Clean Indoor Air in Jakarta: An Unaffordable Experience

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Abstract

Despite the severe health risks posed by air pollution, demand for cleaner air remains low in many highly polluted developing regions. One potential explanation is that clean air has an experience-good component: households may only value it more after directly experiencing it. We provide an experimental test of this hypothesis by randomly assigning households in Jakarta, Indonesia, to a three-month air purifier free rental. Purifier rentals reduced indoor $PM_{2.5}$ concentrations by 33%, confirming that the intervention meaningfully exposed households to cleaner air. Treated households were more likely to report health improvements and expressed stronger beliefs about the benefits of clean air. The treatment had no effect on mean willingness to pay for air purifiers in the full sample, but it significantly increased willingness to pay among above-median-income households, suggesting that financial constraints limit the translation of learning into action. These findings show that experiential learning can shape environmental preferences, while highlighting the persistent importance of affordability.

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1 Introduction

Developing country megacities like Jakarta, Delhi or Dhaka feature some of the world's highest levels of ambient air pollution, driven by rapid urbanization and industrialization. The health consequences of such exposure can be dire. For example, Jakarta inhabitants are losing about 2.2 years of life expectancy from ambient air pollution levels above the World Health Organization guidelines (AQLI 2024). Furthermore, because outdoor $PM_{2.5}$ infiltrates homes readily (Sun et al., 2025), exposure to air pollution is as much an indoor as an outdoor problem. Yet, despite the growing availability of air purifiers, urban dwellers in these fast-growing cities exhibit very low demand for these protective devices (Chowdhury et al., 2025), therefore exposing themselves to severe health burdens.

The first explanation often advanced to explain this low demand for clean air is the lack of information: households may lack accurate beliefs about the severity of indoor pollution, the health consequences of exposure, or the effectiveness of air purifiers. Such biases may span both easily verifiable generic facts (e.g. ambient pollution levels) and more subjective beliefs about personal impacts on well-being. Generic information campaigns have had mixed results (Greenstone et al., 2021; Ahmad et al., 2023), implying that households may require direct *experience* of cleaner air to fully update beliefs about its value for their well-being (Kahn et al., 2020). A second candidate is limited income: even if information frictions were resolved, budget constraints may prevent households from acting on updated beliefs (Greenstone and Jack, 2015). These two explanations are often studied independently, but they may interact in important ways: if experience is needed to reveal the true value of clean air, then the role of income in limiting adoption may itself be hidden in the status quo.

We recruit more than 950 households across the income spectrum. To isolate the role of experience, we first provide to all households standard theoretical information about air pollution levels and health impacts, as well as about the role of air purifiers. We then randomly offer a subset of households a two month-long intensive treatment: an air purifier and an indoor air quality monitor, enabling participants to see real-time pollution levels and feel the benefits of cleaner air. To further isolate the impact of experience of clean air, we design another treatment arm where participants only receive an air purifier but no air monitor. We gather high-frequency indoor pollution measurements for all households and capture beliefs and willingness to pay (WTP) for clean air.

Our central result is that indoor clean air has an important experience-good component: experiential learning shifts beliefs about the importance of clean air, but increases willingness to pay only among above-median-income households. In the absence of experience in the status quo (control group), WTP for air purifiers is low and shows no income gradient. This experience translates into higher WTP for air purifiers, but only for high income households

(+44%), revealing a large income gradient that was hidden in the status quo.

Overall, our results offer an explanation for the low adoption and usage of air purifiers in developing markets (Chowdhury et al., 2025). Our results also imply that status-quo WTP estimates for clean air systematically understate the true income gradient of demand and that, conversely, while experience may be necessary, it is not sufficient for action: income remains the binding constraint for at least half of Jakarta households.

We base our experiment in Jakarta, Indonesia's capital city, which consistently ranks among the world's most polluted cities, with $PM_{2.5}$ concentrations averaging more than nine times the WHO health standard in 2023. Jakarta's ongoing transition, characterized by population expansion and escalating environmental degradation, offers a valuable case for understanding how demand for environmental protection emerges in rapidly developing megacities. On the one hand, awareness about the air pollution issue has been rising, especially among a growing minority of Jakarta citizens, as exemplified by a court ruling in a citizen lawsuit that found the Indonesia and Jakarta government negligent in ensuring citizens' rights to clean air. On the other hand, air quality is not a primary concern for most Jakarta residents (Strategies, 2024), who have consistently experienced severe ambient air pollution in the city over the past two decades (AQLI 2024).

We conducted our experiment between June and November 2024. To maximize response rates across the income distribution, we focused on parents, who are more likely to engage with research elicitation. In partnership with Jakarta's Department of Education, we selected 952 households with school-aged children from a random sample of schools across the city.

We begin by engaging with the existing literature, embedding a video information RCT into the baseline survey. The video, created using footage from previous information campaigns conducted by a local clean air NGO, covers pollution sources, health impacts, and mitigation strategies such as air purifiers. The objective of this step is twofold. First, we assess how a generic informational video - analogous to existing information campaigns - may shift objective and subjective beliefs about air pollution. We do so by showing the video to half of the respondents before completing the baseline survey, while the other half watched it afterward. Second, this design allows us to ensure that all participants have been exposed to generic information about air pollution, so that the main intervention focusing on experience does not also fill basic information gaps.

We then randomly split households into an experience only group, an intensive information group, and control group. Households in the experience-only group received a two-month air purifier rental, allowing them to feel the difference cleaner air can make. The intensive information group received both a purifier and an indoor air quality monitor that displayed air quality levels using a color-coded system; this aimed to correct misconceptions about personal

exposure levels, complementing the experiential effect of the purifier. Control group households received a fan — an identical unit without the filter — ensuring that all households in our sample could learn equally about non-health and operational aspects of the purifier, including cooling effects, electricity use, noise, and general novelty.

After two months, we conducted the endline survey. At both baseline and endline, households were asked about their knowledge, beliefs and preferences regarding air quality and related policies or protective actions, as well as perceived health. We also collected respondents' blood pressure and blood oxygen to assess their objective health. In addition, at endline, we elicited households' willingness to pay (WTP) for an additional two-month air purifier rental to assess whether demand for the technology was different across treatment arms. To ensure that the measure of WTP was incentive compatible, we implemented the Becker-DeGroot-Marschak (BDM) mechanism. Over the whole course of the experiment, we performed regular check-ins with participants by phone messages and collected high frequency information on their well-being and beliefs about air quality levels.

We start by documenting new facts about the status-quo levels of indoor air pollution and air purifier effectiveness in Jakarta, one of Asia's most polluted city. We show that indoor air pollution in Jakarta households is dangerously high, yet systematically underestimated by respondents. In the absence of air purifiers, indoor air pollution levels closely map outdoor levels (Sun et al., 2025), averaging $44\mu g/m^3$, or about nine times the WHO annual mean concentration. During the baseline survey, respondents systematically underestimated indoor pollution levels, while their beliefs about outdoor air pollution levels were more accurate. In that context, we find that air purifiers are effective at improving indoor air quality. For the average household, an air purifier decreases $PM_{2.5}$ concentrations by $13.3\mu g/m^3$ or an increase in life expectancy of 8 months.[1]

We then organize our primary findings around our two main contributions.
Our first main contribution is to provide the first causal experimental evidence that indoor clean air is an experience good. We first show that indoor air pollution in Jakarta households is dangerously high, averaging 44 $\mu g/m^3$ in the control group - approximately nine times the WHO annual guideline - and closely track outdoor levels (Sun et al., 2025). Yet 65% of respondents underestimate their indoor AQI (only 24% underestimate outdoor AQI, consistent with indoor $PM_{2.5}$ being inherently less observable). We further find that air purifiers are effective: they reduce mean indoor $PM_{2.5}$ by 13.3 $\mu g/m^3$ (30%), decreasing the probability of dangerous pollution spikes ($PM_{2.5} > 100\mu g/m^3$) by 40%.
Second, we show that generic information may be sufficient to correct outdoor knowledge but

[1]We rely on the AQLI methodology to translate sustained changes in air quality exposure into changes in life expectancy and we weight the impact by the share of time spent by households at home.

not beliefs about personal, indoor exposure. At baseline, only 41% of respondents believe that air pollution can cause heart diseases, despite widespread scientific evidence (Walzer et al., 2020; Xia et al., 2021), and 70% of respondents claim that having lots of indoor plants can absorb most dangerous pollutants, for example. Respondents who watched the generic video before the baseline survey improved their generic knowledge score and beliefs about outdoor AQI, but we find no statistically significant impact on indoor pollution beliefs, perceived health impacts, or WTP (stated). This suggests that generic information alone is insufficient to shift more personal beliefs and demand-relevant outcomes.

Third, we show that experience can correct beliefs about indoor pollution and health impacts. Households who received the purifier + monitor updated their beliefs about indoor $PM_{2.5}$ levels significantly. Crucially, both treatment arms—purifier + monitor and purifier only—updated beliefs about the health benefits of clean air at similar magnitudes. This result establishes that the physical experience of cleaner air — not just exposure to numerical data — is sufficient to shift beliefs about health. The fact that purifier-only households update health beliefs but not AQI level beliefs confirms our experimental design is working as intended: only objective monitoring data can correct level misperceptions, while the physical experience of clean air is enough to shift health utility beliefs. These effects are statistically indistinguishable across income groups, confirming that experiential learning is not itself income-constrained. Preliminary evidence on objective health outcomes is consistent with this channel: treated adults report significantly improved sleep quality, and children in the monitor+purifier group show suggestive reductions in hypertension prevalence (Section 4.2.1).

Our second main contribution is to show that the lack of experience hides the role of income in limited purifier adoption. In the control group, average WTP for a two-month air purifier rental is \$1.48 for below-median income house- holds and \$1.25 for above-median income households—statistically indistinguishable, and both far below the market price. Strikingly, above-median income households in the control group have lower WTP than their below-median counterparts, consistent with air quality in their homes being slightly better. After experiencing clean air, WTP among above-median income households rises to \$1.80 per two-month rental (+44%), while WTP for below-median income households remains unchanged at \$1.52. This creates a significant income gradient in treated WTP that was absent in the status quo. Status-quo adoption patterns therefore understate the true income gradient of demand. The increase in WTP is driven primarily by the purifier + monitor arm among high-income households, consistent with objective monitoring data being particularly valuable for translating health beliefs into willingness to act.

These contributions add to a growing literature at the intersection of development, environmental, and behavioral economics.

Our first contribution supports a dynamic explanation for low estimated willingness to

pay (WTP) for environmental improvements in developing contexts. Experience goods are goods whose quality can only be assessed after consumption (Ackerberg, 2003; Israel, 2005; Bergemann and Välimäki, 2006; Bonatti, 2011; Chen et al., 2022) and have been the focus of a burgeoning branch of economics, mostly in finance, that emphasizes the role of stimuli beyond traditional information content (pamphlets or videos about pollution impacts).[2] Prior work on environmental quality and experience goods is either theoretical (Czajkowski et al., 2015) or correlational (Kahn et al., 2020). Our RCT provides the first clean experimental identification: experience shifts beliefs about the health benefits of clean air and, for high-income households, translates into higher WTP. Crucially, our purifier-only arm allows us to rule out that the mechanism is learning about product functionality rather than about the good itself—physical experience alone updates health beliefs even without numerical feedback (Chowdhury et al., 2025). In settings where populations have long lived with high pollution and limited monitoring, concern for air quality may only emerge after direct exposure. Low experience therefore locks in low demand.

Our second contribution is to show that the lack of experience may hide the role of income in limited purifier adoption. The envirodevonomics literature points to income as a key barrier to demand for environmental quality (Greenstone and Jack, 2015). We show that without experience, the income gradient in WTP is absent: status-quo WTP is low and flat across the income distribution. After experiencing clean air, a large income gradient emerges - above-median income households increase WTP by 44%, while below-median income households do not. This implies that analyses based on status-quo WTP - the standard in cost-benefit analyses of environmental policy - will understate the true income gradient of demand. The absence of purifier adoption among higher-income households in the status quo is not a market failure due to income constraints per se, but reflects an experience-driven information friction. Once experience is provided, income reemerges as the binding constraint for the majority. Notably, WTP among treated high-income households ($1.80 for a two-month rental) still falls well below the market price ($221 for purchase), confirming that income remains the limiting factor for at least half of Jakarta's population even after the experience intervention.

We also contribute to the small but growing body of experimental evidence on WTP for clean air in developing countries and on indoor air purifier effectiveness and adoption in low- and middle-income settings.[3] Additionally, we have preliminary results that cleaner indoor air may improve measured health indicators, even without a change in ambient outdoor air quality exposure.

[2]For a review of this literature, see Malmendier (2021)

[3]We also contribute to the small but growing body of experimental evidence on WTP for clean air in developing countries and on indoor air purifier effectiveness and adoption in low- and middle-income settings.[4] Additionally, we have preliminary results that cleaner indoor air may improve measured health indicators, even without a change in ambient outdoor air quality exposure.

The rest of the paper is organized as follows. Section 2 describes the context, research design, and data. Section 3 documents the status-quo state of indoor air pollution, misperceptions, and low demand for air purifiers—including the absence of an income gradient in control-group WTP. Section 4 shows how the experience of clean air shifts beliefs about air quality and health. Section 5 investigates when these updated beliefs translate into increased demand, revealing the income gradient hidden in the status quo. Section 6 concludes with policy implications.

2 Context, Experimental Design and Data

2.1 Research Context

Jakarta offers a familiar story of a developing megacity, where rapid urbanization, industrial activities, and a growing number of vehicles contribute to elevated air pollution levels. Our research leverages this setting—characterized by high pollution and limited experience with clean air—to explore how direct exposure can shape beliefs, behaviors, and demand for environmental improvements. In this section, we detail the context of Jakarta's air pollution crisis, the rationale behind selecting our sample of parents of elementary school children, and the methods used to measure air quality, beliefs, and demand.

2.2 Sampling

We studied preferences for air quality by repeatedly surveying parents of elementary school children across Jakarta. We focused on this parent sample primarily to ensure the return of intervention hardware, as loss or sale of air purifiers would compromise the experiential learning component central to the study. Ensuring the integrity of the intervention was critical to its success. Moreover, surveying in urban areas of developing countries often faces challenges like low participation and high attrition (Greenstone et al., 2021). By targeting parents, we mitigated these issues, achieving higher uptake and retention rates. As a result, while our sample is not representative of the general Jakarta population, it was intentionally selected to ensure the logistical feasibility of implementing a robust experiential clean air treatment.

We partnered with the Education Office, which provided legitimacy with school administrators and parents. With their support, our field coordinators engaged with principals and administrators at 180 elementary schools to secure participation in the project. These schools were selected to represent the broader landscape of the 2,162 schools in Jakarta, ensuring diversity across consumption expenditure and ambient pollution levels. Using rosters provided

by the schools, we randomly sampled 2,000 households to contact and subsequently enrolled 952 households through text messages. Of these, 952 households completed both rounds and constitute the primary analysis sample (see Appendix Table A1 for details on attrition). Figure 1 provides a map of Jakarta, showing the locations of the households and schools involved in our study.

2.3 Research Design

We design our randomized controlled trial (RCT) so that a randomly selected sample of participants have a comprehensive experience of clean indoor air and that all participants have been exposed to standardized, publicly available generic information about air pollution before the start of the experience. We describe the design in this section.

2.3.1 Experiential Treatments

To test whether limited experience with clean air contributes to an biased beliefs and an underestimation of demand for clean air, we design two treatments, which are designed to isolate two mechanisms of experiential learning: sensory feedback from clean air and sensory feedback combined with objective pollution data. The experimental design is summarized in Figure 2.

Control: The control group received a purifier rental without a filter, which essentially renders the purifier as a fan. Households know this is simplify a fan, and we explain that it does not filter the air for pollutants. This control group design ensures that the primary difference between treatment and control is the provision of clean air. This approach addresses two key confounders. First, when measuring WTP for purifiers at endline, providing the control group with a similar device (a fan) mitigates the risk of conflating the treatment effect with loss aversion.[5] Second, by providing all households—control and treatment—with a device, we allow them to learn about features unrelated to clean air, such as the cooling effect of purifiers and the electricity requirements to run the device.

Main comprehensive treatment: The Experience + Personalized Information is our main treatment and includes both an air purifier and an air monitor. Households in this group receive an air purifier with a filter installed, allowing them to experience the immediate physical and sensory effects of cleaner indoor air. Households in this group also receive an air quality monitor that provides real-time feedback on indoor air pollution levels. The monitor, shown in Figure 3, display both objective pollution measurements (e.g., $PM_{2.5}$ levels) and corresponding Air

[5]To further minimize loss aversion, enumerators emphasize at endline that the current fan or purifier will be replaced with a new device.

Quality Index (AQI) categories with color-coded indicators to enhance comprehension. These monitors were installed approximately one week before the air purifiers to give households time to observe their baseline indoor air quality. This time gap allows participants to learn about their home's air quality without a purifier. This addition allows us to test the added value of personalized, objective pollution data in shaping preferences and demand for clean air.

Additional sensory-only treatment: The Experience-only group is designed to give households a sensory experiential learning experience. Households in this group receive an air purifier with a filter installed, allowing them to experience the immediate physical and sensory effects of cleaner indoor air. By directly comparing this group to the control group, we test whether sensory experience alone shifts households' beliefs and demand for clean air.

Importantly, devices in all three groups record $PM_{2.5}$ levels, but this information can only be accessed by participants in the main comprehensive treatment group (purifier + monitor).

To prioritize the experience of clean air over studying purifier usage, we d households to actively use the purifiers. We offered an incentive of IDR 35,000 (approximately USD 2) every 30 days if the purifier was plugged in and connected to Wi-Fi for an average of 14 hours per day. For households without Wi-Fi or unwilling to use their own, we installed dedicated Wi-Fi units. Additionally, we provided IDR 15,000 (approximately USD 1) every 30 days to compensate for the electricity costs of running the purifier, an amount sufficient to fully cover the energy consumption across all treatment groups.

2.3.2 Embedded Generic Information Treatment

Before implementing the main experience-based treatment, we used an information intervention—a video on air pollution—to document and attempt to correct existing information biases. This serves two key purposes. First, to evaluate whether watching the video influences knowledge and beliefs about pollution. Second, to standardize respondents' knowledge about air pollution. This standardization helps ensure that the subsequent experience-based treatment builds on a common foundation, allowing us to better isolate and measure the impact of experiential learning.

Treatment Design: In this embedded RCT, households were randomized so that half watched the video before completing the baseline survey, while the other half watched it afterward (see Figure 4). By randomizing the timing of the video in relation to when baseline surveys were conducted, we could analyze the immediate impact of a generic information treatment on air pollution beliefs asked in the survey.

The video content was designed to reflect common informational strategies used by NGOs and government agencies to raise awareness about air pollution. Collaborating with a local NGO, we adapted campaign materials into a narrative covering the health impacts of pollution, pollution levels in Jakarta, sources of pollution, risks of indoor air pollution, and protective actions. A link to the video and a transcript in English can be found in Appendix A.4.

2.4 Randomization and Timeline

As detailed in Section 2.2, our sample consists of parents who have children who attend elementary school in Jakarta, Indonesia, and who do not already have a purifier.

We randomized treatment at the classroom level, with 1-2 students in each classroom, in order to address potentials for spillovers within a classroom. Randomization was stratified by grade, baseline poverty index of the school, and baseline pollution level of the neighborhood of the school. Engagement with parents and treatment is administered at the homes of the participants, with no contact happening at the schools; this reduces the likelihood of across-classroom spillovers in the same school.

While high outdoor air pollution is sustained during the whole year, ambient levels of $PM_{2.5}$ are highly seasonal in Jakarta. We target the high pollution season in Jakarta as the topic and effects of the treatment may be most salient. We conducted the experiment in two successive rounds, with approximately 425 households participating in each round. Round 1 was from June 1st to August 28th. Round 2 was from September 10th to December 10th.

After enrolling parents who have never owned an air purifier, enumerators visited the household to conduct the baseline survey and elicit consent to participate in the air purifier installation. Note that for households who were randomized into the Purifier + Monitor treatment group, monitors were installed at the end of the baseline survey, giving households time to learn about their indoor air pollution levels before the purifier is installed. Figure 5 summarizes the rest of the timeline of all field activities.

2.5 Data

2.5.1 Attrition, summary statistics, and balance

We start by examining sample attrition and baseline balance across control and treatment groups. As shown in Appendix Table A1, overall attrition is very low, with only 6% of households in the control group leaving the study.[6] Importantly, we find no evidence of differential

[6]This attrition rate aligns with rates typically observed in rural contexts but is exceptionally low compared to urban settings. For instance, Greenstone et al. (2021) reported attrition rates of 19–32% across their treatment groups.

attrition in either treatment group. Appendix Table A2 further explores the relationship between attrition and baseline characteristics, showing no significant correlations. Lastly, only one household moved during the study, preventing us from retrieving our hardware from them.

Table 1 presents descriptive statistics for our sample and the results of our balance checks. Treatment and control groups were balanced across all key variables, except for the number of smokers in the household, where both treatment groups had fewer smokers than the control group. An F-test did not reject the null hypothesis that these main demographic variables jointly do not predict treatment assignment. Given that indoor smoking is related to indoor air pollution exposure and reflects household composition by gender (as men are more likely to smoke than women), the number of smokers could be important. We use double lasso selection to identify control variables in all main regressions and provide additional results with the number of smokers explicitly included as a control in the Appendix.

Our sample consists of low- and middle-income parents with elementary school children in Jakarta. As shown in Table 1, the average household monthly expenditure in our sample is significantly below the Jakarta population mean, equivalent to about half of the city's average household expenditure.

This income skew is further confirmed in the types of schools attended by the children in our sample. While our sampling frame of 180 schools mirrored Jakarta's citywide ratio of private to public school enrollment, participation in the intervention was disproportionately low among private school students. Although 29% of students citywide attend private schools, only 3% of students in our sample were from private schools (Central Bureau of Statistics).

We collected data on four main groups of outcomes: (1) Air quality, (2) beliefs about air pollution, (3) health, and (4) demand for air quality, with a focus on WTP for air purifiers. We also collected additional demographic and secondary variables to support heterogeneity analyses and examine secondary outcomes. A detailed description of the measurement procedures is included in the survey questionnaire in Section A.7.

2.5.2 Air Quality

Having a substantive impact on a household's indoor air quality is foundational for the rest of our analyses. All fans and purifiers were equipped with internal $PM_{2.5}$ sensors, with readings not visible to respondents. When plugged in and connected to Wi-Fi, the sensors transmitted real-time data to a remote server every five minutes. To incentivize households to assist with data collection, we offered IDR 35,000 every 30 days (approximately USD 2), conditional on the purifier being plugged in and connected to Wi-Fi for an average of 14 hours per day. For households without Wi-Fi or unwilling to use their Wi-Fi for the experiment, we installed dedicated Wi-Fi units. Additionally, we provided IDR 15,000 every 30 days (approximately

USD 1) to compensate for the electricity costs associated with running the hardware.

To measure outdoor air quality, we collaborate with a local organization that has deployed over 100 low-cost sensors across Jakarta. For each household, we calculate a weighted average of air quality readings from the three nearest sensors, assigning weights inversely proportional to the distance to each sensor. These sensors also capture temperature and humidity data.

2.5.3 Beliefs on Air Pollution

We measure three types of beliefs: (1) perceptions of air pollution exposure, (2) beliefs about the health impacts of air pollution and our treatment intervention, and (3) beliefs about air purifier effectiveness

To measure perception of air pollution exposure, enumerators begin our survey by introducing respondents to US Environmental Protection Agency's (EPA) Air Quality Index (AQI) scale, along with an explanation of its health risks and differences from the Indonesian government's scale. This AQI scale is widely used in various countries. Participants are then asked three questions: (1) how they would rate their home's air quality, without an air purifier, over the past week on a scale from 1 (good/green) to 6 (hazardous/brown); (2) how they would rate outdoor air quality in their neighborhood over the past week; and (3) how they perceive indoor air quality in their home compared to outdoor air quality.

Next, to capture beliefs about the health impacts of clean indoor air, we designed proxy questions addressing respondents' marginal utility of clean air. While true beliefs cannot be directly observed, we approximate them by asking participants how much they agree with the following statements: (1) "*Spending 12 hours a day in a clean air environment is good for my immediate health, even if the air is very polluted the other 12 hours*," and (2) "*Spending 12 hours a day in a clean air environment is good for my long-term health, even if the air is very polluted the other 12 hours*." These statements are intended to reflect respondents' beliefs about the short-term and long-term value of cleaner indoor air.

Related to beliefs about the health impacts of clean air, we added a question in the second round of surveys that more directly assessed participants' beliefs about the effects of this treatment. We asked, "*Compared with your health 3 months ago, would you say that your health is now: improved, about the same, or worse?*" For respondents who answered "*improved*," we followed up with, "*What are the top three factors you believe have contributed most to your improved health?*" Participants were provided with a list of eight possible factors, including our intervention as one of the options. This allowed us to better understand participants' perceptions of the treatment's impact on their health within a broader context.[7]

[7]The belief question about the health impacts of this treatment, though not pre-specified, was included to understand if households were connecting their direct experience with our treatment to more general beliefs about the health value of clean air.

Finally, although the primary focus of our research is not on air purifier adoption, we aim to understand whether households learn about purifier efficacy during the experiment. To assess this, we include two targeted questions in the survey: (1) "*What does a purifier do?*" and (2) "*With the windows and doors closed, how effective do you think one air purifier is at removing pollutants from your home?*" The second question offers multiple-choice responses ranging from "*not much effect*" to "*90% effective.*" These questions help us explore whether participants develop a better understanding of purifier technology as a result of their participation in the study.

2.5.4 Health

Biometrics: Particulate matter negatively impacts cardiovascular and respiratory systems. To objectively assess these pollution-related health effects, we measure blood pressure and blood oxygen levels. $PM_{2.5}$ causes blood vessels to narrow, leading to increased blood pressure, and can also increase lung inflammation, impairing oxygen exchange and potentially decreasing blood oxygen levels.[8]

Self-Reported Health: We ask a set of yes/no questions asking whether the respondent experienced a set of symptoms in the past four weeks. These include both pollution (i.e. cough, breathlessness) and non-pollution (placebo) related symptoms (i.e. stomachache, skin rashes). The elicited symptoms are combined into 2 indices: adult pollution symptoms, adult non-pollution symptoms. Each symptom will be weighted by the inverse mean of the number of people with the symptom at baseline. We also ask about medical costs in the last 4 weeks, frequency of hospital visits, and number of days they missed work/daily/school activities due to health issues.

Cognitive Ability: We use four instruments to assess respondents' memory and attention. First, we use word recall to measure working and episodic memory. Second, we use Serial Seven to measure attention. Third, we use forward digit span to test working memory. Fourth, we use backward digit span to test executive functioning. We combine these four cognitive ability measures into one cognitive ability index. We do this by standardizing each of the four measures to mean and standard deviation 1, and then taking the average across the outcomes. Section A.5 has details on these assessments.

Mental Health: We measure depression using the 10-item Center for Epidemiologic Studies-Depression Scale Revised (CESD-R-10) (Radloff, 1977). This questionnaire is commonly used

[8]We measured blood pressure following the CDC's NHANES (2021) procedures as closely as possible. However, field conditions introduced unexpected challenges, such as the lack of a proper chair for respondents or a stable surface for their arms. We documented these anomalies whenever they occurred. Blood oxygen levels were recorded using a pulse oximeter. Although we considered collecting lung capacity data with a spirometer, experts advised that the data might be noisy, and the procedure would be time-intensive and costly to implement. Given these constraints, we opted to focus on our other health measurements instead.

to assess depressive symptoms in adults, and is the assessment used by the Indonesian Family Life Survey (IFLS). Each item has four possible answers that are rated on a Likert scale (0–3), with total scores ranging from 0 to 30. We will use both a binary measure of depression (scores 10) as well as a continuous measure from 0 to 30 (Tran et al., 2019).

Sleep quality: We measure sleep disturbance using ten indicators adopted from the Patient Reported Outcomes Measurement Information System (PROMIS), developed by the USC Center for Economic and Social Research. Again, this has been used by the IFLS, and has been evaluated against other sleep indices. Each question on disturbance was rated on a Likert scale (never, rarely, sometimes, often, and always), and we will run our analysis on the total score for each respondent, which ranges from 10 to 50. Additionally, we collect time-use data from the past 24 hours at endline, for both the respondent and the child. These will allow us to infer sleep duration.

For biometrics, self-reported health, and cognitive ability, we not only measure these outcomes for our parent respondent, but we also measure them for the targeted child in each family.[9] For self-reported health, these are asked to the adult, and we create a measure of adult-reported child pollution symptoms, and adult-reported child non-pollution symptoms.

2.5.5 Demand for Clean Air

Our primary proxy for demand is the willingness to pay (WTP) for a two-month purifier rental. To measure this, we implemented a Becker-DeGroot-Marschak (BDM) mechanism, drawing on the logistical approaches outlined in Berry et al. (2020) and Berkouwer and Dean (2022). At endline, each respondent was randomly assigned a hidden price, printed and sealed inside an envelope labeled with their name, which remained unknown to both the respondent and the enumerator. These prices ranged from USD 1 to USD 40. Additionally, we used an iterative multiple price list (iMPL) approach, which conducts a binary search over a range of USD 0 to USD 45. In each step of this process, respondents were presented with a price and asked whether they would rent the purifier for two months at that price. If the respondent agreed, the price was increased in the next step; if they declined, the price was decreased. This iterative procedure allowed us to efficiently estimate WTP for the rental.

Following Berkouwer and Dean (2022), each respondent also completed two practice BDMs before undertaking the final purifier rental BDM; one for a bottle of lotion and one for a bottle of shampoo. Respondents are randomly assigned whether they would be offered the lotion using take it or leave it (TIOLI) and the bottle of shampoo using BDM, or vice versa. Details about the implementation and the script is in Section A.3.

We collected additional measures of demand to construct three indices, each capturing a

[9]The targeted child is the elementary school child targeted by our sampling methodology.

distinct facet of demand. The Demand for Indoor Clean Air Index includes three components: time spent at home in the last 24 hours, whether there was smoking in the home during that period, and whether households reported closing doors to protect themselves from outdoor pollution in the past week. The Demand for Outdoor Clean Air Index is based on yes/no responses to whether households engaged in specific activities over the past week, including wearing masks, checking outdoor pollution levels, avoiding outdoor areas during high pollution periods, and consuming news about air pollution. Lastly, the Policy Support Index measures households' willingness to support various policies (each with an associated cost), their willingness to add their names to a petition supporting air purifiers in Jakarta elementary schools, and their willingness to follow a local clean air NGO on Instagram or via an email list. To create these indices, we normalized each component as a z-score and calculated a weighted mean using inverse-covariance weights.[10]

3 Status-Quo Knowledge, Beliefs and Demand for Air Purifiers and Clean Air

3.1 Air Pollution Levels

Jakarta is consistently ranked among the world's most polluted cities. Our outdoor sensors, operating between June and December 2024, recorded an average ambient $PM_{2.5}$ concentration of approximately 40 $\mu g/m^3$—about eight times the World Health Organization's (WHO) annual guideline of 5 $\mu g/m^3$ (Sun et al., 2025). Pollution levels are particularly severe during the dry season (May–September), when atmospheric conditions and fires exacerbate air quality issues.

Our own data collection confirms these high outdoor pollution levels and reveal that indoor pollution levels closely track outdoor pollution, as shown in Figure 6. This underscores the pervasive nature of air pollution in Jakarta, where exposure is unavoidable even within homes. Details on how this data was collected is in Section 2.5.2.

Public concern over Jakarta's air quality has been growing over the past decade. In July 2019, a group of Jakarta residents filed a landmark citizen lawsuit against the Indonesian government, alleging negligence in addressing the city's severe air pollution. The plaintiffs argued that authorities had failed to protect citizens' rights to clean air, citing the health risks associated with prolonged exposure to high pollution levels. In September 2021, the Central Jakarta District Court ruled in favor of the plaintiffs, finding President Joko Widodo and other

[10]Note that construction of these indices deviate from our pre-analysis plan. Initially, we did not plan to separate indoor and outdoor actions; however, it became clear during the intervention that households treat these two domains distinctly. Additionally, we revised the index construction method to use inverse-covariance weights due to high correlations among some indicators. For robustness, we follow Kling et al. (2007) and took the average of normalized z-scores, and the results remained consistent.

top officials negligent and ordering them to implement stricter measures to improve air quality. Despite this legal victory, progress in addressing pollution has been slow, and public demand for pollution control remains low (Strategies, 2024).

3.2 Air Purifier Effectiveness

This section presents the regression specification and results for a key prerequisite to our intervention's impact on demand: whether the purifier hardware effectively improved air quality. We find that the purifiers significantly reduced pollution levels, improving mean $PM_{2.5}$ by 30%.

We estimate the impact of treatment on household $PM_{2.5}$ exposure by aggregating data to the hourly level for each respondent. This approach accounts for variability in device usage and allows us to incorporate hour-of-the-day fixed effects, controlling for potential variations in pollution levels and purifier effectiveness across different times of day. Our treatment effect is interpreted as an intention-to-treat (ITT) estimate when the purifier is turned on. We estimate the following regression specification:

$$PM_{ih} = \alpha + \beta 1\{\text{Treatment}\}_{cr} + X_i' \cdot \phi + \mu^{hour} + \mu^{strata} + \mu_r + e_{ihr} \tag{1}$$

Here, PM_{ih} represents the aggregated indoor $PM_{2.5}$ level for household i at hour h, with treatment assigned at the classroom c-level for round r. All specifications use double-selection LASSO to select controls, along with hour-of-the-day, strata and round fixed effects. We assess the purifier's impact on multiple indoor pollution metrics: mean, median, maximum levels, and probability of pollution spikes (when $PM_{2.5}$ exceeds $100\mu g/m^3$).

Across all $PM_{2.5}$ measures, we observe significant reductions from the treatment, shown in Table 2: purifiers decreased mean and median $PM_{2.5}$ by 30%, max $PM_{2.5}$ by 24%, and the probability of pollution spikes by 40%. To test the robustness of these estimates, we used two alternative aggregation methods: one fully disaggregated at the respondent-date-hour level and another with a single pollution value per household. The effect sizes remain consistent across all three aggregation techniques, as shown in Table A4.

We report the effect of the combined treatment in Table 2, as there were no differences between the two treatments in the impact on $PM_{2.5}$. For the effects separated out by treatment arm, please see Table A3.

Our fans and purifiers transmit data every ten minutes when plugged in and connected to Wi-Fi, but our indoor air quality dataset contains significant gaps due to a combination of purifier non-use and Wi-Fi connectivity issues. While missing data from purifier non-use can offer insights into barriers to adoption and sustained usage, the data do not allow us to distinguish between non-use and Wi-Fi instability.

Since our primary focus is on providing households with the experience of clean air—and we specifically incentivized them to use the purifiers for at least 14 hours per day—we do not consider purifier usage a main outcome variable. We believe Wi-Fi issues are likely random across treatment groups; Table A5 shows that there is balance across treatment groups on whether the household had their own Wi-Fi. In addition, there is no difference in amount of transmitted data between treatment groups. Given that Wi-Fi connectivity was balanced, this suggests that purifier usage was balanced across intervention groups, and thus the experience of clean air was balanced across the groups. For more information on data availability, see Appendix A.6.

3.3 Low Status-Quo Demand For Air Purifiers

We now turn to whether the effectiveness of air purifiers in improving indoor air quality is reflected in households' demand for these devices. Our primary measure of demand is households' WTP for a two-month purifier rental at endline, elicited via BDM. Figure 7 displays the inverse demand curve separately for control and treatment groups. We interpret the control group's demand as status-quo demand.[11]

The demand curve reveals that 52% of control households are unwilling to pay any price for the good, as indicated by the steep drop at zero price. Moreover, about one-third of respondents declined to participate altogether; we code non-participants as having a WTP of zero. For the remaining 48% of households with non-zero WTP, WTP decreases as price rises, with a small price-insensitive segment maintaining high WTP levels. Overall, the market is characterized by a bifurcation between a large share of households with no demand and a small tail with high valuations.

Average WTP for a two-month rental in the control group is \$1.4 (\$1.48 for below-median income households and \$1.25 for above-median income households).[12] This is equivalent to an annual WTP of \$8.9 (below median) and \$7.5 (above median), or approximately \$4.3 and \$15.2 per $10\,\mu g/m^3$ annual reduction in $PM_{2.5}$ respectively (under 24-hour use assumptions).

Strikingly, there is no income gradient in status-quo WTP: above-median income households are willing to pay no more - and in fact slightly less - for air purifiers than below-median income households. This may be due to the fact that above-median income households experience slightly lower indoor pollution at baseline. This absence of an income gradient in the status quo is a central result of the paper and motivates the analysis in Section 5.

These WTP figures are remarkably low relative to the market price of air purifiers (above \$200 for the purifiers used in our experiment, or an annual cost of above \$50 assuming a five-

[11] We did not conduct a BDM at baseline.

[12] The small, statistically insignificant difference in WTP across income groups in the control group is discussed in Section 5.2.

year lifetime and a 10% discount rate), and would not even cover filter replacement costs ($10 per filter, replaced every three months).

To reconcile this low demand with the facts that indoor pollution is high and purifiers are effective, we investigate the existence of information frictions in Section 3.4.

3.4 Evidence of Information Frictions

One possible explanation for the remarkably low WTP for air purifiers in the status-quo (control) is that our study participants hold biases and have imperfect information about either the levels of air pollution, the effectiveness of air purifiers, or the impact of air pollution on their well-being.

Underestimation of the Levels of Indoor Air Pollution

To assess the presence of misinformation about the levels of air quality, during the baseline survey, we asked participants to estimate indoor AQI over the past seven days. While we lack measurements of participant-specific levels of indoor air pollution over that time-frame, our surveyors recorded indoor AQI levels during their baseline visit, offering a reasonable point of comparison for these stated beliefs.[13]

Comparing respondent beliefs to these objective measures reveals substantial underestimation, as shown in Figure 8a. A majority of households classified their indoor air quality as "*Moderate*," while measured AQI levels were centered at the "*Unhealthy for Sensitive Groups*" category. If no biases existed and households were randomly guessing their indoor AQI levels, we would expect roughly equal numbers of overestimations and underestimations. Instead, 66% of households underestimated their indoor AQI, while only 11% overestimated it.

To further examine beliefs about indoor air quality, we asked participants to compare it to outdoor air quality. Figure 8b shows that a striking 87% of respondents believed that outdoor air was more polluted than indoor air, with 56% stating that outdoor air was much more polluted. However, in Figure 6, we saw that, on average, indoor air quality closely mirrors outdoor air quality. This disparity between the measured outdoor-indoor relationship and participants' perceptions provides further evidence of a systematic underestimation of indoor air pollution levels.

[13] Additionally, we have data on outdoor air pollution levels over that time-frame, which we have shown to closely map indoor air pollution levels in Section 3.1. The results are qualitatively similar when using this measure of objective exposure.

Air Purifier Effectiveness and Protection Against Indoor Air Pollution

In addition to underestimating indoor air pollution exposure, survey participants at baseline are not well informed about how to improve indoor air quality. As described in Section 2.5, participants took a knowledge quiz (incentivized) to test their objective knowledge about air pollution. To assess knowledge in the status quo, we plot responses to three questions targeting protective behaviors against indoor air pollution on Figure 9, restricting the sample to participants who had not yet seen the informational video. We find than more than $2/3^{rd}$ of respondents wrongly believe that *"Having lots of plants indoors can absorb most dangerous pollutants,"*, more than $2/3^{rd}$ of respondents wrongly believe that *"Non-HEPA air purifiers are the most efficient at removing the most dangerous indoor pollutants,"*, and more than half of respondents wrongly believe that *"Air conditioners also remove pollutants from indoor air."* Overall, these findings reveal a widespread absence of knowledge about the air purifier technology and how to improve indoor air quality among Jakarta households at baseline.

Low Beliefs of Impacts of Clean Air on Well-Being

Our study participants also exhibit low levels of concerns about the impacts of air pollution on their health and well-being. As for knowledge questions related to protective actions, more than half of survey participants at baseline fail to recognize that *"Air pollution can cause respiratory diseases but not heart diseases"* (Figure 9), despite widespread supporting scientific evidence (Walzer et al., 2020; Xia et al., 2021).

Consistent with these results, when asked whether they agree with the statement "*Spending 12 hours a day in a clean air environment can significantly improve my immediate health, even if the air is very polluted the other 12 hours*" on a scale of 1 to 6 going from strongly disagree (1) to strongly agree (6), more than more than 33% of households at baseline (before seeing the informational video) strongly disagree, disagree or somewhat disagree with the statement. This number goes up to 40% when respondents are asked about the impact on their long-term health.

4 Impact of Information and Experience on Knowledge and Beliefs

In this section, we assess whether standardized generic video information interventions or experience-based interventions can correct these biased beliefs and information frictions. We start by showing that the generic video fails at correcting personal biases, which can however be improved upon through one's experience of clean indoor air through the air purifiers.

4.1 Failure of the Standardized Generic Information Video to Correct Personal Biases

To assess whether generic information interventions - as the ones existing in outside of this experiment - can affect knowledge and beliefs about air pollution, we cross-randomized all participants into watching such a video before or after the baseline survey was completed and participants answered a knowledge quiz, incentivized as described in Section 2.3.2. The video was designed to address all of the knowledge and belief questions.

We estimate the impact of watching the video on the outcomes of interest with the following regression specification:

$$y_i = \alpha + \beta^{\omega} \mathbf{1}\{PostVideo_i\} + e_i \tag{2}$$

where $PostVideo_{it}$ is a binary indicator for whether respondent i watched the informational video before or after taking the baseline survey. The index t represents the survey round, as our intervention was administered in two rounds. Our outcome variable y_{it} includes: (1) knowledge score, a score out of eight for correct answer to True/False questions, (2) beliefs about air pollution levels and impacts, detailed in Section 2.5.3 , and (3) an indicator for whether households stated that they were WTP more than USD 5 for a two-month air purifier rental.[14] The knowledge quiz was incentivized, offering participants IDR 15,000 (approximately USD 1) if they correctly answered at least five questions.

The results are summarized in Table 3. We find that the video intervention significantly increased participants' knowledge scores by 0.156 standard deviations and improved beliefs about outdoor AQI levels by 0.293 AQI units (columns 1-2). These findings demonstrate that the intervention effectively conveyed factual, generic knowledge and increased beliefs about outdoor air pollution levels.

Despite improving generic knowledge, the video did not significantly change beliefs related to indoor air pollution, the efficacy of air purifiers, personal health, or stated WTP for protective measures, as seen in columns 3-7 of Table 3. This suggests that while informational videos can correct general knowledge, they may be insufficient for influencing personal beliefs.

Furthermore, as all participants had watched the video by the time we elicited their WTP

[14] We ask the following true/false questions to test respondent knowledge: (1) *The smaller the dust particles are, the worse they are for your health* [true], (2) *Air pollution can cause respiratory diseases but not heart disease* [false], (3) *Long-term exposure to air pollution affects children's brain development* [true], (4) *Indoor air is always safer than outdoor air* [false], (5) *Having lots of plants indoors can absorb most dangerous pollutants* [false], (6) *Air conditioners also remove pollutants from indoor air* [false], (7) *Non-HEPA air purifiers are the most efficient at removing the most dangerous indoor pollutants* [false], (8) *Green spaces and trees are effective at absorbing all dangerous pollutants* [false]. All correct answers to these questions were in the video.

for air purifiers, the low WTP recovered for the control group (Section 3.3) suggests that this type of standardized information also fails at motivating substantial protective actions.

Overall, these findings highlight the limitations of generic informational interventions in addressing biases related to personal exposure and impacts. Correcting these biases may require more targeted approaches, such as feedback from air quality monitors or experiential demonstrations of clean air benefits, which we investigate in the main experiment.

4.2 Experience is Effective at Correcting Personal Biases

We then move to our main experiment, which targets the role of experience in correcting personal biases and misinformation on air pollution and air purifiers.

To estimate the impact of treatment on respondent beliefs, we use a model analogous to Equation 1, with the following specification:

$$y_{it} = \alpha + \beta^{\omega} \mathbf{1}\{Treatment_{ct}\} + X_i' \cdot \phi + \mu^{strata} + \mu^{r} + e_{it} \tag{3}$$

Here, t indexes which survey round the household participated in, and c indexes the classroom, the level of the treatment. We use double-selection LASSO to select controls, X_i, and include strata and round fixed effects. We start by focusing on our main treatment arm, where households receive both an air purifier and an air monitor.

Levels of Air Pollution

In columns 1 and 2 of Table 5, we show that treated participants who received both an air purifier and an air monitor believe that outdoor air is as polluted as control participants (column 1), but treated participants believe that indoor air pollution (in the absence of an air purifier) is higher than control participants (column 2). As control participants underestimate indoor air pollution levels (Section 3.4), this result is consistent with treated participants learning about indoor air pollution levels throughout the experiment.

Air Purifier Technology

Since air purifiers were an unfamiliar technology for most households in our sample, it is possible that households were learning about the purifier technology itself rather than about clean air. To address this potential confounding factor, we incorporated several design features into our study. First, the control group received a "fan" identical to the air purifier used in the treatment groups, but without the filter. This allowed control households to experience the cooling and other features of the device without exposure to its air purification capabilities or the associated clean air benefits. Second, all households were shown a baseline video highlighting

the functionality and efficiency of air purifiers to ensure a consistent level of knowledge about the technology across all groups.

However, purifier efficiency can vary substantially based on household characteristics, suggesting there may still be household-specific learning. To explore whether learning about the technology occurred along this dimension, we asked two targeted questions: (1) "*What does a purifier do?*" and (2) "*With the windows and doors closed, how effective do you think one air purifier is at removing pollutants from your home?*" Responses to the second question were multiple choice, ranging from "*not much effect*" to "*90% effective.*"

Table 6 presents the results. Column (1) measures whether households provided the correct definition of a purifier, and Column (2) reflects the standardized response to purifier effectiveness, where higher values indicate higher perceived effectiveness. Columns (3) and (4) interact treatment with Above Median income. The results show that treatment increased the ability of households to correctly define a purifier by 5 percentage points, though this increase was not statistically significant. Additionally, there was no observed change in perceived purifier effectiveness.

Impacts of Purifiers and Indoor Air Quality on Well-Being

In columns 3 and 4 we show that the treatment generally increased respondents' beliefs that the purifier and clean air more generally improves their health. In column 3, we find a small, imprecisely estimated impact of treatment on the probability that respondents reported that their health had improved over the course of the experiment. Among those who do feel healthier (column 4), the treatment group shows a 17.7 percentage point increase in attributing their health improvement to the air quality hardware provided, a 44% increase compared to the control group.

This shift is reflected in stronger beliefs about the immediate health benefits of clean air exposure, with a 0.173 standard deviation increase in this belief. A smaller sized and imprecise increase is observed in beliefs about the long-term health benefits of clean air exposure.

Taken together, these results suggest that having an air purifier and an air monitor for three months allowed participants to notice that the air purifier improved their health, and subsequently adjust their belief that air quality is important for their health.

4.2.1 Preliminary Evidence on Objective Health Outcomes

Beyond subjective beliefs, we examine whether the treatment produced measurable changes in objective health indicators. These results are preliminary and should be interpreted with caution, but they provide suggestive evidence that even a two-month reduction in indoor $PM_{2.5}$ can yield detectable health improvements.

The results for adults are reported in Table 7. The most robust finding is on sleep quality: treated households report significantly less poor sleep (-6.3 to -9.4 percentage points, $p < 0.01$) and less trouble sleeping (-5.6 to -7.3 percentage points, $p < 0.05$). Point estimates for pollution-related symptoms, blood pressure, and blood oxygen are directionally consistent with health improvements but are not statistically significant at conventional levels.[15]

We report the results for children in Table 8. We find evidence of reductions in hypertension prevalence among the monitor+purifier group (-3.6 percentage points, $p < 0.10$; stage 2 hypertension: -1.8 pp, $p < 0.10$). The purifier-only group shows smaller, insignificant effects, consistent with the monitor+purifier arm producing a more intensive treatment experience. Effects on blood pressure levels and blood oxygen for children are directionally consistent but imprecisely estimated.

These health results are notable for two reasons. First, they suggest that even a modest, temporary reduction in indoor $PM_{2.5}$ of approximately $13\,\mu g/m^3$ can produce detectable health improvements—particularly for sleep, which may be the health domain most sensitive to short-run air quality changes. Second, the sleep improvements may themselves be a channel through which experience shifts beliefs: households that sleep better may more readily attribute health benefits to the purifier, reinforcing the experience-good mechanism documented above.

4.2.2 Non-Purifier-Related Air Quality Demand

To further explore whether the treatment influenced demand for clean air independently of learning about purifiers, we analyzed non-purifier-related demand outcomes. These outcomes were grouped into three indices: demand for indoor clean air, demand for outdoor clean air, and demand for clean air policies. Each index was standardized, allowing treatment effects to be interpreted in terms of standard deviations.

Table 4 summarizes these findings. Among Below Median income households, there is some evidence of increased demand for indoor clean air. For outdoor clean air, however, we observe a noisily estimated negative effect, which may reflect a substitution effect between preferences for indoor and outdoor air quality.

The indoor and outdoor indices primarily capture household behaviors during the treatment period. Since treatment households experienced improved air quality indoors due to the intervention, they may not have felt the need to further adjust their behaviors to signal increased demand for clean air. This could indicate that these households had already achieved their desired level of clean air consumption during the intervention.

In contrast, the policy index reflects preferences for future clean air improvements, offering a broader and potentially more general measure of shifts in clean air demand. The results

[15] We are currently investigating additional analyses to improve the preciseness of these results, for example through controlling for baseline characteristics etc.

reveal a statistically significant increase in policy demand among Above Median income households, with a 0.113 standard deviation effect. This finding supports the conclusion that the observed increase in WTP for air purifier rentals in the Above Median income group is not solely attributable to learning about purifiers. Instead, it suggests a broader shift in clean air preferences and priorities among this group, extending beyond the context of the intervention.

4.3 What Aspect of Experience Matters Most for Belief Updates?

Our main treatment, giving participants both an air purifier and an air monitor for three months is designed to provide them with a holistic experience of clean indoor air. Yet, it pools two learning channels together: learning through air monitor readings, and learning through the physical experience of clean air. To isolate the role of the latter, commonly overlooked, we assess the impact of our purifier-only treatment on the same belief outcome variables. The specification is analogous to Equation 3 including the two treatment arms separately. The results are described in Table 5.

In columns 1 and 2, we show that respondents in the purifier-only group do not believe that indoor or outdoor air pollution is higher than households in the control group. Yet, respondents in the purifier-only group update their beliefs about the impacts of clean air on health (columns 3 to 6) in ways that are slightly smaller but not statistically different from those in the purifier+monitor group.

Therefore, the primary distinction between the two treatments lies in their impact on beliefs about indoor air quality, rather than beliefs about impacts on health. Overall, these results suggest belief about health improvements are shaped, at least in part, by the physical experience of using a purifier. On the other hand, correcting misconceptions about indoor air quality requires unambiguous information on air quality levels, such as the one given by an air monitor.

5 Impact of Experience on Demand for Air Purifiers and Clean Air

In this section, we investigate under which conditions updated beliefs translate into increased demand for air purifiers. We show that the treatment does not raise average WTP, but reveals a large and economically significant income gradient that is entirely absent in the status quo. This is our second main contribution: the lack of experience hides the role of income in limited purifier adoption.

5.1 No Impact on Average WTP for Air Purifiers

We recover participants' WTP for air purifiers by eliciting their demand for a two-months air purifier rental through BDM during the endline survey, as detailed in Section 2.3.1. We start by examining the (inverse) demand curves, which we display on Figure 7, panel (a). More precisely, we plot $s(WTP \geq p)$ at each prices at \$.01 intervals, separately for the control and pooled treatment groups. Comparing the demand curves across groups reveals no treatment effects in the overall sample, as the control and treated curves overlap closely. These descriptive facts are confirmed in our regression analysis. Table 9 presents the results of regressions estimating the effect of the treatment on household willingness to pay (WTP) for the good. Columns 1 and 2 include the full sample, with zeros imputed for non-participants, while columns 3 and 4 restrict the sample to BDM participants only. In columns 1 and 3, we pool both treatments together, while we split them in columns 2 and 4.

5.2 Experience Reveals the Income Gradient in WTP

To explain why the change in beliefs did not translate into average WTP increases, we leverage the income heterogeneity across participants and split the sample at the median income. This reveals a striking pattern: the treatment creates a large income gradient in WTP that was *completely absent* in the status quo.

Figure 7 displays the inverse demand curves separately for below-median income (panel b) and above-median income (panel c) households. While demand curves for control and treated groups overlap closely for below-median income households, there is a marked outward shift for treated above-median income households, concentrated in the right tail (i.e., among households willing to pay higher prices).

Our regression analyses confirm this pattern. In columns 5–8 of Table 9, we interact treatment with above/below median income. When pooling treatment arms (column 5), we estimate a \$0.55 increase in WTP for above-median income households (+44% over the control mean), while the treatment effect for below-median income households is small and statistically insignificant (\$0.035). The control means are \$1.48 (below median) and \$1.25 (above median), confirming the absence of an income gradient in the status quo - and in fact a slightly negative gradient, which may be due to higher income households having lower indoor pollution at baseline).

Non-participants are likely to have a true zero WTP (they declined even a subsidized purifier), so we impute zeros as our main specification; the patterns are amplified when non-participants are excluded (columns 7–8).

Why does the treatment effect differ by income? We argue that this result is explained by the higher marginal utility of income for below-median households. This explana-

tion is supported by 51% of non-participants citing cost as the reason for opting out. We can reject three alternative explanations for this result. First, differential baseline indoor pollution levels across income groups: we find these are statistically similar. Second, differential $PM_{2.5}$ reductions from purifiers across income groups: purifiers actually reduce $PM_{2.5}$ by *more* among lower-income households (who have higher baseline indoor pollution), so differential effectiveness works against this explanation. Third, differential belief updating: we cannot reject that the two income groups update beliefs at the same rate (Table 5, columns by income interaction). Together, these results are most consistent with an income constraint explanation: both income groups learn about the value of clean air, but only higher-income households can afford to act on it.

Increased Demand Among High Income Households is Driven by the Comprehensive Treatment Arm

What aspect of the experience increased demand for air purifiers among high income households? We examine columns 6 and 8 of Table 9, where we split participants by both income group and treatment arm. We find that the increased demand is driven by high-income households in the monitor+purifier group, while high-income households in the purifier-only group do not display significantly higher WTP than the control (0.886* vs 0.250 for column 6, for example). This is suggestive evidence that while the physical experience of clean air alone can help households recognize that clean air impacts their well-being (Section 4.2), objective measures of air quality improvement—as provided by the monitor—may be additionally important for translating this recognition into willingness to pay for the technology.

5.3 Translating WTP for Purifiers into WTP for Clean Air

To translate demand for purifiers into demand for clean air—the indicator relevant for policymakers—we use households' WTP for a two-month rental and annualize it based on the purifier's estimated effectiveness in reducing $PM_{2.5}$ levels. Table 11 summarizes WTP for clean air across groups.

WTP per $10\,\mu g/m^3$ annual reduction in $PM_{2.5}$. We calculate WTP for a $10\,\mu g/m^3$ annual reduction in $PM_{2.5}$ separately for the control group below-median income, control group above-median income, and treated above-median income households. Using the WTP and $PM_{2.5}$ reduction estimates from Table 10, households in the below-median income control group are willing to pay \$4.28 per $10\,\mu g/m^3$ annual reduction in $PM_{2.5}$ under 24-hour use assumptions

($6.99 under reported-use assumptions).[16] Among above-median income control households, despite lower rental WTP in levels, the WTP per unit of clean air is higher at $15.24 (24h) / $24.88 (reported), reflecting the lower effectiveness of purifiers in their homes (driven by lower baseline indoor pollution levels, likely due to better-sealed housing). After experiencing clean air, treated above-median income households' WTP rises to $21.95 (24h) / $35.84 (reported) per $10\,\mu g/m^3$ annual reduction.[17]

Situating estimates within the literature. Our below-median income estimates ($4.28–$6.99) are comparable to Baylis et al. (2023)'s post-information WTP estimate of $2.50 per person for a $10\,\mu g/m^3$ reduction in Delhi (the comparison population has similar income levels). They contrast sharply with the usage-based MWTP estimates in Chowdhury et al. (2025), who find a revealed-preference MWTP close to zero ($0.30 per $\mu g/m^3$ per year, or approximately $3 per $10\,\mu g/m^3$) in Dhaka, despite much larger purifier effectiveness in that setting. Importantly, Chowdhury et al. show that purchase-based MWTP estimates - like ours - are sensitive to assumptions about purifier usage, and can vary by an order of magnitude depending on whether one assumes full, reported, or actual use. Our estimates, which are based on BDM-elicited rental WTP, are less susceptible to this critique because they price a fixed rental period rather than an indefinite stream of usage. Nonetheless, the near-zero usage-based valuation in Dhaka underscores that even our treated above-median income estimates may reflect an upper bound on private demand, reinforcing the case for public provision.

Our treated above-median income estimates ($21.95–$35.84 per $10\,\mu g/m^3$) align closely with the urban Chinese estimate of approximately $23 per $10\,\mu g/m^3$ annual reduction from Ito and Zhang (2020) (as adjusted by Baylis et al. 2024).[18] Given that urban household income in China is approximately 50% higher than in our above-median sample, this comparability suggests that the experience treatment effectively bridges income-driven differences in clean air valuation, enabling Jakarta households to value clean air similarly to their richer Chinese counterparts.

These comparisons highlight both the binding role of income and the potential of experience-based interventions to reveal latent demand for environmental quality.

[16] We assume households use the purifier 24 hours a day for the conservative estimate. Under reported usage of 14.7 hours per day, the implied WTP per unit of air quality improvement is higher.

[17] Pre-analysis plan specified food expenditure as the heterogeneity measure; we found income to be a more reliable proxy. WTP results using food expenditure are in Appendix Table A7, alongside other measures of income.

[18] See Baylis et al. (2024) for the adjustment converting PM_{10} WTP to $PM_{2.5}$ equivalence with updated economic conditions.

6 Conclusion and Policy Implications

This paper provides the first causal experimental evidence that indoor clean air has an important experience-good component. We show that in a highly polluted developing megacity, experience with clean air through air purifiers shifts beliefs about pollution levels and health benefits, but that these updated beliefs only translate into increased WTP for above-median income households. Status-quo WTP estimates thus understate the true income gradient of demand: the absence of an income gradient in purifier adoption is not because income does not matter, but because low-income *and* high-income households alike lack experience with clean air and therefore similarly undervalue it.

Our findings further have three main implications for policy. First, status-quo WTP estimates are systematically biased downward, so cost-benefit analyses of air quality policies that rely on revealed-preference or stated-preference WTP measures from populations without experience of clean air will underestimate the benefits of pollution reduction. Policymakers should account for this experience-good correction when evaluating the social value of clean air interventions. Second, income is the binding constraint for at least half of Jakarta households. Even after a free two-month trial of clean air, WTP among below-median income households ($1.52 for a two-month rental) remains far below the market price ($221 for purchase). The absence of a free trial is therefore not a market failure for lower-income households: even if they experienced clean air, they could not afford to sustain it. This finding suggests that subsidies - not just information or experience - are needed to expand access to clean air among lower-income populations. Third, preliminary evidence on objective health outcomes—particularly improved sleep quality among treated adults and reduced hypertension prevalence among children—suggests that the health benefits of cleaner indoor air may be detectable even over a two-month intervention period, further supporting the case for public provision of air filtration in schools and health facilities. Fourth, such intervention generating experience at scale could generate spillovers by potentially shifting beliefs and WTP for those who later earn higher incomes. Decreasing ambient PM - which drives indoor PM through high infiltration rates - could thus address both the experience barrier and the underlying exposure burden simultaneously.

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Figures

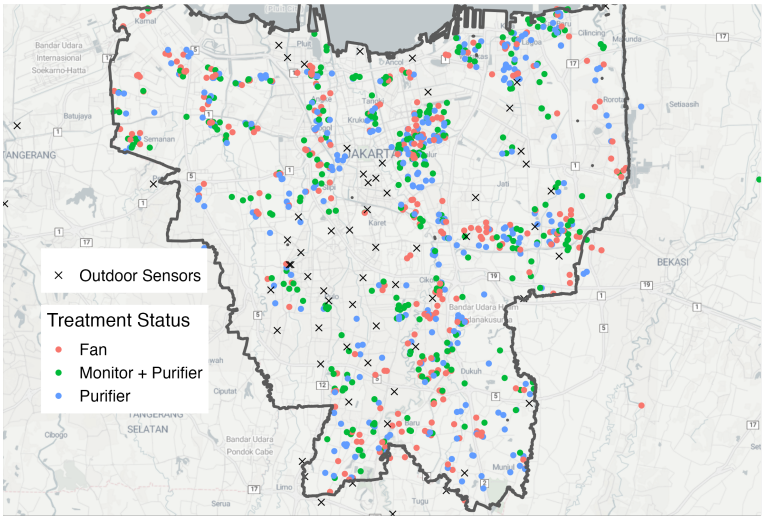


Figure 1: Locations of Households and Outdoor Air Quality Sensors

Note: This figure shows locations of respondents and installed air quality monitoring hardware. There are 308 indoor air quality monitors (orange) installed in respondent homes. We match these homes to the three closest outdoor sensors, utilizing 63 low-cost sensors (green) to measure respondent-specific outdoor air quality.

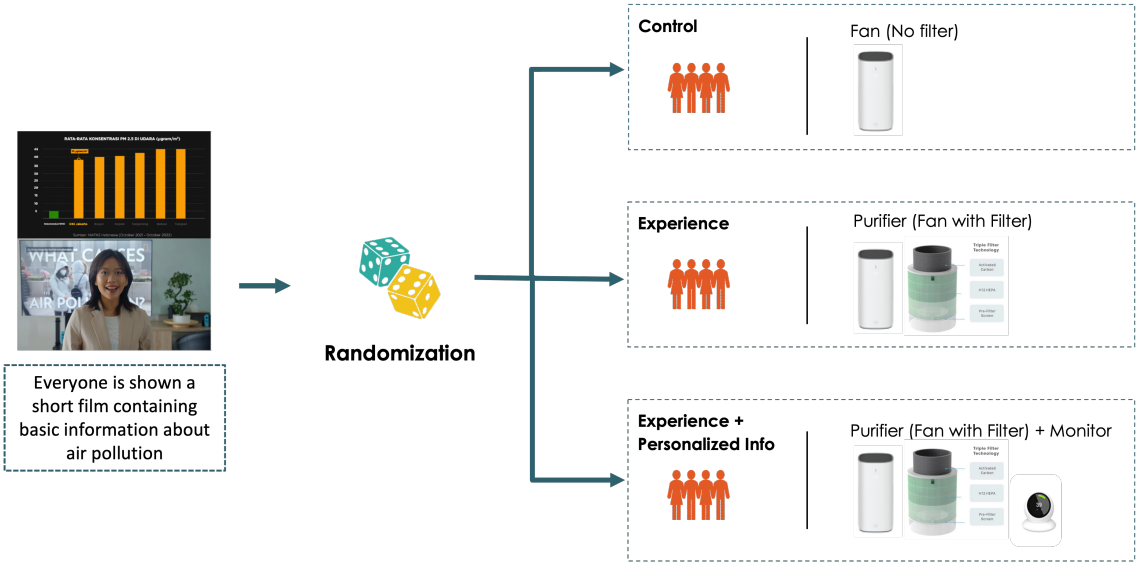


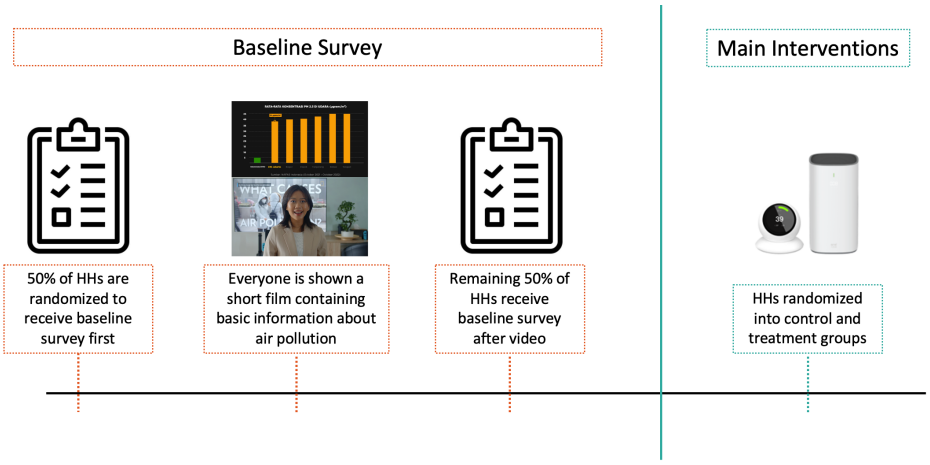
Figure 2: Experimental Design - HH-Level Treatment, Sampled from Jakarta Parents

Notes: This figure shows the design for our cluster-randomized experiment, which includes a control arm with a fan, a purifier arm, and purifier plus monitor treatment consisting of purifier and monitor treatment. In each classroom, we will sample 1-2 households to participate in our survey and experiment

Figure 3: Air Quality Monitor Display at Various $PM_{2.5}$ Levels



Figure 4: Generic Information Experiment Design



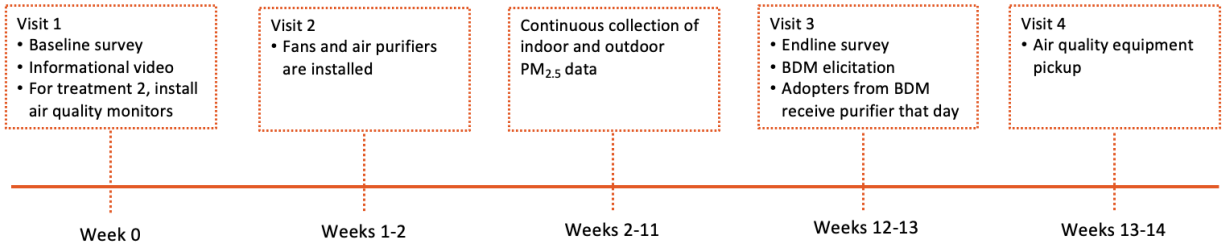
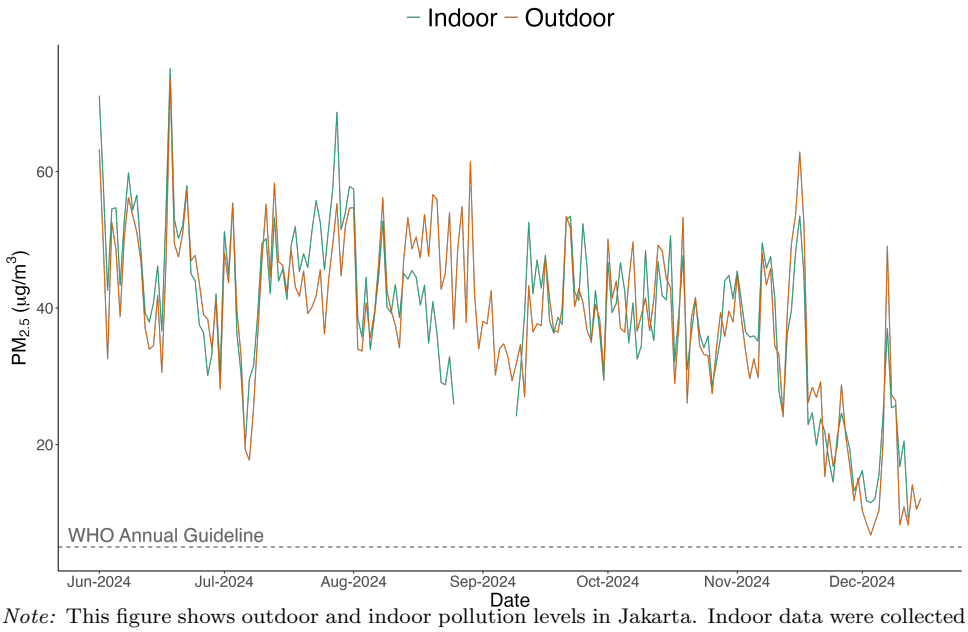


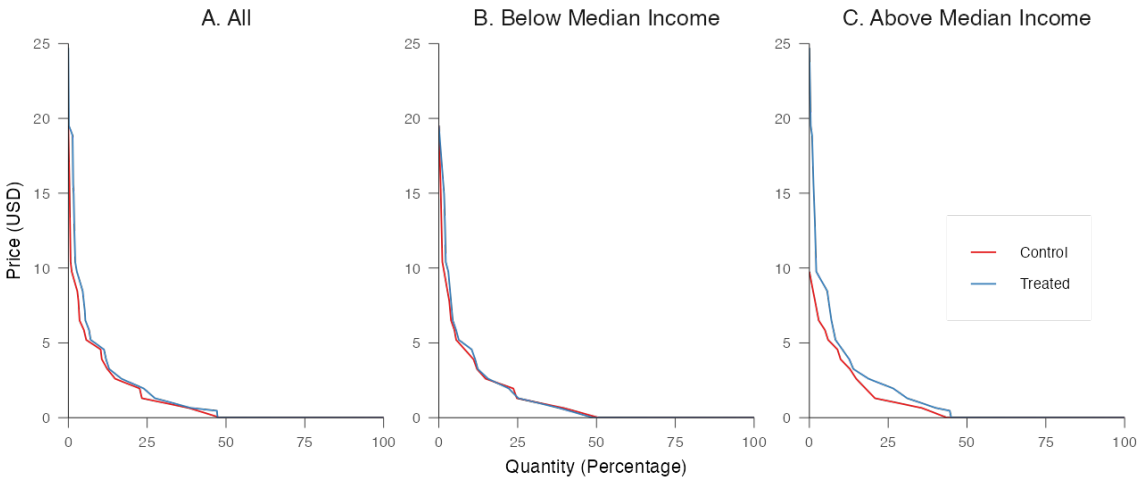
Figure 5: Timeline of field activities

Figure 6: Average Recorded Daily $PM_{2.5}$ Levels



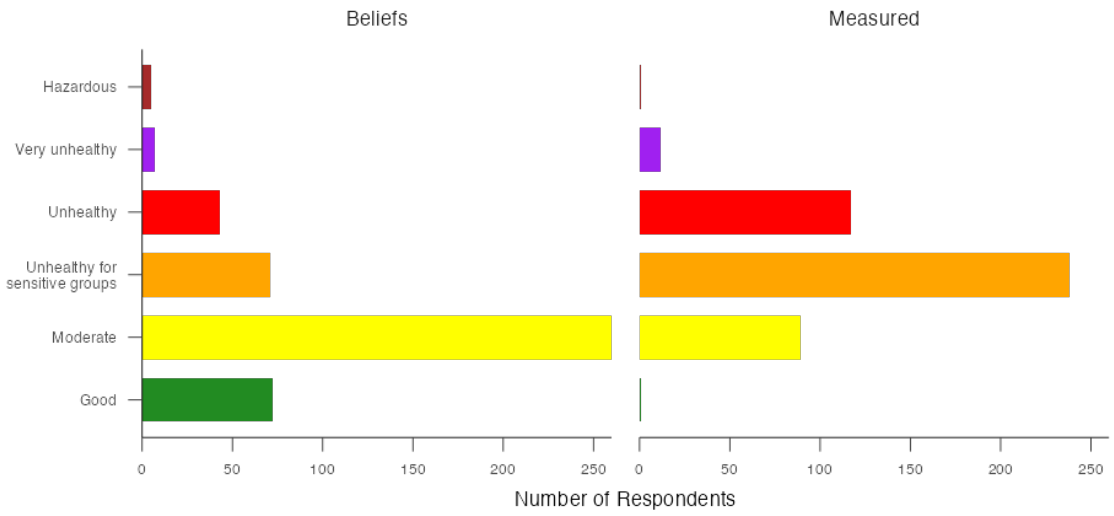
Note: This figure shows outdoor and indoor pollution levels in Jakarta. Indoor data were collected from 308 air quality monitors placed in households, while outdoor data were gathered from 62 low-cost sensors. To account for the uneven spatial distribution of outdoor sensors, we first computed district-level averages for outdoor readings, which were then aggregated to produce a daily citywide average. Indoor pollution levels were averaged across all households on a daily basis. The gap in the indoor data from August 26 to September 8 occurred during a transition period when the air quality hardware was being moved between households. Details on how this data was collected is in Section 2.5.2.

Figure 7: Demand for Two Month Purifier Rental



Notes: This figure shows shares of household with WTP greater than or equal to each price. Panel A shows results for all households. Panel B shows results for households below the median sample income. Panel C shows results for household above the median sample income. Households who did not wish to participate were imputed as having 0 WTP.

(a) Indoor



(b) Beliefs Comparing Outdoor vs Indoor Pollution

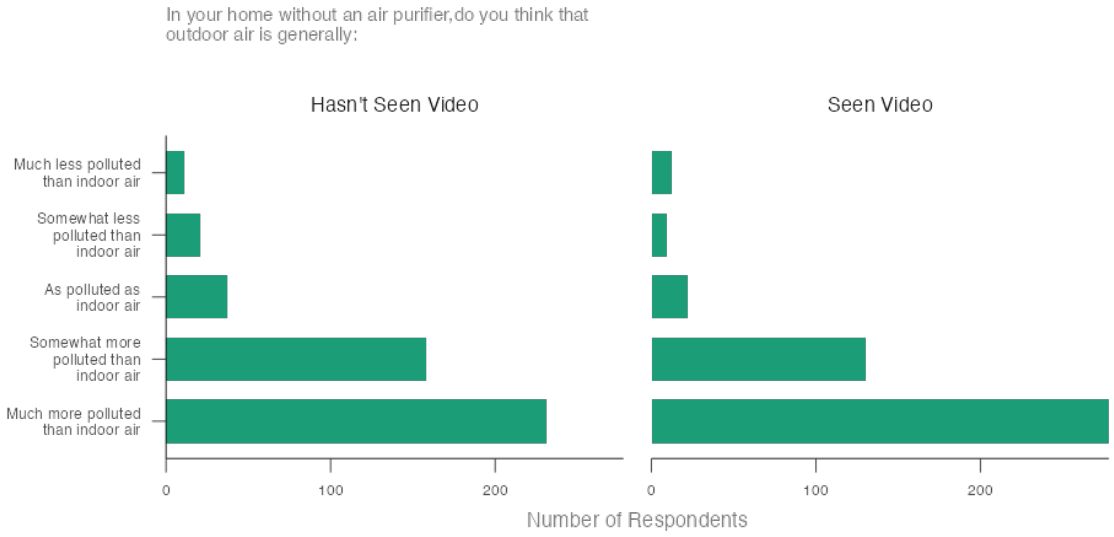
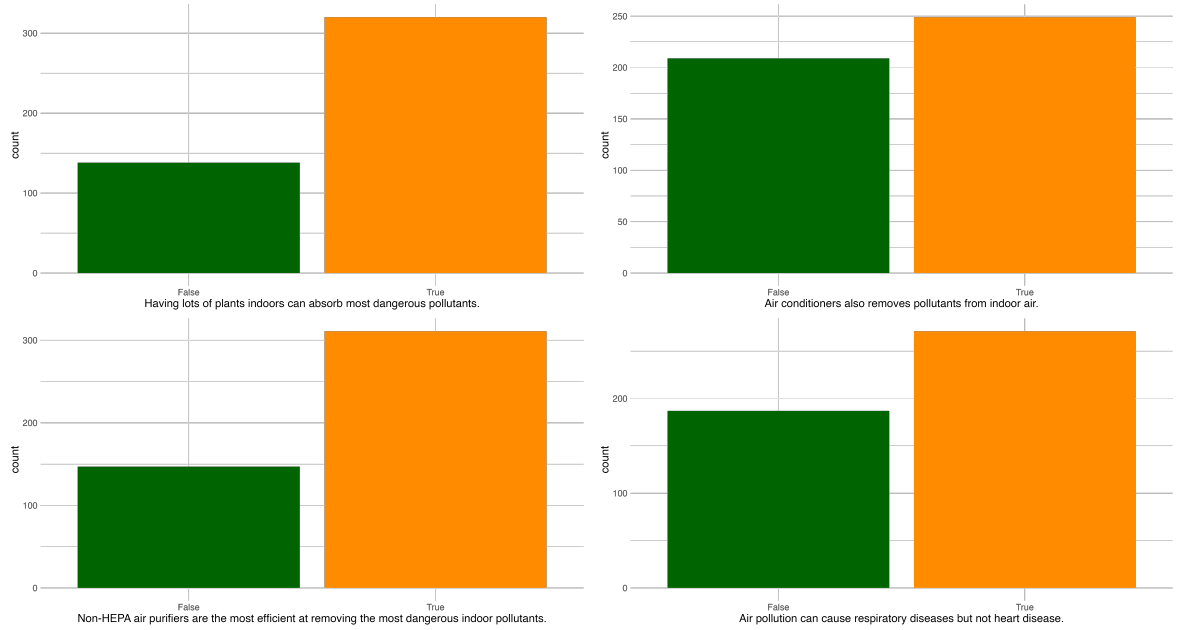


Figure 8: Respondent Beliefs and Measured Pollution Levels

Notes: Panels (a) and (b) compare respondents' perceived air quality ("beliefs") with actual measured pollution levels indoors and outdoors, categorized using the EPA's AQI based on $PM_{2.5}$ levels. Panel (a) shows indoor beliefs versus measurements taken by enumerators using an indoor air quality monitor. Bars represent counts within AQI categories; we show results from the 475 respondents who had not seen the video at the time of answering this question. Panel (b) shows responses to question asking respondents to compare outdoor air quality to indoor air quality in their home.

Figure 9: Widespread Misinformation On Health Impacts of and Protective Actions Against Indoor Air Pollution



Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Participants at baseline we asked to answer a series of True/False questions. We display here the answers for four questions related to the health impacts of air pollution and potential ways to decrease levels of indoor air pollution. The correct answer is colored in green, while the incorrect answer is colored in orange. We restrict the sample to participants who had not yet watched the generic video on air pollution video.

Tables

Table 1: Baseline Summary Statistics and Balance Table

Variable	Control Mean	Monitor + Purifier	Purifier	N	Population Mean
Female	0.9	-0.02	0.00	952	
		(0.03)	(0.02)		
Age	40.95	0.31	-0.40	952	
	(6.73)	(0.55)	(0.52)		
HH Size	5.04	-0.10	-0.15	952	3.79
	(1.74)	(0.15)	(0.15)		(1.31)
Number of Children	2	-0.04	-0.09	951	
	(0.96)	(0.08)	(0.08)		
HH Monthly Exp. (USD)	260.68	-2.41	2.38	952	687.68
	(121.71)	(9.96)	(9.37)		(741.95)
HH Monthly Income (USD)	328	11.11	11.28	952	
	(194.55)	(15.44)	(15.4)		
HH Head Attended Secondary	0.9	0.02	0.03	950	0.88
		(0.02)	(0.02)		
HH Head Attended Tertiary	0.14	0.01	0.03	952	0.3
		(0.03)	(0.03)		
Owns AC	0.53	-0.01	-0.03	911	0.39
		(0.04)	(0.04)		
LPG Stove	0.98	-0.01	0.00	951	0.96
		(0.01)	(0.01)		
Number of Smokers	0.84	-0.14**	-0.14**	952	0.73
	(0.79)	(0.06)	(0.06)		(0.71)
Outdoor PM2.5	40.47	-0.47	-0.93	952	
	(11.09)	(0.64)	(0.65)		
Indoor AQI Beliefs	2.27	0.04	-0.04	952	
	(0.9)	(0.08)	(0.07)		
Pollution Symptoms	0.02	-0.02	0.07	951	
	(0.64)	(0.05)	(0.05)		
Non-Pollution Symptoms	0.03	0.03	0.06	951	
	(0.67)	(0.05)	(0.05)		
F-test		0.86	0.96		

Notes: This table presents baseline characteristics and tests for balance in household characteristics across the treatment arms. Column (1) reports the mean and standard deviation for the control group. Columns (2) and (3) report the pairwise differences between each treatment group and the control group, along with standard errors clustered at the classroom level. Column (4) reports the sample size. Column (5) reports the mean values of the variables in the wider Jakarta population, calculated using data from National Socioeconomic Survey (SUSENAS) 2023.

Table 2: Impact of Purifier on Indoor $PM_{2.5}$

Model:	Mean (1)	Median (2)	Max (3)	P(PM2.5 > 100) (4)
Variables				
Treated	-13.29***	-12.11***	-24.10***	-0.03***
	(2.60)	(2.57)	(5.32)	(0.01)
Fixed-effects				
Strata	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes
Hour-of-Day	Yes	Yes	Yes	Yes
Fit statistics				
Control Mean	44.2	39.9	102	0.0738
Observations	15,979	16,118	15,979	15,979

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Each column is a regression of a measure of indoor $PM_{2.5}$ on treatment. Each $PM_{2.5}$ measure is aggregated to the household-hour-of-day level. Column (1) is mean $PM_{2.5}$, (2) is median $PM_{2.5}$, (3) is maximum $PM_{2.5}$, and (4) is the probability that $PM_{2.5}$ is above 100 $\mu g/m^3$. All regressions include fixed effect for strata, round, and hour-of-day. Controls are selected using Double-LASSO procedure. Errors are clustered a the classroom level.

Table 3: Video Treatment on Generic Knowledge

	Generic		Personal				
Dependent Variables:	Knowledge Score	Belief - Outdoor AQI	Beliefs - Indoor AQI	Short-term Health	Long-term Health	Purifier Efficacy	WTP At Least USD 5
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Video	0.156***	0.293***	0.001	0.032	0.014	-0.007	-0.004
	(0.029)	(0.069)	(0.060)	(0.031)	(0.033)	(0.064)	(0.030)
Fit statistics							
Control Mean	0.003	3.068	2.275	0.657	0.585	0.000	0.703
Observations	899	910	910	909	909	910	910

Notes: IID standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Each column reports the effect of watching the air pollution video, estimated using Equation 2. (1) shows the effect on knowledge score, the standardized sum of how many questions the respondent answered correctly out of eight. (2) is beliefs about outdoor AQI levels in their neighborhood. (3) is beliefs about indoor AQI levels in their homes. (4) is beliefs about impact of pollution on short-term health. (5) is beliefs about impact of pollution on long-term health. (6) is beliefs about effectiveness of purifier in their own homes at getting rid of pollutants. Column (7) is an indicator for whether households state that they are willing to pay at least USD 5 for a two-month air purifier rental.Outcomes in columns (1), (4), (5), (6), and (7) are standardized to a z-score, and thus the coefficients should be interpreted as the effect size in standard deviations. Standard errors are clustered at the classroom level.

Table 4: Impact of Treatment on Non-Purifier Demand Measures

	Indoor Index		Outdoor Index		Policy Index	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Treated	0.040		-0.049		0.046	
	(0.038)		(0.039)		(0.036)	
Treated × Below Median		0.091*		-0.044		0.003
		(0.048)		(0.050)		(0.045)
Treated × Above Median		-0.053		-0.056		0.113*
		(0.062)		(0.062)		(0.060)
Above Median		0.133**		-0.023		-0.012
		(0.066)		(0.065)		(0.063)
Fixed-effects						
Strata	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	886	886	892	892	876	876

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Column (1)-(2) reports the impact of treatment on the Demand for Indoor Clean Air Index, composed of time spent at home, in-home smoking, and door-closing behavior to reduce pollution. Column (3)-(4) examines the Demand for Outdoor Clean Air Index, a series of yes/no questions on mask-wearing, checking pollution levels, avoiding outdoor areas during high pollution, and reading pollution related news. Column (5)-(6) assesses the Policy Support Index, measuring support for clean air policies, signing a school air purifier petition, and following a clean air NGO. Indices are z-score normalized and weighted using inverse-covariance weights. Regressions include Double-LASSO-selected controls, with strata and round fixed effects, and errors clustered at the classroom level.

Table 5: Impact of the Two Treatments on Beliefs

Dependent Variables:	Outdoor AQI	Indoor AQI - No Purifier	Health Has Improved	Hardware Improved Health	AQ Matters - Short-term Health	AQ Matters - Long-term Health
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Purifier	-0.029	-0.046	0.020	0.127	0.109	0.111
	(0.082)	(0.077)	(0.056)	(0.077)	(0.082)	(0.086)
Monitor+Purifier	0.050	0.216***	0.036	0.171**	0.173**	0.076
	(0.086)	(0.079)	(0.059)	(0.073)	(0.084)	(0.085)
Fixed-effects						
Strata	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Control Mean	2.64	2.35	0.558	0.402	0.00719	0.00677
F-test, Monitor+Purifier = Purifier	0.367	0.001	0.776	0.542	0.447	0.692
q-value, Monitor + Purifier	0.5644	0.0376	0.5644	0.0625	0.0789	0.5512
q-value, Purifier	0.721	0.721	0.721	0.401	0.401	0.401
Observations	895	888	454	264	894	894

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. The table shows how each of our treatments affected (1) beliefs about households' indoor AQI in their own homes, without a purifier, (2) beliefs about outdoor AQI levels in their neighborhood, (3) binary outcome of whether their health improved in the last three months, (4) for households who stated their health did improve, a binary outcome of whether they attributed that to the hardware provided in the intervention, (5) whether spending 12 hours in a clean air environment is good for their immediate health, (6) and whether spending 12 hours in a clean air environment is good for their long-term health. Controls were selected by the Double-LASSO method, and all regressions include strata and round fixed effects. Errors are clustered at the classroom level.

Table 6: Impact of Treatment on Purifier Learning

Dependent Variables:	AP Definition	Purifier Effectiveness	AP Definition	Purifier Effectiveness
Model:	(1)	(2)	(3)	(4)
Variables				
Treated	0.050	0.027		
	(0.034)	(0.070)		
Treated × Below Median			0.037	0.031
			(0.043)	(0.086)
Treated × Above Median			0.069	0.021
			(0.056)	(0.121)
Above Median			0.036	-0.001
			(0.059)	(0.126)
Fixed-effects				
Strata	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes
Fit statistics				
Control Mean	0.608	-0.00261	0.608	-0.00261
Observations	895	895	895	895

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Column (1) shows the treatment effect on whether households are able to correctly define what an air purifier does. Column (2) shows the treatment effect on households beliefs about efficacy of a purifiers their homes at reducing pollution. Answers were coded from 1-6 (with 1 being not effective at all and 6 to at least 90% effective), and then standardized to z-scores. Columns (3) and (4) repeat the previous two analyses, but interact treatment with whether the household income is above the median sample income. Controls were selected by the Double-LASSO method, and all regressions include strata and round fixed effects. Errors are clustered at the classroom level.

Table 7: Impact of Treatment on Adult Measured Health Outcomes

Dependent Variables:	poorsleep	troublesleeping_often	Sleep Length		Pollution Symptoms		Cognitive Index		Systolic BP		Diastolic BP		Blood Oxygen	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Variables														
Monitor+Purifier	-0.094***	-0.073***	0.241	0.306	-0.058	-0.056	-0.049	0.011	-1.251	-0.962	-0.686	-0.733	0.082	-0.129
	(0.028)	(0.027)	(0.204)	(0.201)	(0.051)	(0.052)	(0.056)	(0.057)	(1.356)	(0.842)	(0.996)	(0.680)	(0.151)	(0.195)
Sample	Adult	Adult	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Fixed-effects														
Strata	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics														
Control Mean	0.175	0.158	7.31	9.98	-0.00122	-0.00227	0.0198	-0.001	120	98.3	83.2	68.9	97.2	97.4
q-value, Monitor + Purifier	0.011	0.050	0.497	0.497	0.497	0.497	0.536	0.842	0.536	0.497	0.591	0.497	0.635	0.591
Observations	589	589	577	574	578	578	560	571	557	568	576	572	578	574

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1.

Table 8: Impact of Treatment on Children Measured Health Outcomes

Dependent Variables:	Hypertension	Hypertension, Stage 2	Systolic BP	Diastolic BP	Blood Oxygen
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Purifier	-0.006	-0.005	-0.042	0.444	-0.054
	(0.021)	(0.011)	(0.693)	(0.594)	(0.206)
Monitor+Purifier	-0.035*	-0.017*	-1.045	-0.814	-0.133
	(0.019)	(0.009)	(0.717)	(0.610)	(0.197)
Fixed-effects					
Strata	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Control Mean	0.0813	0.0212	98.7	68.9	97.4
Control St. Dev.			10.9	8.32	1.76
Observations	885	886	879	879	890

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1.

Table 9: Impact of Treatment on WTP for Two-Month Purifier Rental

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Treated	0.223		0.366					
	(0.199)		(0.284)					
Purifier		0.240		0.422				
		(0.236)		(0.337)				
Monitor+Purifier		0.206		0.307				
		(0.244)		(0.347)				
Treated × Below Median					0.035		0.087	
					(0.262)		(0.363)	
Treated × Above Median					0.550*		0.887*	
					(0.318)		(0.470)	
Purifier × Below Median						0.255		0.467
						(0.327)		(0.461)
Purifier × Above Median						0.250		0.380
						(0.330)		(0.484)
Monitor+Purifier × Below Median						-0.196		-0.302
						(0.288)		(0.394)
Monitor+Purifier × Above Median						0.886*		1.479**
						(0.453)		(0.676)
Above Median					-0.401	-0.404	-0.347	-0.351
					(0.301)	(0.302)	(0.420)	(0.420)
Fixed-effects								
Strata	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Below Median = Above Median					0.22	0.22	0.19	0.19
Control Mean, Below Median					1.48	1.48	2.41	2.41
Control Mean	1.4	1.4	2.35	2.35				
Drop Non-Participants			Y	Y			Y	Y
Observations	877	877	537	537	877	877	537	537

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. The results show the pooled treatment effect on WTP for a two-month purifier rental, elicited through the BDM mechanism. Columns (1) and (2) show average effect on all households, with non-participating households imputed with zero WTP. Column (5) and (6) shows interaction between treatment and whether the household income is above the median sample income. Columns (3) and (4), and (7) and (8) are analogous regressions, but WTP for non-participants are excluded. Controls were selected by the Double-LASSO method, and all regressions include strata and round fixed effects. Errors are clustered at the classroom level.

Table 10: Impact on WTP for Two Month Purifier Rental and $PM_{2.5}$, by Income

Dependent Variables:	WTP	PM2.5 - Mean
Model:	(1)	(2)
Variables		
Above Median	-0.40	-17.14***
	(0.30)	(4.65)
Treated × Below Median	0.04	-20.71***
	(0.26)	(4.49)
Treated × Above Median	0.55*	-4.92**
	(0.32)	(2.42)
Fixed-effects		
Strata	Yes	Yes
Round	Yes	Yes
Hour-of-Day		Yes
Fit statistics		
Control Mean, Below Median	1.48	51.4
Observations	877	15,979

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Column (1) presents the pooled treatment effect on WTP for a two-month purifier rental, measured using the BDM mechanism. For households that did not participate, a WTP of zero was assigned. The analysis includes an interaction term between treatment status and whether the household's income is above the median income in the sample. Strata and round fixed effects were included. Column (2) presents treatment effect on indoor $PM_{2.5}$ levels, where we also add the interaction between treatment and Above Median income. Strata, round, and hour-of-day fixed effects were included. Controls were selected by Double-Lasso method for both regressions. Errors are clustered at the classroom level.

Table 11: From WTP for the Air Purifier to WTP for Clean Air

		2-month rental	Annual rental	Annual $\downarrow 10\,\mu g/m^3$ $PM_{2.5}$	
		WTP	WTP	24h use	Reported use
Control	< median income	\$1.48	\$8.88	\$4.28	\$6.99
	> median income	\$1.25	\$7.50	\$15.24	\$24.88
Treated	< median income	\$1.52	\$9.12	\$4.40	\$7.18
		[1.08–1.95]	[6.48–11.7]	[3.13–5.65]	[5.11–9.22]
	> median income	\$1.80	\$10.80	\$21.95	\$35.84
		[1.26–2.32]	[7.68–13.92]	[15.61–28.29]	[25.49–46.19]

Notes: 2-month rental WTP come from the endline survey BDM elicitation. 90th CI are reported for the treated group. Annual rental WTP is obtained by multiplying the 2-month rental WTP by 6. WTP for an annual decrease of 10 $\mu g/m^3$ of $PM_{2.5}$ is obtained by normalizing the WTP for an annual rental, by the average impact of the device on indoor air quality, by income group, assuming a 24h use (column 3) or reported use (column 4).

A Appendix

A.1 Tables

Table A1: Differential Attrition by Treatment

Dependent Variable:	Attrition
Model:	(1)
Variables	
Monitor+Purifier	-0.004
	(0.019)
Purifier	-0.010
	(0.018)
Fixed-effects	
Strata	Yes
Round	Yes
Fit statistics	
Control Mean	0.062
Observations	952

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. This table presents attrition by treatment status. Standard errors are clustered at the classroom level.

Table A2: Correlates of Attrition

	Attrition
Female	0.029
	(0.018)
Age	0.000
	(0.001)
HH Size	-0.003
	(0.003)
Number of Children	-0.006
	(0.007)
HH Monthly Exp. (USD)	0.000
	(0.000)
HH Monthly Income (USD)	0.000
	(0.000)
HH Head Attended Secondary	-0.012
	(0.028)
HH Head Attended Tertiary	-0.002
	(0.022)
Owns AC	0.009
	(0.008)
LPG Stove	-0.109
	(0.088)
Number of Smokers	0.002
	(0.009)
Outdoor PM2.5	0.000
	(0.001)
Indoor AQI Beliefs	-0.001
	(0.009)
Pollution Symptoms	-0.033
	(0.023)
Non-Pollution Symptoms	-0.008
	(0.022)

Notes: Each coefficient in the Attrition column represents a separate regression testing whether the outcome variable predicts attrition. Standard errors are clustered at the classroom level.

Table A3: Robustness, Impact of Separate Treatments on $PM_{2.}$

Model:	Mean (1)	Median (2)	Max (3)	P(PM2.5 > 100) (4)
Variables				
Monitor+Purifier	-13.09***	-11.83***	-24.76***	-0.03***
	(2.86)	(2.77)	(6.05)	(0.01)
Purifier	-13.48***	-12.38***	-23.50***	-0.03***
	(2.73)	(2.71)	(5.86)	(0.01)
Fixed-effects				
Strata	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes
Hour-of-Day	Yes	Yes	Yes	Yes
Fit statistics				
Control Mean	44.2	39.9	102	0.0738
Observations	15,979	16,118	15,979	15,979

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Each column is a regression of a measure of indoor $PM_{2.5}$ on an indicator for each of the two treatment interventions. Each $PM_{2.5}$ measure is aggregated to the household-hour-of-day level. Column (1) is mean $PM_{2.5}$, (2) is median $PM_{2.5}$, (3) is maximum $PM_{2.5}$, and (4) is the probability that $PM_{2.5}$ is above 100 $\mu g/m^3$. All regressions include fixed effect for strata, round, and hour-of-day. Controls are selected using Double-LASSO procedure. Errors are clustered a the classroom level.

Table A4: Robustness: Impact of Treatment on $PM_{2.5}$ Using Alternative Aggregation

Model:	Avg HH - Hour of Day (1)	Avg HH - Hour (2)	Avg HH (3)
Variables			
Treated	-13.29***	-14.02***	-13.13***
	(2.60)	(3.04)	(2.60)
Fixed-effects			
Strata	Yes	Yes	Yes
Round	Yes	Yes	Yes
Hour-of-Day	Yes	Yes	
Fit statistics			
Control Mean	44.2	39.9	43.1
Observations	15,979	506,595	889

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Each column is a regression of mean $PM_{2.5}$, on an indicator for whether the household received any treatment. Column (1) uses data aggregated at the household-hour-of-day level. Column (2) uses data aggregated at the household-hour-date level. Column (3) uses data aggregated at the household level. Controls are selected using Double-Lasso procedure. Errors are clustered at the classroom leve.

Table A5: Baseline Wifi Availability

Model:	(1)
Variables	
Monitor+Purifier	0.058
	(0.041)
Purifier	0.014
	(0.041)
Fixed-effects	
Strata	Yes
Round	Yes
Fit statistics	
Control Mean	0.51
Observations	951

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. This table presents Wifi availability, recorded at baseline, by treatment status. Standard errors are clustered at the classroom level.

Table A6: Impact of Treatment on Beliefs

Dependent Variables:	Outdoor AQI	Indoor AQI - No Purifier	Health Has Improved	Hardware Improved Health	AQ Matters - Short-term Health	AQ Matters - Long-term Health
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Purifier	-0.029	-0.046	0.020	0.127	0.109	0.111
	(0.082)	(0.077)	(0.056)	(0.077)	(0.082)	(0.086)
Monitor+Purifier	0.050	0.216***	0.036	0.171**	0.173**	0.076
	(0.086)	(0.079)	(0.059)	(0.073)	(0.084)	(0.085)
Fixed-effects						
Strata	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Control Mean	2.64	2.35	0.558	0.402	0.00719	0.00677
F-test, Monitor+Purifier = Purifier	0.367	0.001	0.776	0.542	0.447	0.692
q-value, Monitor + Purifier	0.5644	0.0376	0.5644	0.0625	0.0789	0.5512
q-value, Purifier	0.721	0.721	0.721	0.401	0.401	0.401
Observations	895	888	454	264	894	894

Notes: The table shows how our pooled treatment affected (1) beliefs about households' indoor AQI in their own homes, without a purifier, (2) beliefs about outdoor AQI levels in their neighborhood, (3) binary outcome of whether their health improved in the last three months, (4) for households who stated their health did improve, a binary outcome of whether they attributed that to the hardware provided in the intervention, (5) whether spending 12 hours in a clean air environment is good for their immediate health, (6) and whether spending 12 hours in a clean air environment is good for their long-term health. Controls were selected by the Double-LASSO method, and all regressions include strata and round fixed effects. Errors are clustered at the classroom level.

Table A7: Robustness: Impact of Treatment on WTP for Two Month Purifier Rental, by Various Wealth Measures

Model:	All (1)	Income (2)	Food Exp. (3)	Housing Size (4)	Composite Index (5)	HOH Schooling (6)
Variables						
Treated	0.223					
	(0.199)					
Treated × Below Median		0.035	-0.032	0.064	0.171	
		(0.262)	(0.302)	(0.229)	(0.287)	
Treated × Above Median		0.550*	0.467*	0.853**	0.300	
		(0.318)	(0.270)	(0.391)	(0.286)	
Treated × Elementary						0.039
						(0.282)
Treated × Secondary						0.141
						(0.244)
Treated × Tertiary						0.703
						(0.502)
Above Median		-0.401	-0.404	-0.357	-0.037	
		(0.301)	(0.301)	(0.295)	(0.306)	
Secondary						0.897***
						(0.243)
Tertiary						0.250
						(0.417)
Fixed-effects						
Strata	Yes	Yes	Yes	Yes	Yes	Yes
Round	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Control Mean	1.4					
Control Mean: Below Median/Elementary		1.48	1.52	1.48	1.29	0.414
Below Median = Above Median		0.22	0.23	0.084	0.75	
Tertiary = Secondary						0.31
Tertiary = Elementary						0.25
Observations	877	877	877	877	874	877

Notes: Clustered standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. Column (1) presents the pooled treatment effect on WTP for a two-month purifier rental, measured using the BDM mechanism. Column (2) interacts treatment with whether the household's income is above the median sample income, (3) interacts treatment with whether the household's food expenditure is above the median sample food expenditure, (4) interacts treatment with whether the household has more than 5 rooms in the house, (6) is an aggregate economic well-being measure that is created by through a principle component analysis of household income, expenditure, whether the HOH is employed, housing size, whether the household had an AC, and whether the household has WIFI. The index is the first principal component, (7) whether the head of the household attended primary, second, and tertiary schooling. For households that did not participate in the BDM, a WTP of zero was assigned. Strata and round fixed effects were included. Errors were clustered at the classroom level.

Table A8: Impact of Treatment on Indoor $PM_{2.5}$ Levels, by Whether HH Has a Smoker

Dependent Variable:	PM2.5 - Mean	
	No Smokers	Smoker
Model:	(1)	(2)
Variables		
Above Median	-2.782	12.80*
	(4.254)	(7.304)
Treated × Below Median	-12.10***	-8.498**
	(3.118)	(3.954)
Treated × Above Median	-8.691**	-23.72***
	(3.617)	(7.072)
Fixed-effects		
Strata	Yes	Yes
Round	Yes	Yes
Hour-of-Day	Yes	Yes
Fit statistics		
Observations	5,569	10,410
Dependent variable mean	26.888	38.145

Notes: This table shows the impact of purifiers on indoor $PM_{2.5}$, interacting treatment with whether household income is above the median sample income. Column (1) shows the results for households with no smokers, while (2) shows results for households with at least one smoker. Controls were selected by Double-Lasso procedure. Regressions include strata round, and hour-of-the-day fixed effects. Errors are clustered at the classroom level.

Table A9: Correlates of HH Characteristics and Classification Inconsistencies

Dependent Variable:	Inconsistent
Model:	(1)
Variables	
Number of Smokers	0.070***
	(0.023)
Number of People in HH	-0.021*
	(0.013)
Number of Children in HH	0.004
	(0.024)
Number of Boys in HH	0.017
	(0.024)
Hours Cooking	-0.004
	(0.005)
Hours at Home	0.002
	(0.003)
Head of HH Employed	-0.078
	(0.057)
Respondent Employed	-0.003
	(0.038)
Respondent Female	0.033
	(0.072)
Respondent is Head of HH	-0.032
	(0.057)
Fit statistics	
Dependent variable mean	0.36303
Observations	898
R^2	0.01513

*Notes: IID standard-errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1. This table presents the correlates of household characteristics associated with inconsistencies in classification as Above or Below Median when comparing food expenditure to income.*

A.2 Figures

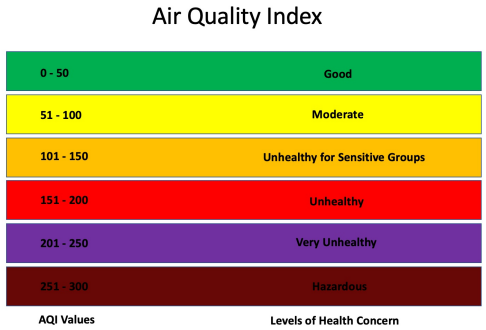


Figure A.1: US EPA Air Quality Index

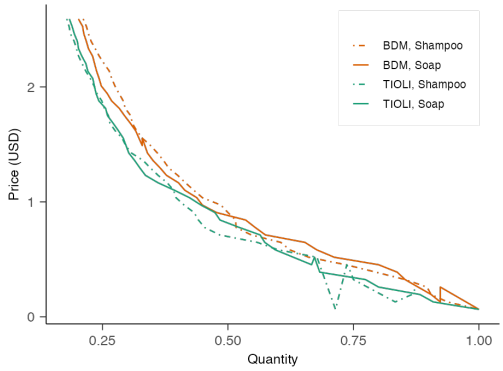


Figure A.2: Practice TIOLI vs BDM

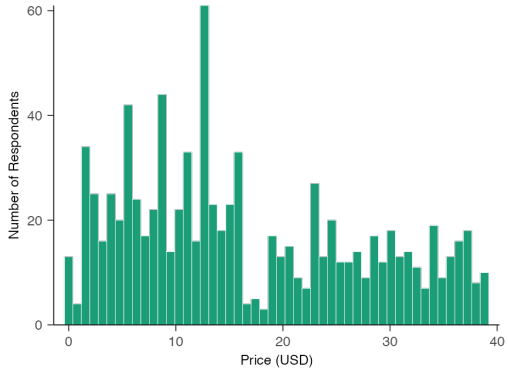


Figure A.3: Randomly Allocated BDM Prices

A.3 BDM Implementation Details

To elicit willingness to pay (WTP) for the air purifier, we use the Becker et al. (1964) mechanism. Following Berkouwer and Dean (2022), each respondent completes two practice exercises before

the BDM procedure: one for a bottle of soap and one for a bottle of shampoo. Each respondent is randomly allocated a price for the soap and shampoo. Respondents are randomly assigned whether the lotion is offered at a take-it-or-leave-it ("TIOLI") price and the bar of soap using BDM, or vice versa. As described by Berkouwer and Dean (2022), comparing the demand curves elicited through both mechanisms tests comprehension. Similar demand curves for both goods suggest respondents understand the BDM mechanism and that the elicited WTP values reflect realistic decisions. This comparison is presented in Figure A.2.

After the practice, we explain the purifier BDM procedure to the household. Below, we outline the steps of our BDM methodology, followed by the full script used with respondents:

1. Before the endline visit, each participant is randomly assigned a BDM price drawn from a distribution ranging from USD$0.3 to USD$40.

2. Each enumerator receives a sealed envelope containing the BDM price (in IDR) for the participants they are visiting that day. Enumerators are unaware of the assigned prices.

3. At the start of the BDM procedure, the enumerator places the sealed envelope in view of the participant.

4. Starting from IDR 300,000 (approximately USD$20), the enumerator asks if the participant would commit to purchasing the purifier at that price.

   - If the participant agrees, the next price presented is the midpoint between the current price and the maximum price in the range.
   - If the participant declines, the next price is the midpoint between the current price and the minimum price in the range.

   This iterative process continues for a total of 11 rounds, progressively narrowing the price range until the participant's maximum willingness to pay is identified.

5. Once the participant confirms their maximum WTP, the participant and enumerator open the envelope together to reveal the randomly assigned BDM price.

6. If the participant's maximum WTP is lower than the BDM price in the envelope, they cannot purchase the purifier.

7. If the participant's maximum WTP is at least as high as the BDM price in the envelope, they purchase the purifier.

We had 40 purifiers available for rent in each round, totaling 80 purifiers across the two rounds. Therefore, we set the distribution of BDM price draws to ensure no more than 80 purifiers were rented in total. We based the distribution we drew prices from on our pilot results and stated WTP at baseline. The distribution of prices is shown in Figure A.3.

BDM Script

SECTION 1: PRACTICE TIOLI WITH [item1]

Households are randomly assigned into one of the following two groups:

Group 1: item1 = soap item2 = lotion

Group 2: item1 = lotion item2 = soap

Each household is also randomly assigned a price for the TIOLI item [pracprice1] and a price for the BDM item [pracprice2].

READ

> We will first give you the opportunity to buy a lotion and a soap. After that, we will sell the air purifier. You will not have to spend any more for these items than you want to. If you decide you want to buy the lotion or soap, you will need to pay us on the spot, and we will give you the good.
>
> Do you have any questions?

Pause to take any questions.

Show the [item1] to the respondent

READ

> Let's start with [item1]. Would you like to buy this [item1] for Rp [pracprice1]? If you say 'yes', you will pay [pracprice1] and receive the [item1]. If you say 'no', you will not receive it and not pay anything.
>
> Would you like to buy this item?

Record the response. If the participant responded "yes" to purchasing [item1], hand over [item1].

SECTION 2: PRACTICE BDM WITH [item2]

Please take 1 blank piece of paper that says: PRICE: RP _____

WITHOUT SHOWING THE RESPONDENT, WRITE DOWN THE PRICE ON THE PIECE OF PAPER: [pracprice2].

FOLD THE PAPER CLOSED. WRITE DOWN "[item2]" on the OUTSIDE. Then, put the FOLDED paper on the table. Just to confirm, please write down the price that you just wrote on the piece of paper: _____

READ

> The process for buying the [item2] and the air purifier today will be a little bit different from [item1]. Before we play for the purifier, we will practice with [item2].
>
> First, you and I will figure out the highest price that you are willing to pay. Then, we will together open a secret piece of paper to look at the price. If the secret price is higher than what you said you are willing to

pay, then you will NOT be able to buy [item2] from us today. If you named a price that was the same or higher as the price that is on the paper, then you will be able to purchase [item2] from us today. You would then pay the price written on the piece of paper. This may be even lower than the price you chose! You will not have to pay anything more than you want to.

Since this is complicated, we will first make a plan for which price you would like to pay. I will ask you whether you would be willing to pay several prices and you will tell me "yes" or "no" for each price. After we are done, you will not be able to change your plan. You will only be able to buy the [item2] if you are willing to pay more than the secret price.

This offer is available for today only. If you do not get [item2] today, you will not be able to get it tomorrow. Do you understand?

If the respondent does not understand, please re-explain or answer their questions].

READ

This offer is for your household only. This offer cannot be used by anyone else.

Show the [item2] to the respondent

READ

Let's start by doing a practice exercise for this [item2]. The price of this good is written on this piece of paper

SHOW THE FOLDED PIECE OF PAPER BUT KEEP IT CLOSED

READ

Afterwards, we will do the same for the air purifier. We will use a different secret price for the air purifier. Do you have any questions?

Note: For this next section, the quantity in each question depends on the answer immediately prior. If the prior answer is “no”, the subsequent price will be lower. If the prior answer is “yes”, the subsequent price will be higher. This process proceeds with a binary search.

READ

If the price was 75 Rp, would you want to buy the [item2]?

If the price was [prac_x1] Rp, would you want to buy it?

If the price was [prac_x2] Rp, would you want to buy it?

If the price was [prac_x3] Rp, would you want to buy it?

If the price was [prac_x4] Rp, would you want to buy it?

If the price was [prac_x5] Rp, would you want to buy it?

If the price was [prac_x6] Rp, would you want to buy it?

Record respondent's final bid, [prac_wtp1].

Confirmation section

READ

So the most you are willing to pay to buy the [item2] is [prac_wtp1]?

So how much is the most you are willing to pay?

Just to make sure you understand, what happens if the price ends up being [prac_wtp1_p5]?

[If not correct:]

READ

This is not correct! If you are willing to pay [prac_wtp1] and the price turns out to be [prac_wtp1_p5] then you would NOT be able to buy the air purifier from us! You previously said that you were not willing to pay [prac_wtp1_p5]. Do you understand?

And what happens if the price ends up being [prac_wtp1_m5]?

[If not correct:]

READ

This is not correct! If you are willing to pay [prac_wtp1] and the price turns out to be [prac_wtp1_m5] then you SHOULD buy the [item2] from us! You previously said that you were willing to pay [prac_wtp1_m5]. Do you understand?

Just to double check, if the price ends up being [prac_wtp1_p5], would you want to buy the [item2] for [prac_wtp1_p5]?

[If yes:]

READ

So the most you are willing to pay to buy the [item2] is [prac_wtp2]?

[If no:]

READ

So how much is the most you are willing to pay?

READ

Just to make sure you understand, what happens if the price ends up

being [prac_wtp2_p5]?

Note: the Confirmation Section can happen up to 4 times. If the respondent still changes their mind, the field officer will start again from the beginning.

READ

Great! So the final highest price you will pay is [prac_finwtp]. We have figured out that the maximum amount that you are willing to pay for the [item2] is [prac_finwtp] Rp. We will now open the piece of paper to see the price.

Give the respondent the piece of paper and ask them to read the number.

[If win:]

READ

Congratulations! The price is [pracprice2] Rp which is less than you said you were willing to spend ([prac_finwtp] Rp).You may have this [item2] after you pay [pracprice2] Rp right now.

DO NOT LET THE RESPONDENT CHANGE THEIR MIND AT THIS POINT!!!

[If lose:]

READ

Unfortunately, the price is [pracprice2] Rp which is more than you said you were willing to spend ([prac_finwtp] Rp). You will not be able to buy the [item2] today.

DO NOT LET THE RESPONDENT CHANGE THEIR MIND AT THIS POINT!!!

READ

Do you have any questions?

Did the respondent want to change their mind? Did the respondent argue? What was the respondent's argument?

Section 3: ACTUAL BDM WITH AIR PURIFIER

PLACE THE AIR PURIFIER PRICE SCRATCH CARDIN FRONT OF YOU. KEEP IT CLOSED.

READ

We are now going to use the same method that we used for the [item2] to see what price you would like to pay for buying the air purifier. The secret price of the air purifier for you is inside this envelope. I do not know what the price is. It was randomly chosen using a computer by one of my colleagues. As you can see, the scratch card is new. The price may be lower than the price in the stores!

The price inside this envelope was selected by a random lottery. This means that every participant in our study has a different price inside their envelope, and the prices were selected by random chance. Therefore, the price inside your scratchcard will be DIFFERENT from the prices that are written inside the scratchcard of other people who also participate in the study. Everybody has a different price.

Remember: - If the price on the scratchcard is higher than the most you said you were willing to pay, then you will NOT be able to buy the air purifier today. You cannot change your mind later, and you cannot get another chance tomorrow. This offer is for today only, and it is for you only. - If you are willing to pay the amount in the envelope, then you SHOULD buy the air purifier from us today. In practice, this means that we will use the [remaining compensation from the study], and we will ask you to pay directly for the remaining amount, if the total price is greater than [remaining compensation from the study]. You SHOULD then pay the price that is in the envelope TODAY.

To purchase the air purifier, you will need to have the money to pay us via GoPay TODAY. We understand that if we came back in one week, perhaps you will have more money available. For now, we would like you to just think only about the cash that you have available RIGHT NOW, to spend on GoPay. Only think of the money that you have that you can use to buy the air purifier TODAY.

Give respondent some time to think.

READ

We are not affiliated with the air purifier company and to us it does not matter whether you would like to buy the air purifier or not. We are not sales people: we are researchers and we are just trying to learn about people like you. If you do not want to buy the air purifier today, or if you think the price is too high, that is okay. It does not matter to us whether you buy the air purifier or not.

We will do our best to keep all our answers completely confidential. We will not share your name or individual information with anyone, and none of your neighbors, family, or friends will ever be able to see your answers. When you are answering the questions, please answer honestly. We are simply trying to learn from the people we are interviewing.

There is no such thing as "too low" or "too high", and there are no right or wrong answers. Throughout this process, you will be able to look at this screen to see the different prices.

Do you have any other questions? Let's begin.

Decision Section

READ

If the price of the air purifier is [x0] Rp would you want to buy it? Select yes or no:

Note: The Decision Section is repeated 12 times, until the respondent has stated their WTP to the nearest 1 Rp.

Confirmation section

[If yes:]

READ

So the most you would be willing to pay for the air purifier is [wtp1]?

[If no:]

READ

So how much is the most you are willing to pay?

For confirmation:

READ

Just to make sure you understand, what happens if the price ends up being [wtp1_p5]?

[If incorrect:]

READ

This is not correct! If you are willing to pay [wtp1] and the price turns out to be [wtp1_p5] then you would NOT be able to buy the air purifier from us! You previously said that you were not willing to pay [wtp1_p5]. Do you understand?

For confirmation:

READ

And what happens if the price ends up being [wtp1_m5]?

[If incorrect:]

READ

This is not correct! If you are willing to pay [wtp1] and the price turns out to be [wtp1_m5] then you SHOULD buy the air purifier from us for [wtp1_m5]. Do you understand?

Note: the Confirmation Section can happen up to 4 times. If the respondent still changes their mind or does not understand, the field officer will start again from the beginning.

READ

We have figured out that the maximum amount that you are willing to pay for the air purifier is [finwtp]. We will now open the envelope to see the price. Remember, if the price on the envelope is higher than [finwtp], then you will NOT be able to buy the air purifier today. If the price is less than or the same as [finwtp], you SHOULD buy the air purifier today. You will pay the price in the envelope.

Just to make sure you understand, if the price ends up being [finwtp], do you agree to buy the air purifier and pay [finwtp]?

[If no:] The respondent does not understand! Please repeat the rules again.]

READ

And what happens if the price ends up being [checkFinal]?

[If incorrect:] The respondent does not understand! Please repeat the rules again. If they change their mind, that is okay. Please go back and re-do the BDM BEFORE they scratch the scratchcard.

Outcome Section

Please give the respondent the scratchcard and ask them to scratch and read the price.

[If lose:] FO: DO NOT LET THE HOUSEHOLD PURCHASE THE AIR PURIFIER

READ

Unfortunately the price (Rp [price]) is higher than you are willing to pay (Rp [finwtp]). You will not be able to purchase the air purifier today. You may still buy an air purifier at the regular price of Rp 2,990 in major supermarkets.

FO: Did the respondent argue when they found out they could not buy the air purifier?

[If win:]

READ

Congratulations! The price is less than you are willing to pay. You may now purchase the air purifier for [price].

A.4 Video Intervention Transcript

To produce the video, we partnered with Bicara Udara, an Indonesian NGO dedicated to raising awareness about air pollution and advocating for clean air as a fundamental right. The final video largely drew from Bicara Udara's existing campaign materials, interwoven with narration to create a cohesive story. The video can be found here, and a translated transcript of the video is below.

Transcript:
Hi, I am Najma Malia Kurniawan, and today we will talk about how harmful air pollution is for your health, especially at the pollution levels in Jakarta. I will also discuss the causes of outdoor air pollution, how outdoor and indoor air pollution are connected, and how you can protect yourself, your children, and your family from air pollution. Air pollution mainly consists of two main components: gases and particulate matter. Generally, it includes carbon dioxide and nitrogen oxides, as many people know, while particulate matter includes dust particles ranging from 10 micrometers to as small as 0.1 micrometers.

According to the World Health Organization, 93% of the population under 15 years old breathes polluted air. Jakarta ranks first among Southeast Asian capitals as the most polluted capital. Air pollution presents a challenge for parents raising children in major cities like Jakarta. Research from the University of Colorado shows that long-term exposure to air pollution can weaken infants' immune systems. Not only infants, but children are also vulnerable to the effects of air pollution. Based on a study from Southern California Children's Health, air pollution exposure can risk damaging organ development and the respiratory system. Air pollution also increases the risk of future diseases like lung cancer, pneumonia, stroke, and heart disease. Furthermore, according to UNICEF, exposure to air pollution can reduce cognitive ability and intelligence in children.

According to data from Nafas, the annual average air quality in Jakarta is 38 $\mu g/m^3$, meaning Jakarta's air quality is unhealthy for sensitive groups. Unlike the Jakarta Environmental Agency, which claims that 75% of air pollution is caused by motor vehicle activities, research conducted by Vital Strategies in collaboration with the Bandung Institute of Technology shows that motor vehicles contribute only 32-57% to $PM_{2.5}$ pollution. However, one thing to note is that all research shows that most air pollution is caused by human activity.

Children often spend 7 to 10 hours at home and in classrooms, which is often not free from air pollution. Indoor air pollution in Jakarta is more dangerous than most people realize. The air sensor I am holding shows that the indoor air quality here is very good, below 5 $\mu g/m^3$, in line with WHO standards. The air quality here is excellent because I have placed several air purifiers to improve indoor air quality. These purifiers filter dust particles from 10 micrometers to 2.5 micrometers. Therefore, to avoid indoor air pollution, an air purifier is needed.

An air purifier is different from an air conditioner (commonly referred to as AC). AC cools the room, while an air purifier freshens the air by filtering it. Like wearing a mask outdoors, an air purifier reduces the harmful effects of air pollution, but not all air purifiers are the same. Air purifiers with HEPA filters have been scientifically proven to be highly efficient in removing air pollution. Filtered air is channeled out fresh and pollution-free. In lab settings, HEPA filters remove over 99% of all airborne pollutants, including allergens, particles, and bacteria. Its effectiveness in practice depends on installation location and room characteristics.

But doesn't planting trees reduce pollution? The short answer is yes, but trees mainly absorb gaseous pollution and cannot absorb $PM_{2.5}$ particles. Effective interventions include stricter law enforcement, creating integrated public transport, and electrifying public transport. Additionally, we can protect ourselves and our families from air pollution by starting with the following:

1. Use public transportation or switch to electric vehicles.
2. Do not burn trash in the yard; if neighbors burn trash, close your windows and report it to the local environmental agency.
3. Monitor air pollution levels in your area daily. If pollution is high, avoid outdoor exercise and keep infants and children indoors.
4. Use air purifiers when air quality is unhealthy.
5. Always wear a mask when traveling in unhealthy air conditions.

You now know that high air pollution levels in Jakarta not only impact the environment but also negatively affect health, especially for children and vulnerable individuals. You have also learned how to protect yourself from air pollution indoors and outdoors. For more information on air pollution, you can visit Bicara Udara's Instagram, follow their social media, or attend their events. You can also monitor air pollution levels using the Nafas app or the IQAir website. Thank you for your attention.

A.5 Cognitive Ability

1. **Word recall (working and episodic memory)**: the enumerator reads a list of 10 words and respondents verbally recalled as many words as possible. 10 minutes later in the survey, respondents are asked to recall the words from the word recall task.
2. **Serial seven (attention)**: enumerator asks respondent to subtract 7 from 100. This is repeated 5 times.

3. **Forward digit span (working memory)**: the respondent is asked to repeat a series of numbers first indicated by the enumerator, starting with three numbers. Success leads to an increase in the length of the task.

4. **Backward digit span (executive function)**: analogous to the forward digit span, the respondent is asked to repeat *backwards* a series of numbers

A.6 Purifier Data and Usage

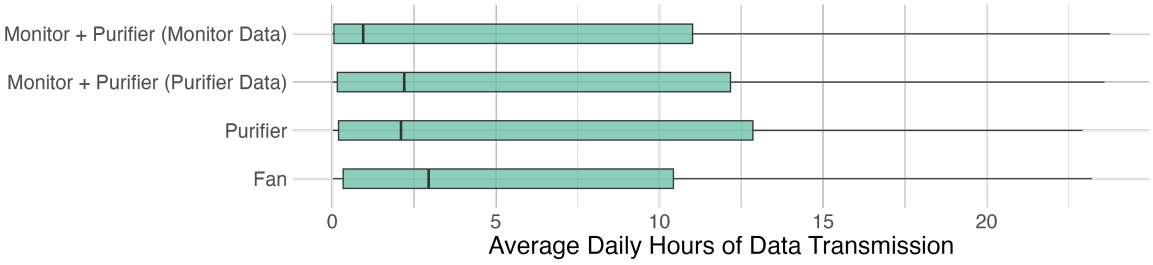
Two primary issues led to missing data. First, some households chose not to use the air purifier, often due to concerns about electricity usage. Many Jakarta households use pre-paid electricity systems, purchasing a set amount of electricity in advance. This setup makes households cautious about adding new devices that could deplete their balance more quickly. In addition, many homes have limited electrical capacity, which may not handle increasing loads effectively, particularly among lower-income households. About 32% of the households reported electrical or voltage limitations that led them to turn off the devices.

The second issue was unstable Wi-Fi transmission, which was particularly affecting lower-income households. This instability arose from weak Wi-Fi signals, reluctance to keep Wi-Fi units plugged in due to electricity concerns, and occasional misuse of Wi-Fi units. In several cases, households repurposed Wi-Fi devices or chargers for personal use, such as removing SIM cards or using chargers for other devices, which disrupted data transmission.

Consequently, our indoor air quality dataset contains gaps due to a combination of purifier non-use and Wi-Fi connectivity issues. While missing data from purifier non-use can offer insights into barriers to adoption and sustained usage, the data do not allow us to distinguish between non-use and Wi-Fi instability. However, we believe Wi-Fi issues are likely random across treatment groups, potentially mitigating bias. Despite this, Wi-Fi instability has limited our ability to accurately measure air purifier usage. At baseline, we recorded whether the household had its own Wi-Fi. Balance across treatment groups on Wi-Fi availability is displayed in A5.

Add reported usage vs recorded usage in the results section - appendix it for now

(a) Daily Data Transmission (hours per day)



(b) CDF of Household Data Coverage: Fraction of Hours with Data

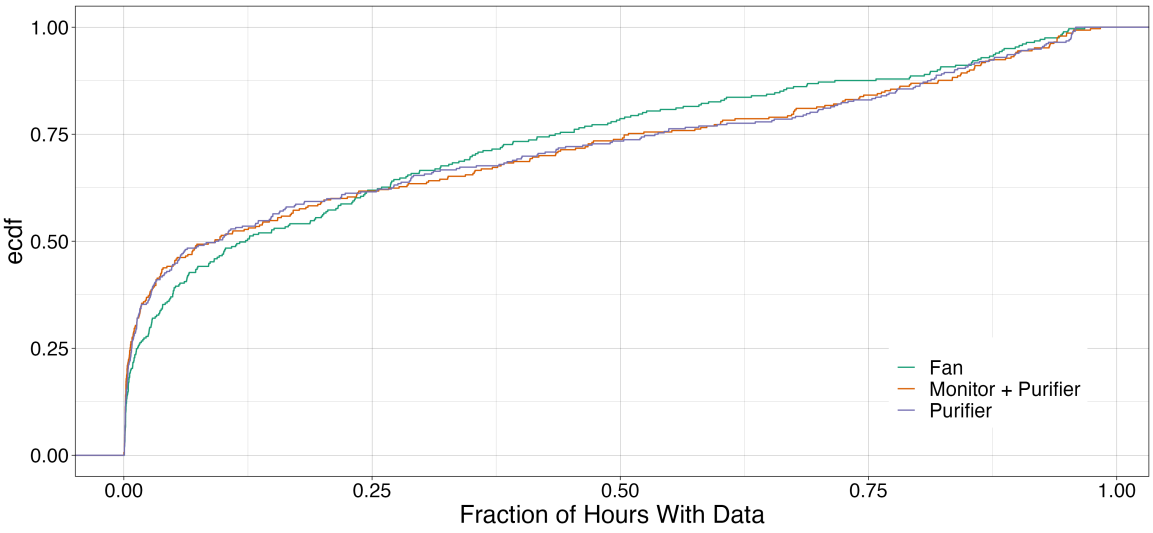
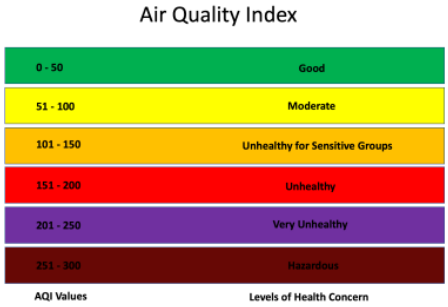


Figure A.4: Data Transmission by Treatment Group

Note: Panel (a) displays boxplots summarizing the distribution of average daily data transmission hours for each treatment group. The statistic for each household is calculated by first counting the number of hours with data each day, and then averaging this value over all days for that household. The boxplots displays the minimum, 1st quartile, median, 3rd quartile, and max. Panel (b) shows the CDF of data collected. The x-axis represents the fraction of hours over the intervention period for which data was transmitted for each household. Each line correspondents to one of the three treatment groups.

A.7 Survey Questions

NOTE: the survey is currently being translated into Bahasa. We can upload the translated version as a revision to BRIN once completed.

	Questions	Answer Field
Beliefs	We are going to talk a lot today about air pollution, so we first want to show you a reference air pollution scale that you may have seen around. The different colors correspond to different levels of health impacts.	
		
	In the past 7 days, how good do you think air quality was in Jakarta, on the scale we just showed you?	1. Good (green) 2. Moderate (yellow) 3. Unhealthy for sensitive groups (orange) 4. Unhealthy (red) 5. Very unhealthy (purple) 6. Hazardous (Brown) -999. Doesn't know
	In your home without an air purifier, do you think that outdoor air is:	1. Much more polluted than indoor air 2. Somewhat more polluted than indoor air 3. As polluted as indoor air 4. Somewhat less polluted than indoor air 5. Much less polluted than indoor air -999. Doesn't know
	In the past 7 days, how do you think air quality was in your home, on the AQI scale we mentioned earlier?	1. Good (green) 2. Moderate (yellow) 3. Unhealthy for sensitive groups (orange) 4. Unhealthy (red) 5. Very unhealthy (purple) 6. Hazardous (Brown) -999. Doesn't know
	Rate this statement on a scale from 1 to 6, with 1 being strongly disagree and 6 being strongly agree. Spending 12 hours a day (e.g. night) in a clean air environment can significantly improve my immediate health, even if the air is very polluted the other 12 hours.	1. Strong disagree 2. Disagree 3. Somewhat disagree 4. Somewhat agree 5. Agree 6. Strongly agree -999. Does not know
	The last question was about immediate health. This is about long-term health. Rate this statement on a scale from 1 to 6, with 1 being strongly disagree and 6 being strongly agree. Spending 12 hours a day (e.g. night) in a clean air environment is good for my long-term health, even if the air is very polluted the other 12 hours.	1. Strong disagree 2. Disagree 3. Somewhat disagree 4. Somewhat agree 5. Agree 6. Strongly agree -999. Does not know
	Now think about $child_name$. Rate this statement on a scale from 1 to 6, with 1 being strongly disagree and 6 being strongly agree. Spending 12 hours a day (e.g. night) in a clean air environment can significantly improve $child_name$'s immediate health, even if the air is very polluted the other 12 hours.	1. Strong disagree 2. Disagree 3. Somewhat disagree 4. Somewhat agree 5. Agree 6. Strongly agree -999. Does not know

	Think again about $child_name$, this time about long-term health. Rate this statement on a scale from 1 to 6, with 1 being strongly disagree and 6 being strongly agree. Spending 12 hours a day (e.g. night) in a clean air environment is good for my long-term health, even if the air is very polluted the other 12 hours.	1. Strong disagree 2. Disagree 3. Somewhat disagree 4. Somewhat agree 5. Agree 6. Strongly agree -999. Does not know
	If I put an air purifier into your bedroom with the window and door closed, how effective do you think it would be at getting rid of indoor pollutants in your home?	1. Reduces pollutants by at least 90% 2. Reduces pollutants by at least 75% 3. Reduces pollutants by at least 50% 4. Reduces pollutants by at least 25% 5. It would not have a big effect on indoor air pollution
	Questions	**Answer Field**
Demand for Clean Air	In the past 7 days, did you check the levels of outdoor air pollution, using the internet, an app, or some other source of information?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	In the past 7 days, where did you check the levels of outdoor air pollution:	1. Mobile App 2. Internet Website 3. Newspaper 4. Discussion with friends / relatives 5. TV program 9. Other
	In the past 7 days, did you avoid going outside because air pollution was very high?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	In the past 7 days, did you avoid taking your children outside because air pollution was very high?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	In the past 7 days, did you avoid exercising outside because air pollution was very high?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	In the past 7 days, did you close windows when outdoor air pollution was high, to protect yourself against outdoor air pollution?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	In the past 4 weeks, have you engaged in any of the following activities / done any of the following? Please select all that apply.	1. Talked about air pollution with members outside your family 2. Engaged with your neighbors about not burning garbage 3. Read articles related to air pollution in Jakarta on online / offline newspapers 4. Read articles about air pollution on social media 5. Participated to a formal gathering (e.g. lecture) related to air pollution 6. Participated to an informal gathering related to air pollution 7. Created content related to air pollution on social media 0. None of the above
	Please prioritize the following four topics according to their significance for the Jakarta government's agenda.	1. Traffic 2. Waste Management 3. Air Pollution Control 4. Health facilities and costs
	We are now going to list a series of policies that the government could take. We want you to think how much you support these policies, on a scale of 1 to 6, with 1 being not support at all, and 6 being greatly support these policies. Once again, there is no good or bad answer and your answers will be kept confidential.	

	How likely are you to support the following policy? Implementing stronger regulations on traffic, like a more stringent odd-even traffic policy, which are meant to tackle air pollution.	1. Extremely unlikely 2. Unlikely 3. Somewhat unlikely 4. Somewhat likely 5. Likely 6. Extremely likely
	How likely are you to support implementing stronger fines for garbage burning?	1. Extremely unlikely 2. Unlikely 3. Somewhat unlikely 4. Somewhat likely 5. Likely 6. Extremely likely
	How likely are you to support policies promoting the transition from coal power plants to renewable energy. Examples of renewable energy are wind and solar power.	1. Extremely unlikely 2. Unlikely 3. Somewhat unlikely 4. Somewhat likely 5. Likely 6. Extremely likely
	How likely are you to support planting more trees in your neighborhood?	1. Extremely unlikely 2. Unlikely 3. Somewhat unlikely 4. Somewhat likely 5. Likely 6. Extremely likely
	How likely are you to support better compensations for households affected by floods?	1. Extremely unlikely 2. Unlikely 3. Somewhat unlikely 4. Somewhat likely 5. Likely 6. Extremely likely
	In the last 24 hours, how many hours did you spend inside your home?	
	Questions	**Answer Field**
Self-reported Health	We are now going to ask you some questions about your health, which is meant to better understand how pollution affects people with different health concerns. We do not want to invade your privacy, and want to remind you that all answers will be kept strictly confidential. You do not have to answer anything you do not want to.	
	Including yourself, is there any member of your household / of your family in Jakarta that you would describe as with "poor health"?	
	In the past 4 weeks, have you experienced the following. Please check all that apply. [Enumerator: read the questions one by one. Pause after each option and let the respondent indicate yes or not].	**1. Headaches** **2. Dizziness** **3. Increased fatigue** **4. Coughing or wheezing** **5. Shortness of breath / chest tightness** **6. Burning eyes** **7. Fever** **8. Runny nose** **9. Vision impairment** **10. Skin rashes** 11. Joint pain 12. Numbess or tingling in the hands 13. Stomach Ache or diarrhea **14. Nausea** 15. Toothaches 16. Hearing impairment 99. Other 0. None of the above -999. Does not know -888. Refuse to answer
	What other symptoms have you experienced?	
	During the last 4 weeks, how many days have these health complaints interefered with work, school, or daily activities?	

Have a doctor/paramedic/nurse/midwife given you any of the following diagnoses? Check all that apply. [Enumerator: read the questions one by one. Pause after each option and let the respondent indicate yes or not].	`-1. Respondent has not been to a health facility 1. Asthma 2. COVID 3. Pneumonia 4. Chronic pulmonary disease 5. Tuberculosis 6. Hypertension 7. Other lung disease 8. Stroke or cardiovascular disease 9. Memory-related disease 0. None of the above (but the respondent has been to a health facility) -888. Refuse to answer
In the past 4 weeks, have you visited the doctor or nurse related to your health?	1. Yes 0. No -999. Does not know -888. Refuse to answer
In the past 4 weeks, have any adults living in this home experienced the following. Please check all that apply.	1. Headaches 2. Dizziness 3. Increased fatigue 4. Coughing or wheezing 5. Shortness of breath / chest tightness 6. Burning eyes 7. Fever 8. Runny nose 9. Vision impairment 10. Skin rashes 11. Joint pain 12. Numbess or tingling in the hands 13. Stomach Ache or diarrhea 14. Nausea 15. Toothaches 16. Hearing impairment 99. Other 0. None of the above -999. Does not know -888. Refuse to answer
What other symptoms have you experienced?	
Think of the family member that was most affected. During the last 4 weeks, how many days have these health complaints interefered with work, school, or daily activities for this person?	
Have a doctor/paramedic/nurse/midwife given any other adults in this household any of the following diagnoses? Check all that apply.	"`-1. Respondent has not been to a health facility 1. Asthma 2. COVID 3. Pneumonia 4. Chronic pulmonary disease 5. Tuberculosis 6. Hypertension 7. Other lung disease 8. Stroke or cardiovascular disease 9. Memory-related disease 0. None of the above (but the respondent has been to a health facility) -888. Refuse to answer"
In the past 4 weeks, has any other adult in your family visited a doctor or nurse related to their health?	
In the past 4 weeks, have you or your family spent any money for medication related to asthma, coughing or any other respiratory condition, for any member of the family? If yes, how much?	
We are now going to ask you some questions about your well-being, outside of physical health. We do not want to invade your privacy, and want to remind you that all answers will be kept strictly confidential. You do not have to answer anything you do not want to.	

[Enumerator: check all words mentioned by the respondent]

Now we would like to ask you some questions about your sleep in the last 7 days.	
I had trouble sleeping	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always -888. Refuse to answer
My quality of sleep was…	1. Very poor 2. Poor 3. Fair 4. Good 5. Very Good -888. Refuse to answer
My sleep was refreshing	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I was satisfied with my sleep	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I had difficulty falling asleep	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I had a hard time concentrating because of poor sleep	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I had problems during the day because of poor sleep	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I had a hard time getting things done because I was sleeping	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
I felt tired	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer

I felt irritable because of poor sleep	1. Not at all 2. A little bit 3. Somewhat 4. Quite a bit 5. Very much -888. Refuse to answer
Now we would like to ask some questions about how you felt in the past week.	
I was bothered by things that usually don't bother me	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I had trouble concentrating in what I was doing	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I felt depressed	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I felt everything I did was an effort	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I felt hopeful about the future	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I felt fearful	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
My sleep was restless	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I was happy	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I felt lonely	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days
I could not get going	1. Rarely, <= 1 day 2. Some days, 1-2 days 3. Occasionally, 3-4 days, 4. Most of the time, 5-7 days

	Questions	**Answer Field**
Cognitive Test - Child	We are going to read a list consisting of 10 words and we would like you to memorize as many as you can. We deliberately ma [Enumerator: probe whether respondent needs more explanation] [Enumerator: Read the list slowly, with interval around 2 seconds between each word] MOUNTAIN. STONE. BLOOD. CORNER. SHOES. LETTER. GIRL.HOUSE. VALLEY. CAR	

[ ] MOUNTAIN
[ ] STONE
[ ] BLOOD
[ ] CORNER
[ ] SHOES
[ ] LETTER
[ ] GIRL
[ ] HOUSE
[ ] VALLEY
[ ] CAR
[ ] None of the above
[ ] Refuse to answer

[Enumerator: check all words mentioned by the respondent]

I will read you a number of digits. Afterwards, you repeat them in th

1. Pass
0. Fail
-888. Refuse to answer

Let's start with a brief example so you can practice. I will give you th

[Enumerator: did the respondent correctly repeat 7-1-9?]

No, you would say 7-1-9. I said 7-1-9, so to say it forwards you would

1. Pass
0. Fail
-888. Refuse to answer

7-1-9. Now try these numbers. Remember, you are to say them forw

[Enumerator: did the respondent correctly repeat 3-4-8?]

Ok, now we will start the official exercise. Again, I will give you 3 nun

1. Pass
0. Fail
-888. Refuse to answer

[Enumerator: please pause for 1 second in between each number]

5 - 8 - 2

1. Pass
0. Fail
-888. Refuse to answer

6 - 9 - 4

1. Pass
0. Fail
-888. Refuse to answer

6 - 4 - 3 - 9

1. Pass
0. Fail
-888. Refuse to answer

7 - 2 - 8 - 6

1. Pass
0. Fail
-888. Refuse to answer

4 - 2 - 7 - 3 - 1

1. Pass
0. Fail
-888. Refuse to answer

7 - 5 - 8 - 3 - 6

1. Pass
0. Fail
-888. Refuse to answer

6 - 1 - 9 - 4 - 7 - 3

1. Pass
0. Fail
-888. Refuse to answer

3 - 9 - 2 - 4 - 8 - 7

1. Pass
0. Fail
-888. Refuse to answer

5 - 9 - 1 - 7 - 4 - 2 - 8

1. Pass
0. Fail
-888. Refuse to answer

4 - 1 - 7 - 9 - 3 - 8 - 6

1. Pass
0. Fail
-888. Refuse to answer

5 - 8 - 1 - 9 - 2 - 6 - 4 - 7

1. Pass
0. Fail
-888. Refuse to answer

3 - 8 - 2 - 9 - 5 - 1 - 7 - 4

1. Pass
0. Fail
-888. Refuse to answer

2 - 7 - 5 - 8 - 6 - 2 - 5 - 8 - 4

	1. Pass 0. Fail
7 - 1 - 3 - 9 - 4 - 2 - 5 - 6 - 8	-888. Refuse to answer
	1. Pass 0. Fail
2 - 2 - 9 - 8 - 3 - 4 - 5 - 4 - 2 - 1	-888. Refuse to answer
	1. Pass 0. Fail
3 - 1 - 4 - 1 - 2 - 4 - 8 - 9 - 6 - 5	-888. Refuse to answer
We will repeat the exercise from before. I will read you a number of	1. Pass 0. Fail
I say 7-1-9, what would you say?	-888. Refuse to answer
[Enumerator: did the respondent correctly repeat 9-1-7?]	
No, you would say 9-1-7. I said 7-1-9, so to say it backwards you wou	1. Pass 0. Fail
say 9-1-7. Now try these numbers. Remember, you are to say them l	-888. Refuse to answer
[Enumerator: did the respondent correctly repeat 8-4-3?]	
Ok, now we will start the official exercise. Again, I will start with 3 nu	1. Pass 0. Fail
6 - 2 - 9	-888. Refuse to answer
	1. Pass 0. Fail
4 - 1 - 5	-888. Refuse to answer
	1. Pass 0. Fail
3 - 2 - 7 - 9	-888. Refuse to answer
	1. Pass 0. Fail
4 - 9 - 6 - 8	-888. Refuse to answer
	1. Pass 0. Fail
1 - 5 - 2 - 8 - 6	-888. Refuse to answer
	1. Pass 0. Fail
6 - 1 - 8 - 4 - 3	-888. Refuse to answer
	1. Pass 0. Fail
5 - 3 - 9 - 4 - 1 - 8	-888. Refuse to answer
	1. Pass 0. Fail
7 - 2 - 4 - 8 - 5 - 6	-888. Refuse to answer
	1. Pass 0. Fail
8 - 1 - 2 - 9 - 3 - 6 - 5	-888. Refuse to answer
	1. Pass 0. Fail
4 - 7 - 3 - 9 - 1 - 2 - 8	-888. Refuse to answer
	1. Pass 0. Fail
9 - 4 - 3 - 7 - 6 - 2 - 5 - 8	-888. Refuse to answer
	1. Pass 0. Fail
7 - 2 - 8 - 1 - 9 - 6 - 5 - 3	-888. Refuse to answer
	1. Pass 0. Fail
8 - 2 - 3 - 7 - 5 - 3 - 9 - 2 - 1	-888. Refuse to answer
	1. Pass 0. Fail
3 - 7 - 5 - 4 - 9 - 8 - 2 - 6 - 5	-888. Refuse to answer
Let's try some subtraction of numbers now. What is 100 minus 7 equal to?	
and minus 7 from that?	
and minus 7 from that?	
and minus 7 from that?	

	and minus 7 from that?	
		[ ] MOUNTAIN [ ] STONE [ ] BLOOD [ ] CORNER [ ] SHOES [ ] LETTER [ ] GIRL [ ] HOUSE [ ] VALLEY [ ] CAR
	A short while ago, we read a list of words to you and you have tried t [Enumerator: check all words mentioned by the respondent]	[ ] None of the above [ ] Refuse to answer
	Questions	**Answer Field**
Adult Reported Child Health	We are now going to ask you some questions about your children's health	
	What is your relation to the children in the household?	1. Mother 2. Father 3. Grandparent 4. Aunt/Uncle 5. Other -888. Refuse to answer
	Please answer questions below about [child_name]	
	In the past 4 weeks, has [child_name] experienced the following. Please check all that applies. [Enumerator: read the questions one by one. Pause after each option and let the respondent indicate yes or not].	1. Headaches 2. Dizziness 3. Increased fatigue 4. Coughing or wheezing 5. Shortness of breath / chest tightness 6. Burning eyes 7. Fever 8. Runny nose 9. Vision impairment 10. Skin rashes 11. Joint pain 12. Numbess or tingling in the hands 13. Stomach Ache or diarrhea 14. Nausea 15. Toothaches 16. Hearing impairment 99. Other 0. None of the above -999. Does not know -888. Refuse to answer
	What other symptoms has [child_name] experienced?	
	During the last 4 weeks, how many days have these health complaints interfered with [child_name]'s school, or daily activities?	
	Compared with [child_name]'s health 3 months ago, would you say that the child's health is now	
	Did [child_name] have any of these diseases or illnesses during his/her childhood. That is, from when he/she was born up to now. Check all that apply: [Enumerator: Read each option one by one, stopping after each option to allow the participant to indicate yes or no.]	`-1. Respondent has not been to a health facility 1. Asthma 2. COVID 3. Pneumonia 4. Chronic pulmonary disease 5. Tuberculosis 6. Hypertension 7. Other lung disease 8. Stroke or cardiovascular disease 9. Memory-related disease 0. None of the above (but the respondent has been to a health facility) -888. Refuse to answer
	What other diseases/illnesses did [child_name] have?	

	b. In the past 4 weeks, has [child_name] seen the doctor / nurse related to his/her health?	1. Yes 0. No -999. Does not know -888. Refuse to answer
	Questions	**Answer Field**
Knowledge	I am going to ask you 6 True / False questions about air pollution. Please answer True or False. If you do not know the answer, please still answer True or False to the best of your knowledge.	Randomly allocate 6
	The smaller the dust particles are, the worse they are for your health.	
	Air pollution can cause respiratory diseases but not heart disease	
	Air pollution can decrease my children's test scores at school.	
	Indoor air is always safer than outdoor air.	
	Green spaces and trees are effective at absorbing all dangerous pollutants	
	Having lots of plants indoors can absorb most dangerous pollutants	
	More than 50% of air pollution in Jakarta comes from dust and forest fires.	
	Vehicles are a major source of air pollution in Jakarta	
	Air conditioners also removes pollutants from indoor air.	
	Non-HEPA air purifiers are the most efficient at removing the most dangerous indoor pollutants	
	Garbage burning is a source of harmful air pollution in Jakarta	
	Exercising outdoor during high air pollution times makes you more immune against outdoor air pollution	
	Questions	**Answer Field**
Blood Press	Please sit on a chair and keep your back straight	Enumerator check: [ ] Subject is sitting on a chair [ ] Subject is leaning against the back of the chair. If the chair does not have a back, the subject is sitting up straight
	Please put your feet flat on the flood and do not cross your legs	Enumerator check: [ ] Feet are flat on the floor [ ] Legs are not crossed
	Please put your left arm on a flat surface. Keep your upper arm at your heart level	Enumerator check: [ ] Subject's arm is supported [ ] Subject's upper arm is at heart level [ ] Subject is using left arm [ ] Subject does NOT have clothes over the bend of the elbow. If subject does not want to take clothes off that cover the bend, leave this unchecked but proceed with the measurement
	Can I wrap the cuff above the bend of your elbow?	
	Please turn your palm upwards and slightly flex your elbow. Now please wait and remain silent for a minute while the blood pressure machien is working. This will ensure that the measurement is accurate.	
	Enter diastolic pressure	Diastolic pressure should be within likely range of 60-100.
	Enter systolic pressure	Systolic pressure should be wtihin likely range of 90-140 and higher than diastolic pressure.
	Take picture of screen	
	Repeat steps above on right arm	
	Repeat steps above one more time, randomly on either right or left arm	
	Questions	**Answer Field**

Blood Oxyg	Please sit on a chair and keep your back straight	Enumerator check: [ ] Subject is sitting on a chair [ ] Subject is leaning against the back of the chair. If the chair does not have a back, the subject is sitting up straight
	Are you hands warm? If they are not warm, please rub your hands until they are warm	
	Please place your right hand below the level of your heart and relax	
	[Enumerator: you will place the clip on the right middle finger. If they have nail polish, choose any finger on the right hand that does not have nail polish. Otherwise, choose finger on left hand]	
	Now I will place the clip on your [X] finger	
	Now I will start the measurement. We will wait until the reading stops changing. Please do not move while the device is measuring.	
	Enter result of measurement	Must be between 20 and 100
	Take picture of screen	
	Questions	**Answer Field**
HH Controls	In order to better understand how different people think about clean air, I will now ask you some questions about your life. We do not want to invade your privacy and want to remind you that all your answers will be kept strictly confidential.	
	[Enumerator: please do NOT ask this question aloud if possible] What is your gender	
	Can you provide your family ID card, and indicate your month and year of birth?	
	What is the highest level of school you attended?	
	In the last month, are you employed?	
	Would you say that your job is:	1. Fully indoor 2. Mostly indoor 3. Mostly outdoor
	What was your household's total food expenditure in the past 4 weeks (in IDR)?	1. < Rp. 200.000 2. Rp. 200.000 - Rp. 599.999 3. Rp. 600.000 - Rp. 999.999 4. Rp. 1.000.000 - Rp. 1.999.999 5. Rp. 2.000.000 - Rp. 2.999.999 6. Rp. 3.000.000 - Rp. 3.999.999 7. > Rp. 4.000.000
	What was your household's total non-food expenditure in the past month? (in IDR)	1. < Rp. 200.000 2. Rp. 200.000 - Rp. 599.999 3. Rp. 600.000 - Rp. 999.999 4. Rp. 1.000.000 - Rp. 1.999.999 5. Rp. 2.000.000 - Rp. 2.999.999 6. Rp. 3.000.000 - Rp. 3.999.999 7. > Rp. 4.000.000
	What was your household's total income n the past month (in IDR)? This includes cash transfers from the government	1. <Rp 1.000.000 2. Rp 1.000.000 - Rp 2.999.999 3. Rp 3.000.000 - Rp 4.999.999 4. Rp 5.000.000-Rp 7.999.999 5. Rp 8.000.000 - Rp 9.999.999 6. Rp 10.000.000 - Rp12.999.999 7. >13.000.000 -999. Does not know
	In the past 7 days, how many times did you see trash being burned in your neighborhood?	
	How often do you experience drops in your WiFi connection?	1. Rarely, once a month or less 2. Several times a month 3. Several times a week 4. Several times a day 5. I do not have WiFi at home -999. Doesn't know
	Questions	**Answer Field**

Stated WTP	Finally, we are going to ask you a few questions about air purifiers. These questions are hypothetical.	
	Hypothetically, would you be willing to lease an air purifier for two months for Rp 150,000? After 2 months, the purifier would be returned to the air quality company.	1. Yes 0. No -999. Does not know -888. Refuse to answer
	Hypothetically, would you be willing to lease an air purifier for two months for Rp 75,000 ? After 2 months, the purifier would be returned to the air quality company.	1. Yes 0. No -999. Does not know -888. Refuse to answer

	Questions	Answer Field
Child's Bloo	Please sit on a chair and keep your back straight	Enumerator check: [ ] Subject is sitting on a chair [ ] Subject is leaning against the back of the chair. If the chair does not have a back, the subject is sitting up straight
	Please put your feet flat on the flood and do not cross your legs	Enumerator check: [ ] Feet are flat on the floor [ ] Legs are not crossed
	Please put your left arm on a flat surface. Keep your upper arm at your heart level	Enumerator check: [ ] Subject's arm is supported [ ] Subject's upper arm is at heart level [ ] Subject is using left arm [ ] Subject does NOT have clothes over the bend of the elbow. If subject does not want to take clothes off that cover the bend, leave this unchecked but proceed with the measurement
	Can I wrap the cuff above the bend of your elbow?	
	Please turn your palm upwards and slightly flex your elbow. Now please wait and remain silent for a minute while the blood pressure machien is working. This will ensure that the measurement is accurate.	
	Enter diastolic pressure	Diastolic pressure should be within likely range of 60-100.
	Enter systolic pressure	Systolic pressure should be wtihin likely range of 90-140 and higher than diastolic pressure.
	Take picture of screen	
	Repeat steps above on right arm	
	Repeat steps above one more time, randomly on either right or left arm	

	Questions	Answer Field
Child's Bloo	Please sit on a chair and keep your back straight	Enumerator check: [ ] Subject is sitting on a chair [ ] Subject is leaning against the back of the chair. If the chair does not have a back, the subject is sitting up straight
	Are you hands warm? If they are not warm, please rub your hands until they are warm	
	Please place your right hand below the level of your heart and relax	
	[Enumerator: you will place the clip on the right middle finger. If they have nail polish, choose any finger on the right hand that does not have nail polish. Otherwise, choose finger on left hand]	
	Now I will place the clip on your [X] finger	
	Now I will start the measurement. We will wait until the reading stops changing. Please do not move while the device is measuring.	
	Enter result of measurement	Must be between 20 and 100
	Take picture of screen	

	Questions	Answer Field
Cognitive Test - Child	We are going to read a list consisting of 10 words and we would like you to memorize as many as you can. We deliberately ma	
	[Enumerator: probe whether respondent needs more explanation] [Enumerator: Read the list slowly, with interval around 2 seconds between each word] MOUNTAIN. STONE. BLOOD. CORNER. SHOES. LETTER. GIRL.HOUSE. VALLEY. CAR	[ ] MOUNTAIN [ ] STONE [ ] BLOOD [ ] CORNER [ ] SHOES [ ] LETTER [ ] GIRL [ ] HOUSE [ ] VALLEY [ ] CAR [ ] None of the above
	[Enumerator: check all words mentioned by the respondent]	[ ] Refuse to answer
	I will read you a number of digits. Afterwards, you repeat them in th	1. Pass 0. Fail
	Let's start with a brief example so you can practice. I will give you th	-888. Refuse to answer
	[Enumerator: did the respondent correctly repeat 7-1-9?]	
	No, you would say 7-1-9. I said 7-1-9, so to say it forwards you would 7-1-9. Now try these numbers. Remember, you are to say them forw	1. Pass 0. Fail -888. Refuse to answer
	[Enumerator: did the respondent correctly repeat 3-4-8?]	
	Ok, now we will start the official exercise. Again, I will give you 3 nun	1. Pass 0. Fail
	[Enumerator: please pause for 1 second in between each number]	-888. Refuse to answer
	5 - 8 - 2	1. Pass 0. Fail
	6 - 9 - 4	-888. Refuse to answer
		1. Pass 0. Fail
	6 - 4 - 3 - 9	-888. Refuse to answer
		1. Pass 0. Fail
	7 - 2 - 8 - 6	-888. Refuse to answer
		1. Pass 0. Fail
	4 - 2 - 7 - 3 - 1	-888. Refuse to answer
		1. Pass 0. Fail
	7 - 5 - 8 - 3 - 6	-888. Refuse to answer
		1. Pass 0. Fail
	6 - 1 - 9 - 4 - 7 - 3	-888. Refuse to answer
		1. Pass 0. Fail
	3 - 9 - 2 - 4 - 8 - 7	-888. Refuse to answer
		1. Pass 0. Fail
	5 - 9 - 1 - 7 - 4 - 2 - 8	-888. Refuse to answer
		1. Pass 0. Fail
	4 - 1 - 7 - 9 - 3 - 8 - 6	-888. Refuse to answer
		1. Pass 0. Fail
	5 - 8 - 1 - 9 - 2 - 6 - 4 - 7	-888. Refuse to answer

	1. Pass 0. Fail
3 - 8 - 2 - 9 - 5 - 1 - 7 - 4	-888. Refuse to answer
	1. Pass 0. Fail
2 - 7 - 5 - 8 - 6 - 2 - 5 - 8 - 4	-888. Refuse to answer
	1. Pass 0. Fail
7 - 1 - 3 - 9 - 4 - 2 - 5 - 6 - 8	-888. Refuse to answer
	1. Pass 0. Fail
2 - 2 - 9 - 8 - 3 - 4 - 5 - 4 - 2 - 1	-888. Refuse to answer
	1. Pass 0. Fail
3 - 1 - 4 - 1 - 2 - 4 - 8 - 9 - 6 - 5	-888. Refuse to answer
We will repeat the exercise from before. I will read you a number of I say 7-1-9, what would you say?	1. Pass 0. Fail -888. Refuse to answer
[Enumerator: did the respondent correctly repeat 9-1-7?]	
No, you would say 9-1-7. I said 7-1-9, so to say it backwards you wou say 9-1-7. Now try these numbers. Remember, you are to say them l	1. Pass 0. Fail -888. Refuse to answer
[Enumerator: did the respondent correctly repeat 8-4-3?]	
Ok, now we will start the official exercise. Again, I will start with 3 nu	1. Pass 0. Fail
6 - 2 - 9	-888. Refuse to answer
	1. Pass 0. Fail
4 - 1 - 5	-888. Refuse to answer
	1. Pass 0. Fail
3 - 2 - 7 - 9	-888. Refuse to answer
	1. Pass 0. Fail
4 - 9 - 6 - 8	-888. Refuse to answer
	1. Pass 0. Fail
1 - 5 - 2 - 8 - 6	-888. Refuse to answer
	1. Pass 0. Fail
6 - 1 - 8 - 4 - 3	-888. Refuse to answer
	1. Pass 0. Fail
5 - 3 - 9 - 4 - 1 - 8	-888. Refuse to answer
	1. Pass 0. Fail
7 - 2 - 4 - 8 - 5 - 6	-888. Refuse to answer
	1. Pass 0. Fail
8 - 1 - 2 - 9 - 3 - 6 - 5	-888. Refuse to answer
	1. Pass 0. Fail
4 - 7 - 3 - 9 - 1 - 2 - 8	-888. Refuse to answer
	1. Pass 0. Fail
9 - 4 - 3 - 7 - 6 - 2 - 5 - 8	-888. Refuse to answer
	1. Pass 0. Fail
7 - 2 - 8 - 1 - 9 - 6 - 5 - 3	-888. Refuse to answer
	1. Pass 0. Fail
8 - 2 - 3 - 7 - 5 - 3 - 9 - 2 - 1	-888. Refuse to answer

1. Pass
0. Fail
-888. Refuse to answer

3 - 7 - 5 - 4 - 9 - 8 - 2 - 6 - 5

Let's try some subtraction of numbers now. What is 100 minus 7 equal to?

and minus 7 from that?

and minus 7 from that?

and minus 7 from that?

and minus 7 from that?

A short while ago, we read a list of words to you and you have tried t
[Enumerator: check all words mentioned by the respondent]

[ ] MOUNTAIN
[ ] STONE
[ ] BLOOD
[ ] CORNER
[ ] SHOES
[ ] LETTER
[ ] GIRL
[ ] HOUSE
[ ] VALLEY
[ ] CAR
[ ] None of the above
[ ] Refuse to answer