of households who also received the attention treatment Standard errors are clustered at the household level. $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.11: Experiment 2: Predicting IAP Reductions

	(1) IAP Reduction (Levels)	(2) Percentage IAP Reduction
Sex:	25.35	8.566
	(18.39)	(5.643)
Age:	0.486	0.0876
	(0.326)	(0.140)
Highest Ed. Level	0.790	-0.0666
	(0.827)	(0.344)
HH Members	1.872	2.266**
	(2.314)	(1.143)
Beliefs: Severity of AAP (1-10)	-2.953	-0.894
	(2.281)	(1.006)
Beliefs: Severity of IAP (1-10)	5.472**	1.501
	(2.471)	(1.083)
Beliefs: IAP v. AAP (1-10)	-3.639	-1.536
	(2.355)	(1.067)
Has Opinion: Lung Cancer Risk	19.47	6.822
	(13.49)	(6.656)
Has Opinion: ARI Risk	-11.03	-3.368
	(15.11)	(6.546)
Has Opinion: Purifier Effectiveness	-8.857	-2.107
	(9.183)	(3.890)
Altitude	0.498	0.0451
	(0.902)	(0.194)
Do you own an air conditioner?	-19.07*	-4.602
	(11.21)	(4.859)
Observations	299	299
Overall F-test p-value	0.262	0.387

Notes: This table estimates how well baseline variables (used in balance tables) predict IAP reductions. Column 1 uses levels in IAP reductions and Column 2 uses percentage reductions in IAP. The sample size is N=299 which corresponds to observations only in the both (together) group after December 07, 2024. Prior to this date, only one IAP measurement was collected and hence we cannot compute reductions in IAP. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.12: Experiment 2: Balance Table

Variable	(1) Control Mean/(SE)	(2) Purifier Only Mean/(SE)	(3) Monitor Only Mean/(SE)	(4) Both (Separately) Mean/(SE)	(5) Both (Together) Mean/(SE)	(6) Credit Only Mean/(SE)	F-test for balance across all groups F-stat/P-value
Sex:	1.127	1.117	1.125	1.115	1.125	1.103	0.253
	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)	(0.015)	0.938
Age:	47.960	48.127	47.040	46.627	46.528	47.458	0.766
	(0.741)	(0.764)	(0.693)	(0.688)	(0.750)	(0.748)	0.574
Highest Ed. Level	13.473	13.287	13.643	13.670	13.040	13.180	0.577
	(0.290)	(0.299)	(0.290)	(0.268)	(0.293)	(0.402)	0.718
HH Members	4.430	4.505	4.370	4.272	4.370	4.367	0.856
	(0.089)	(0.088)	(0.078)	(0.083)	(0.081)	(0.084)	0.510
Beliefs: Severity of AAP (1-10)	6.650	6.372	6.560	6.348	6.615	6.520	1.305
	(0.120)	(0.120)	(0.114)	(0.118)	(0.120)	(0.119)	0.259
Beliefs: Severity of IAP (1-10)	4.322	4.447	4.482	4.185	4.348	4.287	0.974
	(0.115)	(0.110)	(0.106)	(0.105)	(0.114)	(0.116)	0.432
Beliefs: IAP v. AAP (1-10)	4.482	4.450	4.543	4.143	4.702	4.420	2.310**
	(0.122)	(0.118)	(0.116)	(0.119)	(0.123)	(0.125)	0.042
Observed IAP (Winsorized)	130.405	134.485	138.775	142.635	137.765	138.770	1.228
	(4.207)	(4.356)	(4.295)	(4.480)	(4.282)	(4.311)	0.293
Has Opinion: Lung Cancer Risk	0.907	0.885	0.905	0.887	0.887	0.877	0.581
	(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)	0.715
Has Opinion: ARI Risk	0.930	0.912	0.915	0.925	0.907	0.912	0.405
	(0.013)	(0.014)	(0.014)	(0.013)	(0.015)	(0.014)	0.846
Has Opinion: Purifier Effectiveness	0.420	0.438	0.403	0.443	0.357	0.385	1.802
	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)	0.109
Altitude	-37.658	-38.060	-36.841	-36.973	-37.273	-37.512	0.997
	(0.420)	(0.369)	(0.453)	(0.487)	(0.431)	(0.367)	0.418
Do you own an air conditioner?	0.335	0.370	0.390	0.352	0.365	0.328	0.956
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.023)	0.444
Number of observations	400	400	400	400	400	400	2400

Notes: This table provides balance test on the baseline variables in the add-on experiments. Baseline variables were collected before households received any of the treatment conditions which were Control, Purifier Only, Monitor Only, Both (Separately), Both (Together) and Credit Only. For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.13: Experiment 2: Balance Table (Dropping Group 5 with single IAP reading)

Variable	(1) Control Mean/(SE)	(2) Purifier Only Mean/(SE)	(3) Monitor Only Mean/(SE)	(4) Both (Separately) Mean/(SE)	(5) Both (Together) Mean/(SE)	(6) Credit Only Mean/(SE)	F-test for balance across all groups F-stat/P-value
Sex:	1.127	1.117	1.125	1.115	1.117	1.103	0.210
	(0.017)	(0.016)	(0.017)	(0.016)	(0.019)	(0.015)	0.959
Age:	47.960	48.127	47.040	46.627	45.421	47.458	1.547
	(0.741)	(0.764)	(0.693)	(0.688)	(0.847)	(0.748)	0.172
Highest Ed. Level	13.473	13.287	13.643	13.670	12.254	13.180	2.043*
	(0.290)	(0.299)	(0.290)	(0.268)	(0.335)	(0.402)	0.070
HH Members	4.430	4.505	4.370	4.272	4.311	4.367	0.924
	(0.089)	(0.088)	(0.078)	(0.083)	(0.096)	(0.084)	0.464
Beliefs: Severity of AAP (1-10)	6.650	6.372	6.560	6.348	6.656	6.520	1.318
	(0.120)	(0.120)	(0.114)	(0.118)	(0.139)	(0.119)	0.253
Beliefs: Severity of IAP (1-10)	4.322	4.447	4.482	4.185	4.288	4.287	1.043
	(0.115)	(0.110)	(0.106)	(0.105)	(0.134)	(0.116)	0.390
Beliefs: IAP v. AAP (1-10)	4.482	4.450	4.543	4.143	4.736	4.420	2.202*
	(0.122)	(0.118)	(0.116)	(0.119)	(0.145)	(0.125)	0.052
Observed IAP (Winsorized)	130.405	134.485	138.775	142.635	158.522	138.770	4.546***
	(4.207)	(4.356)	(4.295)	(4.480)	(4.890)	(4.311)	0.000
Has Opinion: Lung Cancer Risk	0.907	0.885	0.905	0.887	0.883	0.877	0.623
	(0.015)	(0.016)	(0.015)	(0.016)	(0.019)	(0.016)	0.683
Has Opinion: ARI Risk	0.930	0.912	0.915	0.925	0.886	0.912	0.969
	(0.013)	(0.014)	(0.014)	(0.013)	(0.018)	(0.014)	0.435
Has Opinion: Purifier Effectiveness	0.420	0.438	0.403	0.443	0.355	0.385	1.737
	(0.025)	(0.025)	(0.025)	(0.025)	(0.028)	(0.024)	0.123
Altitude	-37.658	-38.060	-36.841	-36.973	-37.219	-37.512	1.029
	(0.420)	(0.369)	(0.453)	(0.487)	(0.491)	(0.367)	0.399
Do you own an air conditioner?	0.335	0.370	0.390	0.352	0.308	0.328	1.379
	(0.024)	(0.024)	(0.024)	(0.024)	(0.027)	(0.023)	0.229
Number of observations	400	400	400	400	299	400	2299

Notes: This table provides balance test on the baseline variables in the add-on experiments. The sample excludes 101 households in treatment group 5 for whom no IAP measure at the end of the experiment was recorded. Baseline variables were collected before households received any of the treatment conditions which were Control, Purifier Only, Monitor Only, Both (Separately), Both (Together) and Credit Only. For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.14: Experiment 2: Balance Table (Observations after 07 December 2024)

Variable	(1) Control Mean/(SE)	(2) Purifier Only Mean/(SE)	(3) Monitor Only Mean/(SE)	(4) Both (Separately) Mean/(SE)	(5) Both (Together) Mean/(SE)	(6) Credit Only Mean/(SE)	F-test for balance across all groups F-stat/P-value
Sex:	1.121	1.107	1.109	1.102	1.117	1.090	0.300
	(0.019)	(0.018)	(0.018)	(0.017)	(0.019)	(0.016)	0.913
Age:	47.007	47.800	46.944	45.789	45.421	46.862	1.023
	(0.846)	(0.892)	(0.811)	(0.775)	(0.847)	(0.855)	0.402
Highest Ed. Level	12.708	12.563	12.997	13.007	12.254	12.424	0.595
	(0.338)	(0.349)	(0.337)	(0.304)	(0.335)	(0.485)	0.704
HH Members	4.436	4.450	4.426	4.240	4.311	4.350	0.686
	(0.105)	(0.095)	(0.093)	(0.095)	(0.096)	(0.095)	0.634
Beliefs: Severity of AAP (1-10)	6.742	6.410	6.644	6.385	6.656	6.559	1.263
	(0.141)	(0.139)	(0.135)	(0.140)	(0.139)	(0.139)	0.277
Beliefs: Severity of IAP (1-10)	4.305	4.433	4.393	4.099	4.288	4.318	0.824
	(0.136)	(0.127)	(0.124)	(0.122)	(0.134)	(0.130)	0.533
Beliefs: IAP v. AAP (1-10)	4.594	4.423	4.548	4.230	4.736	4.559	1.407
	(0.144)	(0.140)	(0.136)	(0.141)	(0.145)	(0.141)	0.219
Observed IAP (Winsorized)	146.564	152.630	158.729	160.207	158.522	153.717	1.271
	(4.695)	(5.098)	(4.639)	(5.097)	(4.890)	(4.639)	0.274
Has Opinion: Lung Cancer Risk	0.909	0.893	0.901	0.868	0.883	0.862	1.085
	(0.017)	(0.018)	(0.017)	(0.019)	(0.019)	(0.020)	0.366
Has Opinion: ARI Risk	0.933	0.930	0.914	0.918	0.886	0.907	1.169
	(0.015)	(0.015)	(0.016)	(0.016)	(0.018)	(0.017)	0.322
Has Opinion: Purifier Effectiveness	0.406	0.417	0.393	0.444	0.355	0.357	1.665
	(0.028)	(0.029)	(0.028)	(0.029)	(0.028)	(0.027)	0.140
Altitude	-37.784	-37.913	-36.997	-37.280	-37.219	-37.438	0.477
	(0.457)	(0.400)	(0.459)	(0.492)	(0.491)	(0.413)	0.793
Do you own an air conditioner?	0.275	0.323	0.366	0.280	0.308	0.280	1.753
	(0.026)	(0.027)	(0.028)	(0.026)	(0.027)	(0.025)	0.119
Number of observations	298	300	303	304	299	311	1815

Notes: This table provides balance test on the baseline variables in the add-on experiments. The sample is restricted to data collected after December 07, 2024 which was the date after which two IAP observations were recorded for group 5 (purifier and monitor together) - one before the demonstration and one after the demonstration. Baseline variables were collected before households received any of the treatment conditions which were Control, Purifier Only, Monitor Only, Both (Separately), Both (Together) and Credit Only. For each variable, we report the joint F-test with p-values. Statistical significance thresholds are reported conventionally using $***p < 0.01; **p < 0.05; *p < 0.1$.

Table A.15: Experiment 2: Treatment Effects

	(1) Beliefs about Severity of AAP	(2) Beliefs about Severity of IAP	(3) Beliefs about IAP v. AAP	(4) Willingness to Pay for Air Purifier
Purifier Only	-0.143	0.180	0.0450	199.3
	(0.169)	(0.153)	(0.156)	(220.3)
Monitor Only	0.492***	0.790***	0.662***	-250.4
	(0.163)	(0.153)	(0.157)	(210.2)
Both (Separately)	0.245	0.665***	0.375**	-168.9
	(0.168)	(0.155)	(0.159)	(208.4)
Both (Together)	0.562***	0.695***	0.630***	-47.89
	(0.163)	(0.157)	(0.159)	(205.3)
Credit Only	-0.110	0.115	-0.0950	-213.9
	(0.169)	(0.161)	(0.163)	(218.9)
Observations	2400	2400	2400	2400
Control Mean	6.66	4.21	3.06	2699.55

Notes: This table shows the effect of the treatment arms in the additional experiment. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. Column 1: "Beliefs about Severity of AAP" is households' response to: "How would you rate the current outdoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 2: "Beliefs about Severity of IAP" is households' response to: "How would you rate the current indoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 3: "Beliefs about IAP v. AAP" is households' response to: "How polluted do you believe the air in your home is compared to the air outdoors?" Column 4: "Willingness to Pay for Air Purifier" is the revealed valuation of an air purifier by the household during a BDM game measured in Bangladeshi Takas. WTP is winsorized at the 99% level. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table A.16: Experiment 2: Treatment Effects - Purifier Effectiveness

	(1) Has Opinion on Purifier Effectiveness	(2) Perceived Reduction: $> 0\%$	(3) Perceived Reduction: $> 25\%$	(4) Perceived Reduction: $> 50\%$	(5) Perceived Reduction: $> 75\%$
Purifier Only	0.117***	0.130***	0.120***	0.1000***	0.0675***
	(0.0350)	(0.0351)	(0.0344)	(0.0295)	(0.0183)
Monitor Only	0.00750	0.0150	0.0125	0.0325	0.0200
	(0.0354)	(0.0352)	(0.0337)	(0.0280)	(0.0154)
Both (Separately)	0.137***	0.135***	0.140***	0.0925***	0.0400**
	(0.0348)	(0.0351)	(0.0345)	(0.0293)	(0.0168)
Both (Together)	0.152***	0.182***	0.200***	0.157***	0.0600***
	(0.0347)	(0.0347)	(0.0344)	(0.0304)	(0.0179)
Credit Only	-0.0200	-0.0250	-0.0375	-0.00500	0.0300*
	(0.0354)	(0.0351)	(0.0330)	(0.0269)	(0.0161)
Observations	2400	2400	2400	2400	2400
Control Mean	0.49	0.45	0.34	0.18	0.04

Notes: Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. The outcome is the response to a question asking how effective the household thinks regular air purifiers that can be bought in shops in Dhaka are at removing air pollution from the room in which they are being run. This variable ranges from 0 being completely ineffective to 1 being (almost) completely effective. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (5) are binary variables equal to 1 if the household said the purifier was more than 0%, 25%, 50% or 75% effective. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table A.17: Experiment 2: Treatment Effects - Lung Risk

	(1) Opinion on Lung Risk	(2) Perceived Lung Risk > 0x	(3) Perceived Lung Risk > 1.2x	(4) Perceived Lung Risk > 1.5x	(5) Perceived Lung Risk > 1.75x	(6) Perceived Lung Risk > 2x	(7) Perceived Lung Risk > 3x	(8) Perceived Lung Risk > 4x
Purifier Only	-0.0250	-0.00146	-0.0270	-0.0905**	-0.0909***	-0.0691**	-0.0468*	-0.0371*
	(0.0197)	(0.0322)	(0.0347)	(0.0351)	(0.0339)	(0.0288)	(0.0255)	(0.0216)
Monitor Only	-0.01000	0.0725**	0.0825**	0.0375	0.0475	0.00750	-0.0300	-0.0200
	(0.0189)	(0.0307)	(0.0334)	(0.0354)	(0.0350)	(0.0306)	(0.0261)	(0.0224)
Both (Separately)	-0.01000	0.0375	0.0325	1.39e-15	-0.0100	-0.0225	-0.0200	1.25e-15
	(0.0189)	(0.0314)	(0.0341)	(0.0354)	(0.0347)	(0.0300)	(0.0264)	(0.0232)
Both (Together)	-0.00500	0.0325	0.0175	-0.0500	-0.0600*	-0.0575**	-0.0500**	-0.0225
	(0.0186)	(0.0315)	(0.0342)	(0.0353)	(0.0342)	(0.0291)	(0.0254)	(0.0222)
Credit Only	-0.0200	-0.0158	-0.0235	-0.0389	-0.0341	-0.0420	-0.0296	-0.0248
	(0.0195)	(0.0324)	(0.0346)	(0.0354)	(0.0345)	(0.0295)	(0.0261)	(0.0222)
Observations	2400	2397	2397	2397	2397	2397	2397	2397
Control Mean	0.93	0.71	0.62	0.49	0.41	0.24	0.18	0.12

Notes: This table shows the effect on treatments in the additional experiment on perceived risks of lung cancer from exposure to air pollution. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. . The outcome is the response to a question asking how much do households believe exposure to air pollution increases their risk of lung cancer. This variable ranges from no increase in risk to an increase in risk by 400%. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (8) are binary variables equal to 1 if the household said the risk increased by more than 0%, 20%, 50%, 75%, 100%, 200%, 300% and 400% respectively. Observations are at the household level.

Table A.18: Experiment 2: Treatment Effects - ARI Risk

	(1) Opinion on ARI Risk	(2) Perceived ARI Risk > 0x	(3) Perceived ARI Risk > 1.2x	(4) Perceived ARI Risk > 1.5x	(5) Perceived ARI Risk > 1.75x	(6) Perceived ARI Risk > 2x	(7) Perceived ARI Risk > 3x	(8) Perceived ARI Risk > 4x
Purifier Only	-0.0225	-0.0143	-0.0317	-0.0791**	-0.0487	-0.0408	-0.0205	-0.00281
	(0.0173)	(0.0322)	(0.0342)	(0.0353)	(0.0348)	(0.0310)	(0.0267)	(0.0232)
Monitor Only	-0.0200	0.0564*	0.0368	0.0497	0.0704**	0.0236	0.0441	0.0394
	(0.0171)	(0.0309)	(0.0334)	(0.0350)	(0.0353)	(0.0322)	(0.0285)	(0.0248)
Both (Separately)	-0.0175	0.0489	0.0593*	0.00474	0.0329	0.00861	0.0216	0.0319
	(0.0170)	(0.0310)	(0.0331)	(0.0352)	(0.0352)	(0.0319)	(0.0279)	(0.0245)
Both (Together)	-0.0150	0.0458	0.0259	-0.0189	-0.00860	-0.0157	-0.00296	-0.000309
	(0.0168)	(0.0311)	(0.0336)	(0.0353)	(0.0351)	(0.0315)	(0.0272)	(0.0233)
Credit Only	-0.0350*	5.85e-16	-0.0151	-0.0226	-3.83e-16	-0.0327	0.00503	0.00503
	(0.0180)	(0.0320)	(0.0341)	(0.0354)	(0.0351)	(0.0312)	(0.0275)	(0.0235)
Observations	2400	2394	2394	2394	2394	2394	2394	2394
Control Mean	0.95	0.72	0.65	0.55	0.43	0.28	0.18	0.12

Notes: This table shows the effect on treatments in the additional experiment on perceived risks of acute respiratory infections (ARI) from exposure to air pollution. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. . The outcome is the response to a question asking how much do households believe exposure to air pollution increases their risk of lung cancer. This variable ranges from no increase in risk to an increase in risk by 400%. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (8) are binary variables equal to 1 if the household said the risk increased by more than 0%, 20%, 50%, 75%, 100%, 200%, 300% and 400% respectively. Observations are at the household level.

Table A.19: Experiment 2: Heterogeneity by Observed IAP Changes (Percentages): Restricted Sample

	(1) Beliefs about Severity of AAP	(2) Beliefs about Severity of IAP	(3) Beliefs about IAP v. AAP	(4) WTP for Air Purifier
Purifier Only	-0.155	0.195	-0.0395	219.0
	(0.198)	(0.176)	(0.185)	(260.7)
Monitor Only	0.456**	0.838***	0.673***	-341.7
	(0.192)	(0.180)	(0.189)	(249.2)
Both (Separately)	0.156	0.664***	0.373*	-274.9
	(0.196)	(0.180)	(0.191)	(248.7)
Both (Together)	0.448*	0.296	0.662**	-750.3**
	(0.255)	(0.238)	(0.257)	(313.9)
X % IAP Reduction	0.00391	0.0105**	0.000659	13.03***
	(0.00400)	(0.00413)	(0.00419)	(4.871)
Credit Only	-0.147	0.150	-0.0823	-177.9
	(0.197)	(0.182)	(0.190)	(257.1)
Observations	1815	1815	1815	1815
Control Mean	6.76	4.19	4.43	2774.23

Notes: This table shows the heterogeneous effects of the both (together) treatment arm by observed reductions in IAP (winsorized at the 99% level) by percentage of IAP reductions during the simultaneous demonstration of the purifier and the monitor. The regression omits the 585 observations collected on or before December 07, 2024 when we did not record the post-experiment IAP level for the both (together) treatment group. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. Column 1: "Beliefs about Severity of AAP" is households' response to: "How would you rate the current outdoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 2: "Beliefs about Severity of IAP" is households' response to: "How would you rate the current indoor air quality in your area? [On a scale of 1-10, with 1 being "not polluted at all" and 10 being "extremely polluted.]" Column 3: "Beliefs about IAP v. AAP" is households' response to: "How polluted do you believe the air in your home is compared to the air outdoors?" Column 4: "Willingness to Pay for Air Purifier" is the revealed valuation of an air purifier by the household during a BDM game measured in Bangladeshi Takas. WTP is winsorized at the 99% level. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.

Table A.20: Experiment 2: Heterogeneity by Observed IAP Changes (Percentages):Purifier Effectiveness - Restricted Sample

	(1) Has Opinion on Purifier Effectiveness	(2) Perceived Reduction: $> 0\%$	(3) Perceived Reduction: $> 25\%$	(4) Perceived Reduction: $> 50\%$	(5) Perceived Reduction: $> 75\%$
Purifier Only	0.124***	0.137***	0.138***	0.115***	0.0764***
	(0.0406)	(0.0406)	(0.0400)	(0.0348)	(0.0222)
Monitor Only	0.0120	0.0193	0.0207	0.0135	0.0125
	(0.0408)	(0.0406)	(0.0391)	(0.0321)	(0.0178)
Both (Separately)	0.152***	0.149***	0.151***	0.0885***	0.0353*
	(0.0402)	(0.0404)	(0.0398)	(0.0341)	(0.0195)
Both (Together)	0.0453	0.0648	0.0198	0.0493	0.0163
	(0.0565)	(0.0566)	(0.0547)	(0.0467)	(0.0262)
X % IAP Reduction	0.00327***	0.00337***	0.00424***	0.00221***	0.00107**
	(0.000830)	(0.000842)	(0.000854)	(0.000802)	(0.000504)
Credit Only	-0.0519	-0.0567	-0.0627*	-0.0302	0.0143
	(0.0403)	(0.0398)	(0.0376)	(0.0305)	(0.0178)
Observations	1815	1815	1815	1815	1815
Control Mean	0.47	0.43	0.35	0.18	0.04

Notes: This table shows the heterogeneous effects of the both (together) treatment arm by observed reductions in IAP (winsorized at the 99% level) by percentage of IAP reductions during the simultaneous demonstration of the purifier and the monitor. The regression omits the 595 observations collected on or before December 07, 2024 when we did not record the post-experiment IAP level for the both (together) treatment group. Purifier only: household is shown the purifier and that it works. Monitor only: household is shown that the monitor works and allowed to see the reading. Both (separately): first the household is shown the monitor works and the reading on the monitor. The monitor is then put away the household is shown the purifier and that it works. Both (together): the household is first shown the monitor and it's reading. Then while the monitor is still on and visible, the purifier is turned on for five minutes and the household is allowed to see the changes in the reading. Credit only: the household is offered a zero-interest option for financing the purifier purchase. Each of the five treatment arms are measured against a control group. The outcome is the response to a question asking how effective the household thinks regular air purifiers that can be bought in shops in Dhaka are at removing air pollution from the room in which they are being run. This variable ranges from 0 being completely ineffective to 1 being (almost) completely effective. Column 1 is a binary variable equal to 1 if the household selected any option other than "Don't know/unsure". Columns (2) - (5) are binary variables equal to 1 if the household said the purifier was more than 0%, 25%, 50% or 75% effective. Observations are at the household level. Significance levels are denoted by $***p < 0.01$, $**p < 0.05$, and $*p < 0.1$.