Forecasts: Consumption, Production, and Behavioral Responses*

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*Pre-Analysis Plan***
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Abstract

Economic theory predicts that forecasts are an important determinant of welfare. In developing countries, however, agents may have difficulty forming accurate, precise forecasts because of limited information and human capital. This plausibly limits the scope for optimal responses to uncertain future events. We study the effect of two randomized interventions on forecast formation and behavioral responses. The first is the provision of day-ahead air pollution forecasts. The second is training in forecasting techniques aimed at reducing behavioral biases. We estimate impacts on forecast error in air pollution and travel times. Measured responses include willingness to pay for protective face masks and changes in time use. We examine effects on proxies for the variance of utility, which broadly reflects forecasting and responses to uncertainty. Finally we elicit willingness to pay for our forecasts, an important input to cost-benefit analysis of air pollution monitoring.

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Contents

1 Introduction

Economic theory predicts that forecasts are an important determinant of welfare. For example, an agent who relies on biased forecasts may not optimally smooth her consumption over time. An agent who fails to forecast high air pollution may fail to undertake avoidance behavior that she would have chosen in the presence of a high-skill forecast. Such phenomena may be especially common in developing countries. Third-party forecasts may be unavailable or of poor skill for a given agent's location (Rosenzweig and Udry, 2013, 2014). Forecasting mistakes are common even among self-styled experts (Tetlock, 2017). In developing countries, the behavioral biases that lead to these mistakes may be exacerbated by information scarcity (North, 2003; Stiglitz, 2000) and lower levels of human capital (Hanushek, 2013).

We implement a randomized controlled trial to study people in their roles as consumers and producers of forecasts. The research design includes two orthogonal treatments. The first entails provision of day-ahead air pollution forecasts delivered by text message. The second entails in-person training designed to reduce behavioral biases in forecasts. Broadly, we are interested in three types of outcomes: 1) consumption, e.g. demand for our forecast product; 2) production, e.g. error in forecasting the time required for a future journey; and 3) behavioral responses, e.g. demand for particulate-filtering face masks. In theory these two treatments could be complements or substitutes. While our design will allow us to measure this interaction, it is not our primary focus.

Lahore, Pakistan is the setting for this experiment. The city has suffered from very high air pollution, especially in recent years (Riaz and Hamid, 2018) (Zahra-Malik, 2017). There have been some recent efforts to provide air pollution information. The Environmental Protection Department (EPD) of the Punjab provincial government has provided some measurements online, but coverage is incomplete in space and time (Punjab, 2017). According to the government of Pakistan, "Data on air quality in the province is scant. Sporadic monitoring of air pollutants suggests that ambient air standards for particulate matter with size 2.5 micron (PM2.5)...are exceeded frequently" (Punjab, 2017). The US consulate in Lahore has recently begun providing information online, but the relevance of this information for distant residents is unclear. To the best of our knowledge, air pollution forecasts are not readily available, and this is particularly true for residents who do not speak English. Our pilot interviews suggested that this absence of information does not reflect low demand. In response to stated-preference elicitations 55% respondents reported positive willingness to pay for air pollution information. When asked to rank different types of air pollution information, a large majority of respondents put forecasts first, followed by real-time alerts and day-behind measurements.

Our project contributes to several literatures, of which the first is on forecasting in developing countries. Previous work has focused on farmers and forecasting of weather, especially precipitation (Rosenzweig and Udry, 2013, 2014; Kala, 2017). We study urban residents and forecasting of air pollution, which enables us to ask somewhat different research questions. For example, the commonly studied response to precipitation forecasts is the timing of planting. Our

setting allows for study of repeated choices, like time spent outside, where learning is plausibly more important. The forecasts and choices we study command both research and policy interest because of ongoing trends in developing countries. In many developing countries air pollution levels are much higher than in developed countries (Cohen et al., 2005; McGranahan and Murray, 2012). At the same time, rural citizens continue to move to developing cities (Henderson, 2002).

The second relevant literature is on avoidance behavior.[1] There is a substantial empirical literature on avoidance behavior in developed countries. Prominent examples include Neidell (2004), Graff Zivin and Neidell (2009), and Moretti and Neidell (2011). A thorough review, including a brief theoretical foundation, is in Graff Zivin and Neidell (2013). Our study differs in two aspects. First, we provide evidence from the developing world, where preferences may differ, incomes are lower, and the scope for avoidance may differ (e.g. because of available technologies or intra-day patterns in air pollution). Second, this literature largely relies on natural experiments for identification, which limits the questions it can ask. For example, it is common to observe an avoidance behavior, such as a canceled trip to an outdoor zoo, but agents' air pollution expectations are unobserved. To the best of our knowledge ours is the first experimental study in this literature.

Lastly our project speaks to the literature on economic effects of air pollution in developing countries. Previous work has examined mortality and several dimensions of health (Edwards and Langpap, 2012; Chen et al., 2013; Ebenstein et al., 2015; Arceo et al., 2016).[2] A recent literature has estimated effects on labor productivity (Adhvaryu et al., 2019; He et al., 2019; Chang et al., 2019). Hanna and Oliva (2015) study the effect on labor supply using a Mexico City refinery closure as a natural experiment. We broaden this work to study subjects' time allocation for entire 24 hours, including home production and leisure.

This preanalysis plan outlines the theory, hypotheses, data collection, empirical strategies and our field-plan all of which will be used to collect and analyze the results. This field experiment follows a pilot study conducted in a similar area in Lahore sponsored by the Lahore University of Management Sciences (LUMS) and the Abdul Latif Jameel Poverty Action Lab (JPAL). We use results from our pilot study to inform our research design. The remainder of the plan proceeds as follows. Section 2 provides insight into our research design. Section 3 describes our data collection strategy and section 4 provides details about our outcome measures. We use section 5 to describe the empirical analysis that follows data collection and section 6 lays out the experimental challenges that we anticipate.

[1] Some work prefers the term "averting behavior"; we view the two as synonymous.

[2] Other important work in this area includes: Alberini et al. (1997), Cropper et al. (1997), and Jeuland et al. (2015).

1.1 Research Questions

1.1.1 How do people consume forecasts?

1. How much do people value air pollution forecasts?
2. Does forecast training increase or decrease willingness to pay for third-party air pollution forecasts?

1.1.2 How do people produce forecasts?

1. Do people have any appreciable skill in forecasting air pollution, travel time, and their own labor market outcomes?
2. Can a brief forecast training improve forecast ability? If so, how persistent are the improvements?
3. Does exposure to third-party air pollution forecasts improve forecast ability?
4. Is there an interaction effect of third-party forecasts and training on forecast ability?

1.1.3 Behavioral responses

1. Do people engage in more time-use avoidance in response to air pollution forecasts or forecast training?
2. Do people increase demand for avoidance goods, like particulate-filtering masks, in response to air pollution forecasts or forecast training?
3. Are there interaction effects of third-party forecasts and forecast training on avoidance?
4. Does forecast training reduce the variability of income or utility proxies within subject?
5. Are there interaction effects of third-party forecasts and forecast training on the variance of income or utility proxies within subject?

2 Research Design

2.1 Interventions

Following the baseline survey, we buffer for a two week transitionary period after which we implement our treatment to half our respondents randomized into the treatment group. We develop an air pollution information clearinghouse that uses text messages and a forecast model to inform citizens about air pollution forecasts. This involves a system developed by the research team with support from *OpenCodes* that combines a forecast model, a mobile connection and an API based system to treat our respondents with air pollution forecast information on a

daily basis for a period of 3 months. Figure 1 provides a division of our groups. Our project implements two forms of treatment: day-ahead forecast SMS information and forecast training. The SMS messages are delivered over a time period of three months. While the forecast training is implemented one month following the SMS message intervention and is completed over a period of one month.

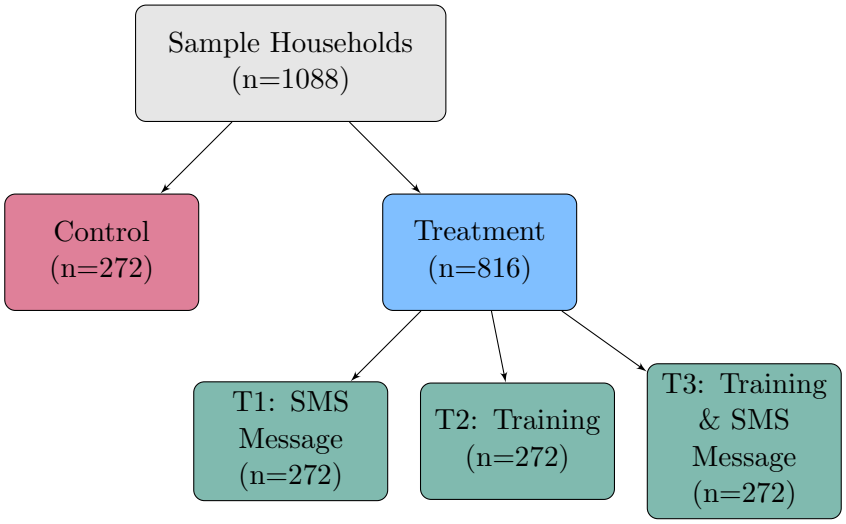


Figure 1: Treatment Groups

2.1.1 Day-ahead Air Pollution Forecasts

2.1.1.1 Forecast Model

We have designed an ensemble model to forecast PM2.5 air pollution for *t+1*. This ensemble model combines individual models:

1. Our own prediction model using air pollution monitors located in Walton
2. Our own prediction model using data from Lahore's US Consulate's AirNow air pollution monitor
3. *t+1* predictions from the MeteoBlue air pollution prediction model
4. *t+1* predictions from the SPRINTARS air pollution prediction model

1. **Our own prediction model using air pollution monitors located in Walton:** This model uses as inputs: average daily PM2.5 readings from one or both of our industry qualified air pollution monitors deployed in Walton and Accu Weather *t+1* forecasts for minimum temperature, maximum temperature, and precipitation in inches. The two monitors are: (i) an AQMesh, and (ii) a Dusttrak II. The AQMesh is located on the roof of a house in central Walton and collects and transmits via GSM air pollution readings continuously. These readings are then accessible via API. The Dusttrak II is a handheld

device that a research assistant uses to manually take readings in Walton 2-3 times per day under a fixed protocol.

We predict *t+1* PM2.5 levels using a simple AR7 model with day of the week fixed effects and weather forecast controls. AR7 was selected through a cross-validation exercise using our data.

2. **Our own prediction model using data from Lahore's US Consulate's AirNow air pollution monitor:**
   This model is identical to that using our own monitors, but it uses data from AirNow[3] from a ground monitor at Lahore's US consulate.

3. ***t+1* predictions from the MeteoBlue air pollution prediction model** This model offers publicly available air pollution forecasts. We access these forecasts at 5pm each day for the following day.

4. ***t+1* predictions from the SPRINTARS air pollution prediction model** This model offers publicly available air pollution forecasts. We access these forecasts at 5pm each day for the following day.

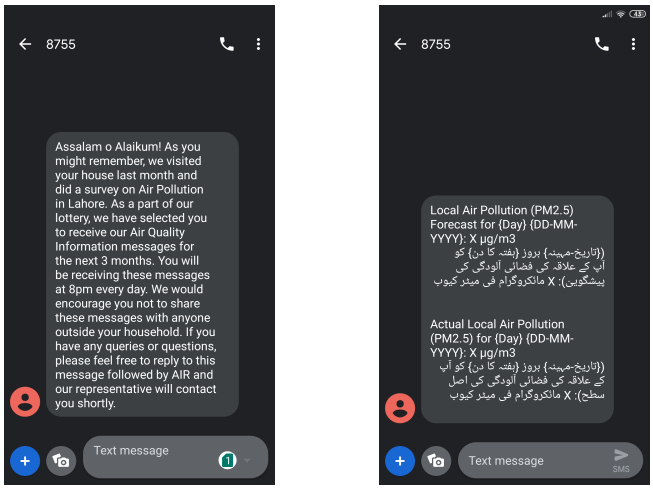
These models are combined through a simple three step process. First, we designate retrospective data from our air pollution monitor(s) as the "groundtruth" and we demean each of the other models (including our own prediction models) according to the true differences between the predictions in these models and the groundtruth over the week prior. Second, we measure the root-mean squared error of each model relative to the groundtruth over the week prior. Third, we take an average of the predictions for *t+1*, inversely weighted by each models root-mean squared error between predictions and truth over the previous week.

2.1.1.2 Forecast Message

We employ an API based SMS messaging service that employs a short-code[4] to send messages to our survey participants in the treatment group. The use of a short-code allows our participants to reply to our forecast messages with a bot and a human in an interactive way. We send our treatment group respondents two sets of information. First, we send them an average PM2.5

[3] `https://airnow.gov/index.cfm?action=airnow.global_summary`

[4] A short code is a 4 digit telephone number that is shorter than a full phone number and is used to send and receive SMS and MMS messages to and from mobile phones. In the local context, short-codes are used to send messages from banks, public institutions, and accredited private organizations. The Pakistan telecommunication authority (PTA) follows a rigourous procedure to obtain access to these numbers. We obtain and use the short-code "8755" to send messages to our survey participants in the treatment groups.



(a) Introductory Message (b) Intervention Message

Figure 2: Sample messages to respondents

air pollution forecast for *t+1*. Secondly, we provide them the actual PM2.5 air pollution level for *t-1*. The text for our forecast message in english and urdu is shown in figure 2 below.

2.1.2 Forecast Training

We implement a one-hour forecast training based on the ideas of Tetlock (2017). In particular we draw on Mellers et al. (2014) and Mauboussin and Callahan (2015), but no material was taken directly from this work. Broadly speaking, the purpose of the training is to reduce behavioral and psychological mistakes that reduce the precision and accuracy of subjects' forecasts. Training takes place in subjects' homes. It is conducted in Urdu[5] by enumerators who have been selected and trained by the research team.

To begin the session, we elicit incentivized forecasts for air pollution and travel time. This allows us to measure within-subject changes over the training session in an incentive-compatible manner. We elicit non-incentivized responses to these same questions over the course of the session in order to estimate the effectiveness of our exercises, before again eliciting incentivized forecasts at the end of the session.

The first exercises subjects complete cover calibration. In the first they provide 80 percent confidence intervals for PM2.5 readings over the five previous days. In the second they answer numerical questions about Pakistani history and culture. (For example, "What is the population of Islamabad?") For each answer, subjects provide a confidence level: the probability that their answer falls within a given range around the truth. In the third calibration exercise, subjects answer true-false general knowledge questions and provide confidence levels for each. In pilot sessions, most subjects make large errors and demonstrate overconfidence, consistent

[5]Urdu is the local language in Lahore, Pakistan.

with evidence from developed country. Taken together, the purpose of the calibration exercises is to show subjects there is room for improvement and open their minds to subsequent lessons.

The next exercises teach subjects to combine "outside" and "inside" views when making a forecast. The former denotes the base rate at which an event occurs in a reference class, e.g. the long-run average level of PM2.5 in Lahore. The latter denotes factors particular to a given forecast task, e.g. subjects' knowledge that air pollution in Lahore is lower on weekends than on weekdays. The exercise teach subjects about choosing a good reference class and avoiding the tendency to give too much weight to the inside view in forecasting.

In the following exercise, subjects are asked to reflect on a previous forecasting task. They are then given the opportunity to change their forecasts. This teaches subjects to slow down and engage "System Two" in the language of Kahneman (2011). Subjects then complete an exercise that encourages them not to round their forecasts excessively. Previous work like Mellers et al. (2014) has found that most subjects round too much; that is, their initial rounded forecast does not incorporate all the information at their disposal.

The next exercise teaches subjects an important heuristic for forecasting time series: they should consider a history at least as long as the time horizon of the forecast task. For example, if they are trying to forecast air pollution in three days, they should consider at least three days of history. The final exercise reminds subjects that people tend to allow their emotions and preferences to influence their forecasts. For example, a person who plans to spend the day outside tomorrow may underrate the chance of rain.

2.2 Project Timelines

The tentative timelines are as follows:

- Design Phase: December 2017-March 2019,
- Baseline Data Collection: April 2019 - May 2019,
- Text Message Intervention: June 2019 to September 2019
- Forecast Training Intervention: July 2019 to August 2019
- Endline Data Collection: September 2019 - October 2019

2.3 Study Site and Sampling Frame

Large cities in Pakistan similar to Lahore are governed by a local government system known as a Metropolitan Corporation, however, the mapping of population to these local bodies happens through a system of grid-based divisions by the Pakistan Bureau of Statistics (PBS). For purposes of the national census, grid-based monitoring and allocating different denominations to different public departments the PBS divides large cities into a uniform set of tehsils, further divided into charges, further divided into circles, and further divided into a final denomination of census blocks. We use this set of denominations as a sampling frame to implement this study

in Lahore for two reasons: (i) we are able to later weight our results using population statistics for external validity, (ii) we can retain the ability to match our dataset with public records.

Lahore is Pakistan's second largest city incorporating 11.1 million citizens and is divided into 8 Sub-Districts (Tehsils) as per PBS (Census, 2017). We use data from the 2011 Multiple Indicator Cluster Survey (MICS) to compare Walton (one of our selected tehsils) to the rest of Lahore on key indicators. The results are shown in table 1[6].

Table 1: Statistical Balance between Individuals in Walton and Rest of Lahore, MICS 2011.

	(1) Rest of Lahore	(2) Walton	(3) (1) vs. (2), p-value
Primary Ed	0.121	0.106	0.041
	(0.002)	(0.007)	
Secondary Ed	0.213	0.198	0.102
	(0.002)	(0.008)	
Higher Ed	0.185	0.270	0.000
	(0.002)	(0.009)	
Age	24.951	25.620	0.104
	(0.113)	(0.407)	
Wealth Index	0.960	1.258	0.000
	(0.005)	(0.014)	
Cough	0.016	0.007	0.001
	(0.001)	(0.002)	
Tuberclosis	0.003	0.004	0.166
	(0.000)	(0.001)	
Child in HH	0.369	0.369	0.980
	(0.003)	(0.010)	
Elders in HH	0.047	0.058	0.013
	(0.001)	(0.005)	
N	26847	2214	

Standard errors in parentheses.

Using data from our pilots and insights from previous surveys we select two tehsils of Lahore for this survey: Walton and Model Town. To draw our sample of 1088 within these tehsils we include only 6 out of the 11 charges of Walton tehsil and 1 charge of Model Town tehsil. The excluded charges include restricted areas of cantonment, high income areas, and a military airbase. We are not allowed to survey in most of these areas apart from the high-income households where we expect the response rates to be very low. The sampling frame for this experiment hence is spread across 7 charges[7], 41 circles and 231 census blocks. A summary of the distribution of population across the two tehsils is given in table 2 and across charges in these selected tehsils is given in table 3. A geographical illustration of the 7 charges in our sample can also be seen in figure 2.

[6]We have not added Model Town as a separate part because the MICS data did not allow us to dissect this tehsil separately from others.

[7]For charge 1 and 6 we drop a particular parts of the charges to exclude high income and restricted areas

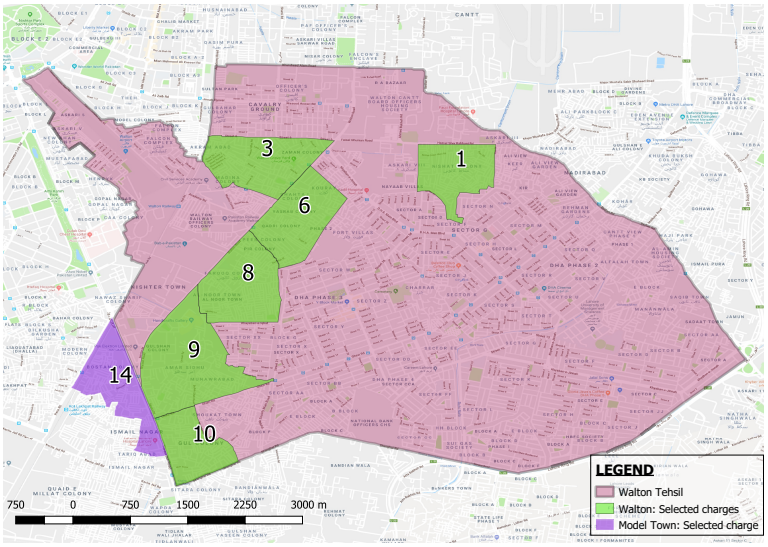
Table 2: Population of the two selected Tehsils, 2017 Census of Pakistan.

	Households	Male	Female	Trangender	All
Lahore District	1,757,691	5,824,131	5,300,931	1,223	11,126,285
Walton Tehsil	117,992	371,375	338,013	78	709,466
Model Town Tehsil	431,856	N/A	N/A	N/A	2,698,235

Table 3: Population of Selected Charges, 2017 Census of Pakistan.

Tehsil	Charge	Households	Individuals	% of tehsil population
Walton	1	9344	59147	8.3
Walton	3	8622	49845	7.0
Walton	6	13154	77267	10.9
Walton	8	12752	77789	11.0
Walton	9	10141	65727	9.3
Walton	10	8347	54310	7.7
Model Town	14	41352	6707	0.2

Figure 3: Sample Tehsil and Charges' Map



2.4 Unit of Analysis

The large majority of analysis will be at the individual subject level. For measures of time-use avoidance behavior collected over the phone, analysis may be conducted at the household level if it proves difficult to reach the baseline respondent every week.

2.5 Power Calculations

We estimate our power to detect changes in our primary outcomes with probability 0.8, assuming a sample of 1088 with a 15 percent attrition rate at endline. Because our two treatments are othogonal, power can be evaluated separately.

For the air pollution forecast treatment, we conduct power calculations using means and standard deviations from a pilot survey of approximately 50 households conducted in a neighborhood near Walton. We do not have a pilot measure of the willingness to pay for particulate-filtering masks nor of proxies for utility variability but do for the other variables. We estimate our power following our planned intent to treat empirical specification and associated hypothesis tests outlined below, with one exception—we do not account for the precision gains from controlling for baseline outcome measures. This is because we do not want to make an assumption about the autocorrelation of these outcomes and would rather be more conservative. We assume an alpha-level of 0.05 divided by the number of variables for which we are testing power (six) as a conservative accounting for our planned multiple hypothesis testing corrections. We find we are powered to detect impacts of 0.191 standard deviations, which translates into the following:

- Willingness to pay for 1 month of additional SMS forecasts (PKR)—we are powered to detect an increase in WTP from 83.33 to 90.68 or larger.
- Air pollution forecast error t+1—we are powered to detect an decrease in absolute forecasting error (the absolute value of the true pollution level minus respondents' forecast in our pilot, in micrograms per meter cubed) from 84.47 to 73.62 or larger.
- Air pollution forecast error t+3—we are powered to detect a decrease in absolute forecasting error from 90.36 to 78.93 or larger.
- Indicator for changed time outside in response to air pollution—we are powered to detect increases from 0.42 (mean from our pilot) to 0.52 or larger.
- Indicator for rescheduled activities in response to air pollution—we are powered to detect increases from 0.41 to 0.51 or larger.
- Indicator for limited outdoor time of children or elderly in response to air pollution—we are powered to detect increses from 0.44 to 0.54 or larger.

While we have conducted focus groups to develop the forecast training treatment, we do not have sufficient data to inform power calculations. Our prior is that our power to detect effects from this treatment will be roughly similar to our power to detect effects from the air pollution forecasts.

2.6 Assignment to Treatment

2.6.1 Primary treatment

Subjects will be blocked or stratified on risk aversion, air pollution forecast MSE (t+1 and t+3), travel time forecast MSE (t+1 and t+3) and willingness to pay for a particulate-filtering mask. These variables will be elicited using incentive-compatible mechanisms as part of the baseline survey. Subjects will also be blocked or stratified on the several self-reported variables: indicators for having rescheduled activities in response to air pollution in the past week, informedness about air pollution, the first principal component of two indicators for households being high risk—the presence of a household member with breathing problems and presence of children in household, presence of elderly people in household—education, gender, age, and a dummy variable for those households for which we were able to verify the phone number they provided at baseline for follow-up phone surveys.

Blocking and randomization will be performed in R using the tools in the *blockTools* package (Moore, 2012), which allows for blocking on a high-dimensional set of covariates and avoids discretizing continuous covariates. For robustness (in terms of block stability) to outliers, multivariate location and spread will be generated using a Minimum Volume Elipsoid (MVE) estimator. Robustness to outliers is important in our setting because pilot surveys have yielded very large forecast errors for some respondents. In computing the MVE, incentive-compatibly elicited baseline outcomes will be weighted twice as heavily as other covariates. While the exact magnitudes of these weights are admittedly *ad hoc,* they make explicit our prior that baseline outcomes should predict endline outcomes better than other covariates. Per the recommendation of Athey and Imbens (2017), blocks will contain at least 8 subjects. Blocking will be performed using the optimal-greedy algorithm implemented in the *block* command. Within each block, *assignment* will be used to randomly assign 2 subjects to each experimental condition.

2.6.2 Secondary treatments

Our experimental design includes a secondary treatment orthogonal to our primary treatment. While this treatment is not the focus of this research, its effects will be estimated. At both baseline and endline, willingness to pay for a particulate-filtering mask will be elicited via a Becker-DeGroot-Marschak mechanism (Becker et al., 1964), with price drawn from a uniform distribution on $[0PKR, 200PKR]$. Conditional on a subject's bid b, receipt of the mask at baseline will be random. The probability of receiving the mask will be $b/200$ for $b \in [0, 200]$ and 1 for $b > 200$. This provides an additional source of exogenous variation. Subjects with $b \leq 200$ can be matched on b and their outcomes can be compared. This is not arbitrary. If masks are experience goods, preferences for them may change over time among individuals who use them. This may, in turn, influence willingness to pay, forecast ability, and other outcomes. Interesting interactions across the primary and secondary treatments are not expected, but will

be reported in the appendix.

3 Data

3.1 Survey Data

3.1.1 Sampling and Subjects

To collect data on our outcome variables and their correlates we survey households/individuals in the area of Walton in Lahore at multiple points in time. The surveys are conducted on electronic tablets using SurveyCTO's Open Data Kit (ODK) server.

For selecting the households at baseline[8] we use the census charge as the primary denomination to slect grids. Following the sampling frame specified in section 2.3 we use 7 charges for our study.

We survey between 140 to 180 households per charge giving a total of 1088 respondents in 7 charges. We use a GIS based system to construct 190 meter by 190 meter grid cells within each charge to draw a $190m^2$ buffer by selecting up to 19[9] survey points within each charge. Our grid buffer ensures that each point is at least 190 meters away from each other. Using the grid as a buffer we draw 128[10] random GPS points across the entire sampling frame of 7 charges. An illustration of these points can be seen in figure 3.

To select households within a charge, we drop a survey point at a random point within each charge boundary. A pair of enumarators[11] proceeds to the dropped survey location, selects the nearest household to the left for the first survey, then selects nine other households on the survey point using the left hand rule, selecting the 5th household to the right of the last household included in the sample. A surveyor is tasked with surveying 5 male and 5 female households at each survey point making a total of 10 respondents at each survey point. We survey 5 male and 5 female households to remain representative of the gender distribution among our population in table 2. A household is excluded from the sample if the dwelling is locked/empty, if all members of the household are below 18 or above 60 years of age[12], if the members of the household are not willing to subscribe to our SMS service or the household refuses to respond or participate in the study. In any of these situations, the enumerator skips the current dwelling and the next closest neighbor will be selected to be asked to participate. However, the original pattern will

[8]The first survey for our panel study in which we implement our selection strategy for our households as well.

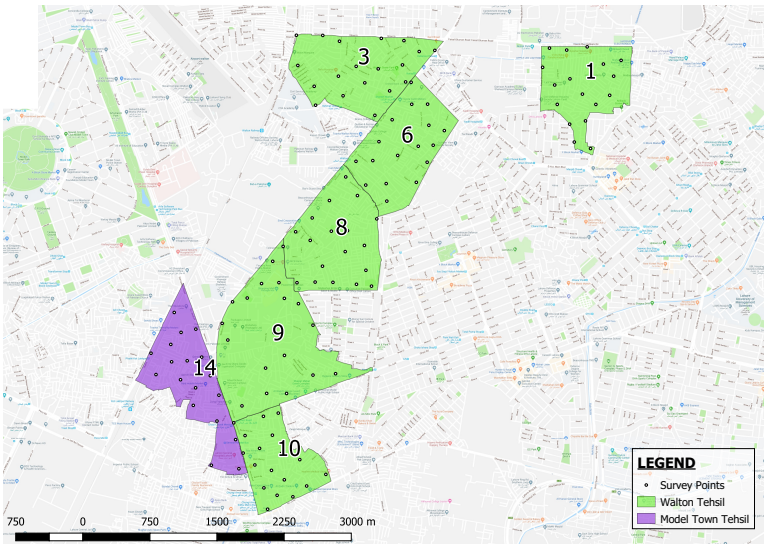
[9]The enumerators use in between 14 to 18 points for each charges; they exclude the points that are not in residential areas.

[10]110 GPS points were original points, and the 18 points were drawn separately for replacement using the same method

[11]We form a pair of enumerators(surveyors) to be one male enumerator and one female enumerator. For logistical and cultural reasons, we restrict the male enumerators to only survey male subjects and female enumerators to survey only female subjects.

[12]We restrict our sample to individuals who are old enough to understand our interventions

Figure 4: Sample points' map for selected charges



continue from the original selection. To classify each household as a female or a male household, we draw a random list *ex-ante* which classifies the order of the household to be either male or female households.

Within the household, respondents are selected by listing all members in the household with their household status. After the listing is complete, a random number generator programmed in the survey tablet randomly selects the member in the household using a three step process: (i) first restrict our within household sample to our eligible population[13], (ii) generate a random number for each eligible member and pre-select members who are either hosuehold heads or spouses of household heads (we randlomly select from the remaining members in the household if neither household head or their spouse is available), (iii) use the random numbers generated in (ii) to select *'x'* household member, and the enumerator asks to speak with the *'x'*th listed eligible individual to conduct a baseline survey, conditional on oral consent.

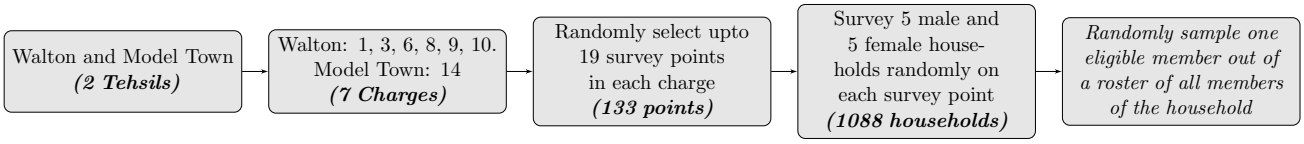


Figure 5: Sampling flowchart

Surveyors reach these points using maps of the sample charge with points ranging from 1 to 16. The surveyor carries a pre-randomzied list which allows him/her to begin the survey at his given survey point and select the nearest house on the left and then selecting every tenth

[13]The eligibility citeria depends upon the following conditions: (i) Between the ages of 18 and 60, (ii) Willing to receive our SMS messages and our treatment.

household until he/she completes 8 households proceeding in a clockwise spiral fashion from the first house to cover the entire grid.

Within each household the enumerator uses a random number generator in SurveyCTO to randomly select 1 respondant in the household. The respondant is selected from a subset roster of household heads and their spouses between the ages of 18 and 60. The male and female are weighed to be selected on the population weights of the charges to make the sample representative for both genders at the charge level. This is done to ensure that the results are gender representative and we only survey respondants with household decision making authority.

3.1.2 Core Modules for the Baseline Survey

1. Demographics
2. Information and Trust
3. Willingness to pay sessions
4. Forecast Elicitation
5. Attitudes and Behaviour towards Air Pollution
6. Time Use of the respondent
7. Risk Aversion elicitation

3.1.3 Survey Frequency

We construct a panel dataset which collects data from our respondents using in-person and telephone based surveys. We use SurveyCTO's ODK based server to collect all our primary data. The frequency of the surveys can be indicated in figure 5. We collect data at three different stages of the project:

1. **In-person surveys:**
   The study starts and ends with similar baseline and endline in-person survey to all the resondents in our study.
2. **Telephone surveys:**
   Following a one week transitionary period from the start of our SMS intervention, we survey all our respondents on a weekly basis using telephone calls. To do this, we draw a random order of respondents at the beggining of the first week and survey the respondents in the same random order every week[14] to avoid day of the week fixed effects. We reach out to every respondent at two significantly spaced out timings in a particular day and on $t + 1$, if in all three attempts of reaching, the respondent does not respond to the phone call, we consider that particular respondent attrited for that particular telephone survey round. Using the results from our pilot we found the response rate of our telephone surveys

[14]This to allow each respondent a gap of 1 week between two telephone surveys

to be 72% for the first week and we expect this rate to diminish in the following weeks. We end the process of weekly data collection one week post the completion of our endline survey.

3. **Treatment Survey**:
   For all individuals in the forecast training treatment group (treatment 2 & 3) we conduct an in-person training session which allows us to collect data on the correlates of our treatment and air pollution forecast outcomes mentioned in section 4.1.2. We use this data to add another round only for treatment groups 2 & 3 in our panel survey.

3.2 Secondary Data

3.2.1 Air Pollution Data

1. **AQMesh and Dusttrak II:**
   We use two industry qualified monitors: (i) the AQMesh[15], and (ii) the Dusttrak II[16]. The AQMesh is located on the roof of a house in central Walton and collects and has been transmitting air pollution readings via GSM continuously since January 2018. These readings are accessible via API. The Dusttrak II is a handheld device that a research assistant uses to manually take readings in Walton 2-3 times per day. We have been collecting air pollution data for over a year prior to beginning this study and will continue to collect air pollution during this study.
2. **AirNow International:** U.S. EPA's AirNow program is a repository of real time air quality data and forecasts for the United States. AirNow International is an international version of the U.S. based air quality data management and display system. It provides hourly data on $PM_{2.5}$ levels. We collect this data on a regular basis from the AirNow website[17]
3. **MeteoBlue:** Meteoblue[18] uses nonhydrostatic mesoscale weather models and multi-scale weather models, which we operate at resolutions between 30 km and 3 km. For air quality data, meteoblue makes use of forecast data from the European Commission and the ECMWF (European Centre for Medium-Range Weather Forecasts) [19]. Meteoblue uses these third-party data to source its predictions and issues them from an atmospheric model with 12 km resolution. We update these predictions everyday at UTC 06:00, 10:00, 12:00 and 18:00 to include them in our secondary data.

[15]The AQMesh is a small-sensor air quality monitoring system for measuring outdoor and indoor air quality. Details on our product can be found here`https://www.aqmesh.com/product/`

[16]The Dusttrak-II is handheld aerosol monitor which is powered by a battery.. Detailed information for the device can be found here: `https://www.tsi.com/dusttrak-ii-aerosol-monitor-8532/`

[17]`https://airnow.gov/index.cfm?action=airnow.global_summary`

[18]`https://content.meteoblue.com/en/content/view/full/4287`

[19]`https://www.ecmwf.int/en/forecasts`

4. **SPRINTARS:** Spectral Radiation-Transport Model for Aerosol Species (SPRINTARS)[20] is a numerical models which estimates using simulations the effect of aerosols on the climatic system and its constribution to global air quality. It has been primarily developed by the Climate Change Science Section at the Research Institute for Applied Mechanics, Kyushu University in Fukuoka, Japan. SPRINTARS uses aerosols from both natural and anthropogenic sources to estimate categories for SPM, PM_{10} and $PM_{2.5}$. We use the forecasts generated from this model in our secondary data on air quality forecasts.
5. **Environment Protection Department**[21] (EPD): We collect data from the local environmental protection department's data. This data is comprised of two different indices: (i) $PM_{2.5}$ levels. (ii) AQI (Air Quality Index). Both of these indices are updated on the EPD's website but not regularly. We use this data not for our forecast model but for robustness checks. website[22]

3.2.2 Weather Data

1. Accu Weather: We scrape on a daily basis weather forecast data from accuweather[23] for the city of Lahore, Pakistan everyday on temperature levels, precipation levels and general cloudcover.

3.2.3 Traffic Data

1. Google Maps: We employ a research assistant to regularly collect data from Google Maps for a month before the baseline and during the baseline. Since google maps does not allow data scraping, we do this through a manual process.

4 Outcomes

4.1 Primary outcomes

To improve statistical power, some primary outcomes will be aggregated into indices, as described below. Relevant baseline section and question numbers are given below. Relevant endline section and question numbers will be added when available.

4.1.1 Willingness to pay for forecast information

This is our primary outcome in the domain of forecast consumption. It will be elicited from all subjects at endline using a BDM mechanism.

[20] https://sprintars.riam.kyushu-u.ac.jp/forecast.html
[21] A public department operating under the provincial government of Punjab, Pakistan.
[22] https://epd.punjab.gov.pk/
[23] https://www.accuweather.com/en/pk/lahore/260622/daily-weather-forecast/260622

4.1.2 Air pollution forecast error index

This is our primary outcome in the domain of forecast production. The following forecast variables will be compared to realized air pollution to compute forecast errors.

- Air pollution forecast t+1 (baseline section 6f, question 3)
- Air pollution forecast t+3 (baseline section 6f, question 7)

These errors will then be aggregated into an air pollution forecast error index.

4.1.3 Willingness to pay for masks

This outcome and following outcomes are primary in the domain of behavioral responses. WTP for masks is elicited by a BDM mechanism at baseline (section 5, question 1) and endline.

4.1.4 Time-use avoidance index

The following variables will be aggregated into a time-use avoidance index:

- "In the past week, I reduced the number of hours I spent on non-work outdoor activities in response to poor air quality" (section 7, question 15)
- "In the past week, I reduced the number of hours I worked significantly in response to poor air quality" (section 7, question 16)
- "In the past week, I have rescheduled activities across days in response to poor air quality" (section 7, question 17)

4.1.5 Proxies for utility variability index

The following variables will be aggregated into an index of proxies for utility variability:

- Concerns about confidentiality and tax enforcement make asking about income or expenditures inadvisable in our setting. Instead we elicit income variability directly using the following question: "How variable has your level of income been over the past month?" (section 8, subsection H, question 2)
- Theory suggests that improved forecasts enable agents to better smooth utility over time, increasing aggregate utility over multiple time periods. Naturally we cannot measure this directly, but as a proxy we ask agents about variability of subjective happiness at both baseline and endline. The question is, "How variable has your level of happiness been over the past month?" (section 7, subsection h, question 1).

- We also ask about variability of expenditure in our weekly phone calls: "How variable has your level of expenditure in the past 7 days been compared to your level of expenditure in the 7 days before that?" When creating an index with our baseline and endline questions, we will first average across responses to this question and then create the index.

4.2 Secondary outcomes

4.2.1 Travel time forecast error

At both baseline and endline, subjects are shown a map with two marked locations, A and B. Based on our pilot surveys, nearly all residents of Walton are familiar with these locations. Subjects are then asked to forecast the minimum time for a trip on a motorbike from A to B at a given time the next day. At baseline the forecast task is from Koray Stop in Walton to Daewoo Station in Thokar, at 7PM tomorrow. Forecasts are recorded in section 6, question 1. Subjects are told they will receive 250PKR if their forecast is within 2.5 minutes and 100PKR if their guess is within 5 minutes of Google Maps' real-time estimate, recorded the next day by our research team. To prevent subjects drawing on Google Maps or other third-party forecasts just before the endline survey, points A and B and the time of day will be different for the endline forecast.

4.2.2 Labor supply forecast error

In weekly telephone surveys, subjects will be asked how many hours they worked in the past seven days, and how many hours they forecast working in the next seven days. Forecast errors will be computed based on these questions. Forecasts will not be incentivized, as we have no way to independently observe labor supply. This outcome enables us to test forecasting ability in a domain that has traditionally been more central to economic research.

4.2.3 Expenditure

At endline, subjects will be asked to forecast their expenditures for the next seven days. This forecast will not be incentivized. One week later they will be asked to report household expenditures for this period. This allows us to look at forecasting performance for another important economic outcome. More importantly, we can compare the variance of expenditure across treatment and control groups. This will provide evidence on whether improved forecast ability leads to more expenditure smoothing.

4.2.4 Calibration

In the course of the experiment, subjects will make a variety of forecasts. In most cases they will be asked for a level of confidence that their prediction is within a given range around the truth. For any single prediction this confidence level is not very informative. But we can compare

success rates (the share of predictions within the given range) to average confidence at the level of a treatment or control group. This will enable us to evaluate whether either treatment improves calibration. For example, a group with average 65 percent confidence should make successful predictions 65 percent of the time.

4.2.5 Weather forecast takeup

We have a strong prior that weather forecasts are a useful input to pollution forecasting. For example, rainfall and high wind speeds typically predict lower particulate air pollution. As part of the baseline survey, subjects are offered the opportunity to view a weather forecast before making an air pollution forecast (section 6f, question 1). There is no associated cost. This provides a test of whether subjects understand the usefulness of this forecast input.

4.2.6 Telephone survey outcomes

We will survey each subject once per week by telephone. In pilot work we have found it can be difficult to reach a subject, and this may lead to reduced sample sizes. For this reason, we put the outcomes collected by telephone in the secondary class, with the exception of the question about expenditure variability discussed in the primary outcomes above.

On each call, first we will ask subjects to report time spent outdoors on the previous day for the following individuals: themselves, the youngest physically active child in the household, and the oldest physically active adult in the household. We inquire about the latter two individuals because a large literature in environmental economics and epidemiology has found health effects of air pollution are more acute for the very young and the very old. If subjects are aware of this, outdoor time for the young and old may be an important margin of response. In order to reduce experimenter demand effects, air pollution will not be mentioned on the calls prior to these questions. Only after eliciting outdoor time will we ask subjects, "Are there any outdoor activities you planned to do yesterday that you decided to cancel or reschedule?" Note that this question does not explicitly mention air pollution, again to reduce experimenter demand effects.

Lastly we will ask subjects, "At any point yesterday did you wear a mask?" Those that respond affirmatively will be asked to report the number of hours the mask was worn.

4.2.7 Time diaries

In both baseline and endline surveys, we elicit 24-hour time diaries covering the period up to 8AM on the survey date. (In the baseline survey, see section 7, questions h1-h24.) For each one-hour period subjects may select multiple options from the following list: Sleep Inside, Sleep Outside, Paid indoor work, Paid outdoor work, Home indoor work, Home outdoor work, Indoor Leisure, Outdoor Leisure, Travel, Other Indoor, Other Outdoor, Refuse to answer. In analysis, when subjects make multiple selections for a given hour, time will be assumed uniformly allocated over selections. For example, if a subject selects "Paid outdoor work" and "Outdoor

leisure" from 4-5PM, we will assume 30 minutes devoted to each activity. This format balances the accuracy gains from the diary format against the need to keep the survey short. Because we observe whether a subject is indoors or outdoors throughout the day, these diaries provide an alternative measure of time-use avoidance that is potentially less subject to experimenter demand concerns. This is not our preferred measure of time-use avoidance, however, because it covers only a day, rather than a week. If endline surveys happen to coincide with a period of low air pollution, there may be little reason for treatment or control subjects to change their time allocations.

4.2.8 Children's avoidance

At both baseline (section 7, question 31) and endline, subjects are asked, "In the past week, have you restricted your children from going outside in response to poor air quality?" Our prior is that responses to this question may be influenced by experimenter demand. To get a sense of whether such effects are present, we will also analyze responses to the question, "In the past week, have you restricted your children from going outside in response to any other reasons?"

4.3 Control variables

4.3.1 Baseline Elicitations

Where available, baseline outcome measures will be used as control variables. For primary outcomes these include: the air pollution forecast error index, willingness to pay for a mask (section 5, question 1), the time use avoidance index, and the index of proxies for the variance of utility. For secondary outcomes these include: travel time forecast error (section 6, question 1), weather forecast takeup (section 6f, question 1), time spent outside (from the baseline diary), and children's avoidance (section 7, question 31).

4.3.2 Risk Aversion

There is a well-established theoretical and empirical link between risk aversion and health-related choices under uncertainty (e.g risk aversion and health insurance). Given that evidence, we expect risk aversion will be an important determinant of willingness to pay for air pollution information and avoidance behavior. Therefore as part of our baseline we elicit the respondent's preferences over risk.

As part of the baseline survey, we elicit both an ordinal (non-incentivized) measure of risk and conduct an incentivized lottery game. While there is evidence that non-incentivized ordinal measures of general risk attitudes are highly correlated with incentivized measures (Dohmen et al., 2011; Friedman, 1974), the relatively low cost of incentivizing our risk measure in Pakistan allows us to use both methods. As part of the section on risk attitudes, we first ask respondents

if they see themselves as someone who takes risk or evades them in the health domain (section 8, question 1).

We then play an incentivized lottery game, in which subjects are offered the choice between a lottery or a sure payment 5 times. In each question the subject is offered the same lottery (a 50-50 chance of getting PKR 150 or PKR 0), but different sure payments, with the sure payment starting at PKR 0 in the first question and increasing by increments of PKR 30. Subjects are informed at the start of the game that payment will be made based on the choice they make for a single round, which will be chosen at random. At the end of five rounds the respondent chooses one of five colors, presented on the surveyors tablet, and a round is selected based on the randomly selected number behind the color. Payments are made in cash at the completion of the section. A minor deviation from the standard process for such games was made based on behavior in the pilot. In the pilot, we found multiple switching across rounds. Discussions with enumerators suggested this was due to low mathematical literacy and inability to understand underlying probabilities. To counter this, we pre-selected the rational choices for the first and last questions to the lottery and sure payment respectively.

4.3.3 Accuracy Rating for Forecasts

In our telephone surveys, subjects receiving our air pollution forecasts will be asked to assess the accuracy of those forecasts. This variable will be employed in analysis of treatment heterogeneity.

4.3.4 Expectations

In our telephone surveys, all subjects will be asked for a forecast of the next day's air pollution on a discrete scale (e.g. "Average", "Somewhat above average"). Based on these forecasts, we will construct a measure of how surprising our forecast should be. This measure of surprise will be employed in analysis of treatment heterogeneity.

4.3.5 Other variables for analysis of heterogeneity

Some demographic variables will be used in analysis of treatment effect heterogeneity. These include: the presence of a household member with a respiratory condition (section 7, question 1), responsibility for one or more elderly (demographic section, question 3), responsibility for one or more children (demographic section, question 5), education (demographic section, question 7), gender (section 2, question 2) and age (section 2, question 3). As part of our baseline survey, we implement a practice BDM auction for a piece of candy and ask comprehension questions afterward (section 4.1). These questions provide a reasonable proxy for numeracy and will also be used in analysis of heterogeneity. Section 3 poses questions on subjects' knowledge of air pollution, while section 7 poses questions on subjects' concern about air pollution.

5 Empirical Analysis

5.1 Balancing Checks

Let Z_F denote treatment with forecasts, Z_T treatment with training, and $Z_{FT} = Z_F * Z_T$ treatment with both interventions. Let $\boldsymbol{Z}$ be a vector with one element representing each treatment condition. Let W denote covariates employed for blocking or stratification, and X covariates not so employed. For each group of covariates a standard balance table will be reported, including means for the three treatment conditions, differences relative to the control condition, and t-tests of the null hypothesis of zero difference. The table for W is merely a check on whether blocking and stratification were conducted properly, so it will appear in the appendix. The table for X is potentially more interesting and will appear in the body of the paper. Should one of the t tests for a covariate in X reveal imbalance, that covariate will be used as a control in all regression analyses. Appendix tables will show models that interact imbalanced covariates with treatment.

In addition, regressions of the following form will be estimated using Z_F, Z_T, and Z_{FT} as the dependent variable;

$$Z_i = \boldsymbol{X_i^{'}\eta_1} + \boldsymbol{W_i^{'}\eta_2} + \epsilon_i$$

. The F statistics for these regressions will be reported, and the associated p-value will be obtained by randomization inference.

Attritors will also be evaluated for balance. First, attrition rates will be reported for all four experimental conditions. The difference between these rates will not be formally tested, as rejecting the null hypothesis of zero difference does not necessarily imply bias in our estimators. Second, attritors and non-attritors will be compared on observables. Let A be an attrition dummy. The following regression will be estimated;

$$A_i = \boldsymbol{Z_i^{'}\kappa_1} + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{X_i^{'}\kappa_{a2}} + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{W_i^{'}\kappa_{a3}} + \boldsymbol{X_i^{'}\kappa_4} + \boldsymbol{W_i^{'}\kappa_5} + \omega_i$$

. Again the F statistic for this regression will be reported, and the associated p-value will be obtained by randomization inference. This will test whether attritors and non-attritors differ on observables, including treatment. Lee bounds for estimated effects on primary outcomes will appear in the appendix.

5.2 Treatment Effects

The estimation strategy for primary outcomes is given explicitly below. The strategy for some secondary outcomes is given explicitly, but for others we will proceed by analogy with the primary outcomes.

5.2.1 Intent to Treat

An effect will be estimated between subjects for the following outcome(s): willingness to pay for 1 month of SMS forecasts. The estimating equation will be as follows;

$$Y_i = \alpha + \boldsymbol{Z_i'}\boldsymbol{\beta} + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_i$$

. The vector $\boldsymbol{X_i}$ will include block indicators and indicators for survey dates during the endline wave. Results with heteroskedasticity-robust asymptotic SEs will appear in the appendix, both with and without time-varying controls. We are most interested in whether willingness to pay is positive for subjects exposed to our SMS forecasts. This is arguably the policy-relevant quantity. If a government begins providing air quality forecasts, then in the long run most constituents will be exposed, and so it is post-exposure willingness to pay that should enter a long-run cost-benefit analysis. The corresponding hypothesis test is one-tailed: $\alpha + \beta_F > 0$. This is the test that will be included in our multiple testing correction procedure. The hypotheses that willingness to pay among control subjects is positive ($\alpha > 0$), that training affects willingness to pay ($\beta_T \neq 0$), and that the treatments interact ($\beta_{FT} \neq 0$), are interesting but secondary.
Effects will be estimated within subject for the following primary outcomes: willingness to pay for a particulate-filtering mask, the air pollution forecast error index, the index of proxies for utility variance, and the time-use avoidance index. The estimating equation will be as follows;

$$Y_i = \boldsymbol{Z_i'}\boldsymbol{\beta} + \gamma Y_{0i} + \boldsymbol{X_i'}\boldsymbol{\delta} + \varepsilon_i$$

. In this equation i indexes subject. Y is the outcome and Y_0 is the corresponding baseline variable. $\boldsymbol{Z}$ is the vector of three treatment dummies Z_F, Z_T, and Z_{FT}, with each equal to 1 for subjects randomized into a given treatment and 0 otherwise. $\boldsymbol{X}$ is a vector of controls, which may be chosen using a procedure such as LASSO. Results will be reported with this vector empty, save for the constant term.[24] Observations will be weighted to reflect block sizes and treatment probability as in Gerber and Green (2012). Hypothesis testing on $\hat{\boldsymbol{\beta}}$ will vary by outcome. For willingness to pay for a particulate-filtering mask, theory predicts that elements of $\boldsymbol{\beta}$ may have either sign, depending on whether information and training are substitutes for, or complements with, masks. The tests will be two-tailed. For the air pollution forecast error index, theory predicts that more information and better forecast training should both weakly improve forecast quality. The tests will be one-tailed, against the alternatives $\beta_F < 0$, $\beta_T < 0$, and $\beta_{FT} < 0$. Theory predicts that both treatments should improve subjects' ability to smooth utility over time, so tests in the model of the index of proxies for utility variance will be one-tailed ($\beta_F < 0$, $\beta_T < 0$, and $\beta_{FT} < 0$). Finally we expect both treatments to increase avoidance, but have no strong prior on their interaction, so tests will be against the following alternatives: $\beta_F > 0$, $\beta_T > 0$, and $\beta_{FT} \neq 0$.

[24] All treatment regressions will include a constant term, but we omit it from most equations in this document in the interest of clarity.

Theory predicts that the sign of the ITT effects may vary, both within and across subjects, because of differences in expectations. We discuss this important heterogeneity in Section 5.3 below.

For the time-use questions in our telephone surveys, dynamic effects may be present and there are multiple ways to estimate them. Several will be reported, either in the primary tables or the appendix. One possibility is to estimate a separate effect for each date on which a telephone survey is conducted. The estimating equation will be as follows.

$$Y_{id} = \boldsymbol{\alpha_i} + \boldsymbol{\delta_d} + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{\beta_{ad}} + \boldsymbol{X_{id}^{'}\gamma} + \varepsilon_{id}$$

The vectors $\boldsymbol{\beta_{ad}}$ are the estimands of interest; each one contains a separate parameter for each date. This is the most flexible way to model dynamic effects, but may suffer from poor statistical power. Regressions will also be estimated pooling these outcomes at the week and month level. Finally a regression will be estimated in which ITT effects are assumed to evolve linearly over dates.

5.2.2 Treatment on the Treated

For the training arm ($Z_T = 1$) we will observe participation in the training session ($P_T = 1$). For the forecast arm ($Z_F = 1$) takeup means looking at our SMS forecast. This will not be observable to us. Moreover it will plausibly vary, both across individuals and within individual over time. We will construct a takeup measure using telephone survey responses to the question "How many times in the last week have you seen our pollution forecast message?" (This question will be asked only of subjects assigned to the forecast treatment.) Denote the response of subject i on date d as R_i. Subjects who respond "not sure" will be assigned $R_i = 0$. Then a subject's takeup for that week is defined as $P_{Fid} = \frac{1}{7}R_i$. The subject's aggregate takeup is $P_{Fi} = \frac{1}{D_i}\sum_{d=1}^{D_i} P_{Fid}$, where D_i is the total number of telephone survey responses for individual i. This variable will range from zero to one, and can be interpreted as the fraction of forecasts taken up. While P_{Fi} will be measured with error, in expectation this error has zero covariance with our random treatment assignment $\boldsymbol{Z_i}$. For subjects in the arm assigned to both treatments $P_{FT} = P_F P_T$. Let the vector $\boldsymbol{P}$ contain all three takeup variables.

TOT effects will be estimated using 2SLS, with $\boldsymbol{Z}$ instrumenting for P_T and P_F. In particular, the second-stage specification for within-subject analyses will be as follows.

$$Y_i = \alpha + \widehat{\boldsymbol{P_i^{'}}}\boldsymbol{\beta} + \gamma Y_{0i} + \boldsymbol{X_i^{'}\delta} + \varepsilon_i$$

In this equation i indexes subject. Y is the outcome and Y_0 is the corresponding baseline variable. $\widehat{P_T}$ and $\widehat{P_F}$ are instrumented takeup. Other controls and hypothesis testing will be as in the ITT regressions. The first-stage specifications will be as follows.

$$P_{Ti} = \eta_T + \boldsymbol{Z_i'}\boldsymbol{\phi_T} + \nu_T Y_{0i} + \boldsymbol{X_i'}\boldsymbol{\theta_T} + \upsilon_{Ti}$$

$$P_{Fi} = \eta_F + \boldsymbol{Z_i'}\boldsymbol{\phi_F} + \nu_F Y_{0i} + \boldsymbol{X_i'}\boldsymbol{\theta_F} + \upsilon_{Fi}$$

$$P_{FTi} = \eta_{FT} + \boldsymbol{Z_i'}\boldsymbol{\phi_{FT}} + \nu_{FT} Y_{0i} + \boldsymbol{X_i'}\boldsymbol{\theta_{FT}} + \upsilon_{FTi}$$

Controls will naturally be identical in both the first- and second-stage regressions.

The high-frequency avoidance measurements again require a different approach. The second- and first-stage specifications will be as follows. In contrast to the immediately preceding specifications, they include individual fixed effects $\boldsymbol{\alpha_i}$ and date fixed effects $\boldsymbol{\delta_d}$.

$$Y_{id} = \boldsymbol{\alpha_2 i} + \boldsymbol{\delta_{2d}} + \widehat{\boldsymbol{P_i'}}\boldsymbol{\beta} + \boldsymbol{X_{id}'}\boldsymbol{\gamma} + \varepsilon_{id}$$

$$P_{Tid} = \boldsymbol{\alpha_{1Ti}} + \boldsymbol{\delta_{1Td}} + \boldsymbol{Z_i'}\boldsymbol{\phi_T} + \boldsymbol{X_{id}'}\boldsymbol{\theta_T} + \upsilon_{Tid}$$

$$P_{Fid} = \boldsymbol{\alpha_{1Fi}} + \boldsymbol{\delta_{1Fd}} + \boldsymbol{Z_i'}\boldsymbol{\phi_F} + \boldsymbol{X_{id}'}\boldsymbol{\theta_F} + \upsilon_{Fid}$$

$$P_{FTid} = \boldsymbol{\alpha_{1FTi}} + \boldsymbol{\delta_{1FTd}} + \boldsymbol{Z_i'}\boldsymbol{\phi_{FT}} + \boldsymbol{X_{id}'}\boldsymbol{\theta_{FT}} + \upsilon_{FTid}$$

Effects will also be estimated by collapsing the data to the subject level and employing the same 2SLS specifications as for other outcomes.

Effects will be estimated between subjects for the following outcomes: willingness to pay for 1 month of SMS forecasts (PKR). The first- and second-stage estimating equations will be as follows.

$$Y_i = \alpha + \widehat{\boldsymbol{P_i'}}\boldsymbol{\beta} + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_i$$

$$P_{Ti} = \eta_T + \boldsymbol{Z_i'}\boldsymbol{\phi_T} + \boldsymbol{X_i'}\boldsymbol{\theta_T} + \upsilon_{Ti}$$

$$P_{Fi} = \eta_F + \boldsymbol{Z_i'}\boldsymbol{\phi_F} + \boldsymbol{X_i'}\boldsymbol{\theta_F} + \upsilon_{Fi}$$

$$P_{FTi} = \eta_{FT} + \boldsymbol{Z_i'}\boldsymbol{\phi_{FT}} + \boldsymbol{X_i'}\boldsymbol{\theta_{FT}} + \upsilon_{FTi}$$

One- and two-tailed hypothesis tests for primary outcomes will be analogous to those in our ITT regressions.

In addition, a variant of the between-subjects TOT specification will be used to estimate the effect of baseline mask takeup on all endline outcomes. The instrument Z_M will be the randomly drawn BDM price, the treatment P_M will be mask takeup, and the control set $\boldsymbol{X}$ will include a set of dummies for subjects' BDM bids. If possible exhaustive bid dummies will be used, but bids may be pooled within an interval up to 20PKR to improve statistical power. These estimated mask treatment effects are of secondary interest. They will not be included in corrections for multiple hypothesis testing.

5.3 Heterogeneous Effects

Theory predicts several important dimensions of heterogeneity: 1) risk aversion; 2) perceived forecast quality; and 3) expectations. First, Rosenzweig and Udry (2013) point out that forecasts serve an insurance function in that they allow agents to take costly variance-reducing action before uncertainty is resolved. A model of this type predicts that more risk-averse agents may respond differently to forecast provision than less risk-averse agents. Second, treated subjects who perceive the forecasts to be low-quality will likely respond less than subjects who perceive them to be high quality. Third, treatment effects may vary both within and across subjects because of differences in expectations. For example, receiving a forecast of high pollution may increase avoidance for a subject with low expectations but decrease it for a subject with high expectations.

Several other dimensions of heterogeneity have an *ex ante* foundation, but are not the focus of our study and results will be reported in the appendix. Subjects who are the primary carriers of a single household cell phone may be more exposed to our SMS forecasts and so exhibit larger responses. Subjects with higher baseline concern about air pollution may respond more to treatment. The interaction of treatment with baseline knowledge of air pollution is not obvious. Highly informed subjects may respond less if there are ceiling effects on avoidance, but if such effects are absent they may respond more. A large economics literature has found larger health effects of air pollution for the very young, the very old, and people with respiratory conditions. The presence of a household member in one of these categories may be an important dimension of heterogeneity. Subjects who are more informed or concerned about air pollution and weather at baseline may exhibit different effects. More educated or numerate subjects may exhibit larger effects because they are more sophisticated producers and consumers of forecasts. Subjects of different ages may respond differently, e.g. because of differing preferences or remaining years of life. Finally, our letter of support from the government of Punjab requires that we examine heterogeneous effects by gender. All estimates of heterogeneity will be excluded from corrections for multiple hypothesis testing.

5.3.1 Intent to Treat

For within-subject analysis of ITT heterogeneity, the estimating equation will be as follows.

$$Y_i = \alpha + \sum_{a=F,T,FT} Z_{ai} \boldsymbol{H_i'} \boldsymbol{\beta_a} + \gamma Y_{0i} + \boldsymbol{X_i'} \boldsymbol{\delta} + \varepsilon_i$$

Here H_i is the relevant dimension of heterogeneity (e.g. risk aversion), a vector of dummies that may represent bins of an underlying continuous variable. These bins are exhaustive, so that treatments $\boldsymbol{Z}$ do not enter separately. Where a continuous measure of heterogeneity is available, we will also estimate specifications in which treatment enters separately and interacted with the continuous variable.

For between-subjects analysis of ITT heterogeneity, the estimating equation will be as follows.

$$Y_i = \alpha + \sum_{a=F,T,FT} Z_{ai} \boldsymbol{H_i'} \boldsymbol{\beta_a} + \boldsymbol{X_i'} \boldsymbol{\gamma} + \varepsilon_i$$

As before, estimating heterogeneous effects on the high-frequency measures of avoidance from telephone surveys requires a different approach. We expect larger effects from the forecast treatment when the forecast is higher relative to subjects' priors. Avoidance may increase when pollution is unexpectedly high, and decrease when it is unexpectedly low. Let E_{id} be mean expected pollution for date d, elicited by telephone from a random subset of subjects in the same experimental condition as subject i at date $d-1$. (Because treatment may have dynamic effects on expectations, we cannot use expectations from subjects in other experimental conditions.) Define "surprise" as $S_{id} = F_d - E_{id}$, the difference between our forecast F_d and expectations.[25] Then heterogeneity can be estimated as follows.

$$Y_{id} = \boldsymbol{\alpha_i} + \boldsymbol{\delta_d} + \boldsymbol{Z_i'} \boldsymbol{\beta} + \sum_{a=F,T,FT} \zeta_a Z_{ai} S_{id} + \boldsymbol{X_{id}'} \boldsymbol{\gamma} + \varepsilon_{id}$$

For conditions involving forecasts ($Z_F = 1$ and $Z_{FT} = 1$), our prior is that coefficients ζ will be positive; larger surprises will lead to larger changes in avoidance behavior. Tests will be one-tailed. For the training condition ($Z_T = 1$), our prior is that surprises will have no effect and tests will be two-tailed. The interaction effect of S_{id} is potentially non-linear or even non-monotonic. For example, surprising moderate pollution might increase avoidance, but surprising extreme pollution might decrease avoidance if a subject believes it will be ineffective. To address this possibility we will estimate a specification including a vector of dummies for binned values of S_{id}.

5.3.2 Treatment on the Treated

For within-subject analysis of TOT heterogeneity, the 2SLS estimating equations will be as follows. Here H_i is the relevant dimension of heterogeneity (e.g. risk aversion).

$$Y_i = \alpha + \sum_{a=F,T,FT} \widehat{P_{ai} \boldsymbol{H_{it}'}} \boldsymbol{\beta_a} + \gamma Y_{0i} + \boldsymbol{X_i'} \boldsymbol{\delta} + \varepsilon_i$$

$$P_{Fi} = \eta + \sum_{a=F,T,FT} Z_{ai} \boldsymbol{H_i'} \boldsymbol{\phi} + \nu Y_{0i} + \boldsymbol{X_i'} \boldsymbol{\theta} + \upsilon_{Fi}$$

$$P_{Ti} = \eta + \sum_{a=F,T,FT} Z_{ai} \boldsymbol{H_i'} \boldsymbol{\phi} + \nu Y_{0i} + \boldsymbol{X_i'} \boldsymbol{\theta} + \upsilon_{Ti}$$

$$P_{FTi} = \eta + \sum_{a=F,T,FT} Z_{ai} \boldsymbol{H_i'} \boldsymbol{\phi} + \nu Y_{0i} + \boldsymbol{X_i'} \boldsymbol{\theta} + \upsilon_{FTi}$$

[25] A binned measure of surprise may be employed as well.

For between-subject analysis of TOT heterogeneity, the 2SLS estimating equations will be as follows.

$$Y_i = \alpha + \sum_{a=F,T,FT} \widehat{P_{ai}\boldsymbol{H_i'}\boldsymbol{\beta_a}} + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_i$$

$$P_{Fi} = \alpha + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{H_i'}\boldsymbol{\phi} + \boldsymbol{X_i'}\boldsymbol{\theta} + \upsilon_{Fi}$$

$$P_{Ti} = \alpha + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{H_i'}\boldsymbol{\phi} + \boldsymbol{X_i'}\boldsymbol{\theta} + \upsilon_{Ti}$$

$$P_{FTi} = \alpha + \sum_{a=F,T,FT} Z_{ai}\boldsymbol{H_i'}\boldsymbol{\phi} + \boldsymbol{X_i'}\boldsymbol{\theta} + \upsilon_{FTi}$$

5.4 Machine Learning Inference

As indicated above, in some specifications we may employ machine-learning techniques to choose a precision-maximizing control set. This is consistent with the recommendation of Ludwig et al. (2019). According to Wager et al. (2016), ridge regression, LASSO, elastic net, and random forest procedures can all be used to improve efficiency without introducing bias into estimated treatment effects.

5.5 p-Value adjustments

Standard errors will be computed using randomization inference (RI), as described in Gerber and Green (2012). For within-subject analyses we will have multiple observations per subject. In such cases we will permute treatment over subjects, not observations. This is the RI equivalent to clustering at the subject level. For between-subjects analyses will have one observation per subject. Because treatment will be randomized at the individual level and we have designed the experiment to eliminate spillovers, clustered permutations will not be necessary. We expect to use the established R library *ri*. In specifications with covariate adjustment, treatment permutation will be over residualized outcomes.

As RI can be computationally demanding, Appendix tables will display results with SEs based on asymptotics. For within-subject analyses SEs will be clustered at the individual level. For between-subjects analyses heteroskedacticity-robust SEs will be used.

To address the problem of multiple hypothesis testing, the Benjamini-Hochberg procedure (Benjamini and Hochberg, 1995) will be used to control the false discovery rate (at five percent) for a subset of hypotheses related to our primary outcomes: willingness to pay for forecast information ($\alpha + \beta_F > 0$), air pollution forecast error index ($\beta_F = 0$, $\beta_T = 0$), willingness to pay for masks ($\beta_F = 0$, $\beta_T = 0$), time-use avoidance index ($\beta_F = 0$, $\beta_T = 0$), and proxies for uiltility variability index ($\beta_T = 0$). The total count of included tests is 8. Note this is not an exhaustive list of hypotheses involving treatment effects on our primary outcomes. Where a test is less

interesting we exclude it from the Benjamini-Hochberg procedure and report an unadjusted p-value. Unadjusted p-values will also be reported for secondary outcomes.
We will also correct for multiple hypothesis testing across each tests of the three primary dimensions of heterogeneity within each primary outcome (i.e. we will conduct 8 distinct corrections).

6 Experimental Challenges

6.1 Attrition from the Sample

Some subjects are expected to attrit. The principal mechanism for attrition would be refusal to participate in the endline survey. The extent of such attrition is difficult to forecast, but pilot surveys provide one piece of evidence that may be relevant. Conditional on answering the door, 12.5 percent of subjects refused to take part in the pilot survey. If subjects were to exhibit similar behavior at endline, the study would see roughly 12.5 percent attrition. Another recent survey conducted by our implementing partner in Lahore saw roughly 15 percent non-response, which suggests this estimate is reasonable.
Subjects will receive payment for completing the endline survey, which should reduce attrition somewhat. In the event subjects are not home at the time of the first attempted endline visit, enumerators will return up to two times.
We assume a 15 percent attrition rate in our power calculations above.

6.2 Spillovers

Given the ease of relaying our forecasts, spillovers may be a first-order concern for our SMS forecast treatment. The sampling was designed to mitigate these concerns by separating subjects in space, but some networks may include both treatment and control subjects despite this. We also ask subjects not to share pollution forecasts outside their household. We seek to measure those spillovers we cannot eliminate. At baseline we ask subjects which cellular network they are on (section 4, question 9z); this may be weakly correlated with social networks. More importantly, we ask whether subjects are members of social media groups in which information about Walton is shared (section 9, question 3). For subjects who reply "Yes," we ask for the names of the groups. At endline we will repeat these questions. We will also ask directly whether subjects have shared our forecasts and if so, where they have shared our forecasts. And we will directly ask control group members if they received our forecasts from someone else.

If we do detect spillovers, we will not directly address them in our primary analysis as we will consider them to attenuate any estimated impacts. We will address measured spillovers in two ways in the appendix: first, we will consider them as one would non-compliance, by instrumenting for receiving forecasts by treatment assignment in our primary outcome regressions; second, we will treat membership in a social media group where somebody shared our forecasts

as a (non-random) dimension of heterogeneity.

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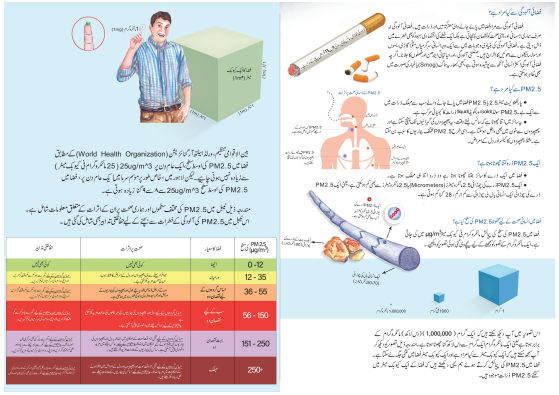
7 APPENDICES

7.1 Materials used in the baseline

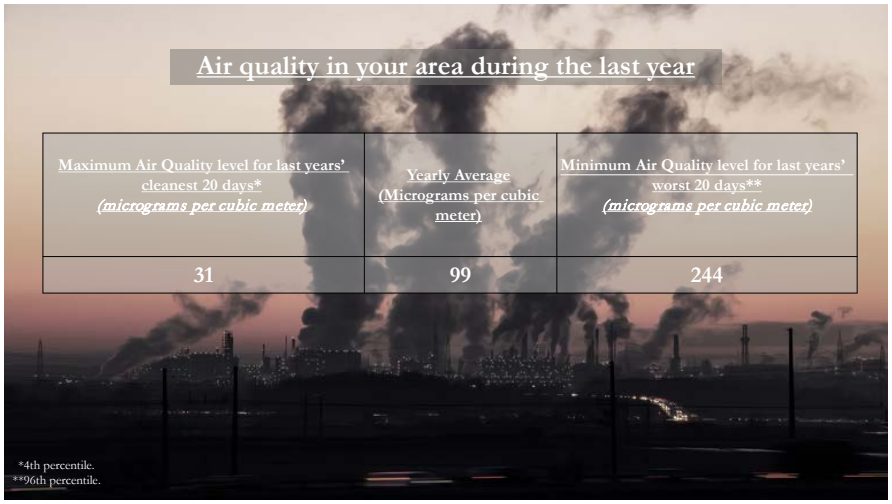
7.1.1 Pamphlet



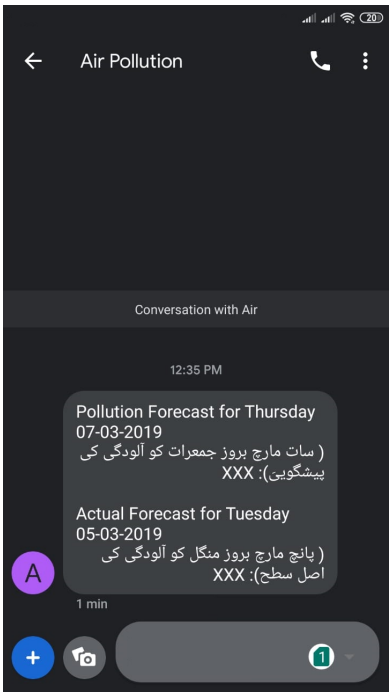
7.1.2 Keychains

7.1.3 Particulate matter masks

7.1.4 Historical pollution data



7.1.5 Forecast text message sheet



7.2 Baseline Survey

Air Pollution Survey

Field	Question	Answer	
enum_name *(required)*	Conducted By	120	Ali Shahab
		121	Hamza Mehmood
		122	Yasir Ayyaz
		123	Malik Nauman
		124	Fareeha Naseem
		125	Maria Khalid
		126	Kaifa Arshad
		127	Kabir
		128	Tehmina Zia
		129	Komal Sami
		130	Asiya Sultana
		131	Shayan
		132	Iqra
		777	Others
tries *(required)*	Number of tries		
try1 *(required)*	What happened in Try 1?	1	The respondent did not answer because he did not want to receive the SMS service.
		2	No one opened the door
		3	The house was empty/ there was a lock on the door
		4	Did not answer because the respondent didn't have time
		6	The respondent did not answer because he did not trust the survey
		7	There were no women in the household.
		8	There were no men in the household
		777	Other
try2 *(required)*	What happened in Try 2?	1	The respondent did not answer because he did not want to receive the SMS service.
		2	No one opened the door
		3	The house was empty/ there was a lock on the door
		4	Did not answer because the respondent didn't have time
		6	The respondent did not answer because he did not trust the survey
		7	There were no women in the household.
		8	There were no men in the household
		777	Other
try3 *(required)*	What happened in Try 3?	1	The respondent did not answer because he did not want to receive the SMS service.
		2	No one opened the door
		3	The house was empty/ there was a lock on the door
		4	Did not answer because the respondent didn't have time
		6	The respondent did not answer because he did not trust the survey
		7	There were no women in the household.
		8	There were no men in the household
		777	Other

Field	Question	Answer	
try4 *(required)*	What happened in Try 4?	1	The respondent did not answer because he did not want to receive the SMS service.
		2	No one opened the door
		3	The house was empty/ there was a lock on the door
		4	Did not answer because the respondent didn't have time
		6	The respondent did not answer because he did not trust the survey
		7	There were no women in the household.
		8	There were no men in the household
		777	Other
try5 *(required)*	What happened in Try 5?	1	The respondent did not answer because he did not want to receive the SMS service.
		2	No one opened the door
		3	The house was empty/ there was a lock on the door
		4	Did not answer because the respondent didn't have time
		6	The respondent did not answer because he did not trust the survey
		7	There were no women in the household.
		8	There were no men in the household
		777	Other
enum_other *(required)*	Please specify other		
Enumerators to enter current plus 1 days forcast as provided by SMS.			
s1_t1_q1 *(required)*	Lowest Tempertaure in centi-celsius		
s1_t1_q2 *(required)*	Highest Tempertaure in centi-celsius		
s1_t1_q3 *(required)*	Chances of rain (Answer in %'s) کتنے فیصد امکان ہے؟		
s1_t1_q4 *(required)*	Windspeed in KM/H		
s1_t1_q5 *(required)*	Condition of weather	1	Sunny
		2	Rain
		3	Clouds
		4	Chances of Shower
Enumerators to enter t plus 2 days forcast as provided by SMS.			
s1_t2_q1 *(required)*	Lowest Tempertaure in centi-celsius		
s1_t2_q2 *(required)*	Highest Tempertaure in centi-celsius		
s1_t2_q3 *(required)*	Chances of rain (Answer in %'s) کتنے فیصد امکان ہے؟		
s1_t2_q4 *(required)*	Windspeed in KM/H		
s1_t2_q5 *(required)*	Condition of weather	1	Sunny
		2	Rain
		3	Clouds
		4	Chances of Shower
Enumerators to enter t plus 3 days forcast as provided by SMS.			
s1_t3_q1 *(required)*	Lowest Tempertaure in centi-celsius		
s1_t3_q2 *(required)*	Highest Tempertaure in centi-celsius		
s1_t3_q3 *(required)*	Chances of rain (Answer in %'s) کتنے فیصد امکان ہے؟		
s1_t3_q4 *(required)*	Windspeed in KM/H		
s1_t3_q5 *(required)*	Condition of weather	1	Sunny
		2	Rain
		3	Clouds
		4	Chances of Shower

Field	Question	Answer
charge_id *(required)*	Charge ID	1 1 2 2 3 3 4 4 5 5 6 6 7 7
point_id *(required)*	Point ID	1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19
hhid *(required)*	Household ID	1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10
consent_note	Consent Note	
consent_note1	Consent Note *3227788110*	
consent *(required)*	Can we start our survey activity?	1 Yes 2 No
no_consent *(required)*	Reason of not conducting survey	1 No one opened the door 2 Unit was empty 3 Refused because of time constraint 4 Refused because of trust issues 777 Other
no_consent_o *(required)*	Specify other	
survey		
survey > sec1		
s1_q1 *(required)*	Neighborhood name کالی نصیر یا والنٹر کے اندر محلے کا نام لکھیں۔	
s1_q2 *(required)*	Household address	
s1_q5 *(required)*	Gender to be interviewed	1 Male 2 Female
male_18 *(required)*	Number of male and female members with age bracket	
survey > Details of HH members (1)		(Repeated group)
name_rg_male *(required)*	Name	
gender_rg_male *(required)*	Gender	1 Male 2 Female
age_rg_male *(required)*	Age	
status_rg_male *(required)*	Status	1 Head of the HH/Spouse of head of the HH 2 Others
p_rg_male *(required)*	Is he/she present?	1 Yes 2 No
selected_mem_male	1, [selected_name], has been randomly chosen.	

Field	Question	Answer
s4_q7	Imagine we provide you forecasts of air pollution readings on your mobile device. Forecasts would be generated by LUMS using past measurements from a LUMS-operated monitor in your neighborhood. Each day you would receive a SMS message with two elements. First, the message would contain a forecast of tomorrow's air pollution. Second, the message would compare yesterday's actual average air pollution to our forecast for that day. This will enable you to evaluate the quality of our forecast yourself. Enumerator: Display mockup of text message. This will not contain real numbers, as we don't want to give people a reference point. If you agree, you will receive this service for three months at zero cost.	
s4_q8 *(required)*	At this point we are offering this service randomly (or on a lottery basis) to some people. If you are randomly selected to receive SMS messages on your phone, Would you agree to receive the air pollution	1 Yes 2 No 888 Don't know 999 Refused
s4_q9 *(required)*	Can you confirm the phone number that you would like the SMS messages to be sent to?	
s4_q9z *(required)*	Network of cell number provided	1 Jazz 2 Warid 3 Telenor 4 Zong 5 Ufone
s4_q10 *(required)*	We would in the later part of this survey play games with you which might or might not lead to you making money. If you do ending up money, some of it you will receive during the survey and some of it after 5 days of the survey via mobile credit. Please let us know the mobile number you would like to receive the payments at if your answers are correct.	
s4_q10z *(required)*	Network of cell number provided	1 Jazz 2 Warid 3 Telenor 4 Zong 5 Ufone
survey > consent_yes		
note	Brief Script	
survey > consent_yes > sec2		
s2_q1 *(required)*	Name of respondent *Should be same as randomly choosen respondent*	
s2_q2 *(required)*	Gender	1 Male 2 Female
s2_q3 *(required)*	Age *888 = Don't know 999 = Refused*	
s2_q4 *(required)*	Marital Status	1 Single 2 Married 3 Divorced 4 Widow 5 Unmarried 999 Refused
survey > consent_yes > Information and Trust		
survey > consent_yes > Information and Trust > sec3_a		
s3_q1 *(required)*	I care about air quality in the places I live and work.	1 Strongly Agree 2 Agree 3 Neither agree or disagree 4 Disagree 5 Strongly Disagree 888 Don't know 999 Refused
s3_q2 *(required)*	I am aware of the air quality in Lahore.	1 Strongly Agree 2 Agree 3 Neither agree or disagree 4 Disagree 5 Strongly Disagree 888 Don't know 999 Refused
s3_q3 *(required)*	I am aware of the air quality in Walton.	1 Strongly Agree 2 Agree 3 Neither agree or disagree 4 Disagree 5 Strongly Disagree 888 Don't know 999 Refused

Field	Question	Answer	
s3_q4 *(required)*	I am aware of the air quality in the area where I work.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s3_q5 *(required)*	I am aware of the air quality where my children go to school.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		6	No child
		888	Don't know
		999	Refused
s3_q6 *(required)*	From what sources have you learned about air quality in Lahore? *Enumerator: Please do not read out the options.*	0	I am not interested
		1	The newspaper
		2	Punjab government (EPD)
		3	Community members
		4	Social media
		5	AirVisual app
		6	My own observation
		7	Television
		8	Word of Mouth
		777	Other, please list
		888	Don't know
		999	Refused
s3_q6_o *(required)*	Please specify		
s3_q7 *(required)*	How many times in a week do you check the weather forecast.	1	Less than once per week
		2	Once per week
		3	1-2 times per week
		4	3-4 times per week
		5	5-7 times per week
		6	Never
		888	Don't know
		999	Refused
s3_q8 *(required)*	Why are weather forecasts important/useful for you?	1	Determine Travel Plans
		2	Determine Work Plans
		777	Other, please list
		888	Don't know
		999	Refused
s3_q8_o *(required)*	Please specify other		
s3_q9 *(required)*	From which sources do you obtain weather forecasts?	1	Internet
		2	Mobile Phone
		3	News on Television
		4	Newspaper
		5	Mobile Application
		777	Other, please list
		888	Don't know
		999	Refused
s3_q9_o *(required)*	Please specify other		
s3_q10 *(required)*	How reliable do you think weather forecasts that you are familiar with are?	1	Completely reliable
		2	Somewhat Reliable
		3	Neither reliable nor unreliable
		4	Sometimes unreliable
		5	Completely Unreliable
		888	Don't know
		999	Refused
note_s3	The air pollution that you experience here in Walton can come from many sources. some can be nearby and others can be hundreds of kilometers away		
survey > consent_yes > Information and Trust > Source of Air Pollution in Walton			

Field	Question	Answer	
s3_q11_a *(required)*	First Source	0	No Air pollution in Walton
		1	Construction
		2	Industrial sources/manufacturing facilities
		3	Burning crops
		4	Motor vehicles
		5	Household cooking and heating
		6	Power plants
		7	Smoke of cigarettes
		8	Burning of Garbage
		9	Pollution from other countries
		10	No source
		777	Other, please list
		888	Don't know
		999	Refused
s3_q11_b *(required)*	Second Source	0	No Air pollution in Walton
		1	Construction
		2	Industrial sources/manufacturing facilities
		3	Burning crops
		4	Motor vehicles
		5	Household cooking and heating
		6	Power plants
		7	Smoke of cigarettes
		8	Burning of Garbage
		9	Pollution from other countries
		10	No source
		777	Other, please list
		888	Don't know
		999	Refused
s3_q11_c *(required)*	Third Source	0	No Air pollution in Walton
		1	Construction
		2	Industrial sources/manufacturing facilities
		3	Burning crops
		4	Motor vehicles
		5	Household cooking and heating
		6	Power plants
		7	Smoke of cigarettes
		8	Burning of Garbage
		9	Pollution from other countries
		10	No source
		777	Other, please list
		888	Don't know
		999	Refused
s3_q11_a_o *(required)*	Others-First Source		
s3_q11_b_o *(required)*	Others-Second Source		
s3_q11_c_o *(required)*	Others-Third Source		
s3_q13 *(required)*	Please evaluate the following statement: I trust air quality measurements delivered to me by the Punjab government.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
survey > consent_yes > Key Chain Game			

Field	Question	Answer
note_forcast	Let us now play a simple game in which you bid for a key chain. Think about how much you value this key chain and the maximum amount you are willing to pay for it. Please don't think about the market price of the key chain; just consider the value of this jelly to you? I will now give you 20 rupees. In a moment, I will ask you to write down the maximum amount you would be willing to pay for one ABCD jelly. Then I will randomly draw a price between 0 PKR and 20 PKR. If the price I draw is lower than the price you write down, you will pay me the randomly drawn price and receive the mask. If the price I draw is higher than the price you write down, you will pay nothing and you will not receive the ABCD jelly. Notice that if the transaction occurs, the price is the randomly selected one, not the amount of your bid. The amount of your bid matters because it influences the probability that the transaction will occur. Now please write down the maximum you would be willing to pay for one ABCD jelly. It is fine to answer 0 PKR if you do not wish to purchase an ABCD jelly at any price. Please take a minute to think about this.	
s4_q1 *(required)*	Please note amount that respondent has written or handover tablet to him so that he can write the amount himself/herself	
s4_q2	[rand4] is the randomly choosen amount	
s4_q3	This draw resulted in purchase.	
s4_q4	Please take [rand4] rupees from the respondant.	
s4_q5	This draw did not result in purchase.	
s4_q6	Please take nothing from the respondant.	
s4_q7a *(required)*	Did random draw result in purchase?	1 Yes 2 No
s4_q8a *(required)*	Did the price you choose reflect the maximum you would want to pay? Or was it above or below it?	1 Maximum you wanted to pay 2 Above 3 Below
s4_q9a	Consider what would happen if you chose a price below your maximum: if your maximum price for the ABCD jelly is 20 PKR but instead you write down 15 PKR then you will not win the ABCD jelly if I draw the numbers 16, 17, 18, 19, or 20 in my random draw. You will now be worse off since you could have won the ABCD jelly by stating your true maximum willingness to pay (20 PKR), in such cases and still gotten the ABCD jelly for less than (or at worse) equal to how much you were willing to pay for it	
s4_q10a	Now consider what would happen if you overstate your maximum willingness to pay: if your true willingness to pay for the ABCD jelly is 15 PKR but instead you write down 20 PKR then you will win the ABCD jelly if I draw the numbers 15, 16, 17, 18, and 19 in my random draw. However, you will now be worse off since you will have to pay an amount greater than your true maximum willingness to pay for the ABCD jelly.	
survey > consent_yes > Quiz		
s41_0	Please answer the following questions in light of the game explained to you above.	
s41_3	Suppose you go to buy apples from the local market. The fruit vendor randomly qoutes Rs. 60 a kilogram. Your willingness to pay is Rs. 40 a kilogram. Would you buy the apples?	1 Yes 2 No
s41_3_c	Your answer was correct.	
s41_3_nc	Your answer was not correct	
s41_1	Suppose you bid Rs. 15 for the jelly but the randomly drawn amount is Rs. 10. Do you buy the jelly?	1 Yes 2 No
s41_1_c	Your answer was correct.	
s41_1_nc	Your answer was not correct	
s41_2	At what price do you buy the jelly?	1 Rs.10 2 Rs.15
s41_2_c	Your answer was correct.	
s41_2_nc	Your answer was not correct	
survey > consent_yes > Mask Game		
s5_note	There are many different pollutants in the air, some are gasses and others are small microscopic particles. While there is no practical way of protecting ourselves from the former (other than staying in doors), masks are a good way of protecting ourselves from the latter. This type of face mask is called a N95 respirator. The designation refers to the fact that in laboratory testing such masks have been shown to filter out 95% of harmful microscopic particles in the air. Please note that this is not the same as a "surgical mask" used by doctors in hospitals. Surgical masks are not capable of filtering the air we breathe from pollutants. Furthermore, like all "filter" systems, this mask has a limited lifetime, and has been tested to work for approximately one month after which they need to be thrown out. Replacement masks may be purchased from the local market. Enumerator: put mask on to demonstrate. It is important for the mask to fit snugly to your face, or it will not work properly. ماسک پہن کر دیکھئیں . یہ ضروری ہے کے ماسک آپ کے منہ پر سہی طرح پہنا گیا ہو ورنہ یہ سہی طرح استعمال نہیں ہو سکے گا	

Field	Question	Answer
s5_exp	We will now give you an opportunity to bid for a mask. Think about how much you value this mask and the maximum amount you are willing to pay for it. Please don't think about the market price of the mask; just consider the value of this mask to you? I will now give you 100 PKR. In a moment, I will ask you to write down the maximum amount you would be willing to pay for one mask. Then I will randomly draw a price between 0 PKR and 100 PKR. If the price I draw is lower than the price you write down, you will pay me the randomly drawn price and receive the mask. If the price I draw is higher than the price you write down, you will pay nothing and you will not receive the mask. Notice that if the transaction occurs, the price is the randomly selected one, not the amount of your bid. The amount of your bid matters because it influences the probability that the transaction will occur. Now please write down the maximum you would be willing to pay for one mask. It is fine to answer 0 PKR if you do not wish to purchase a mask at any price. Please take a minute to think about this.	
s5_q1 *(required)*	Please note amount that respondent has written or handover tablet to him so that he can write the amount himself/herself	
s5_q2	[mask_ra] is the randomly choosen amount	
s5_q22	This draw resulted in purchase.	
s5_q222	Please take [mask_ra] rupees from the respondant.	
s5_q23	This draw did not result in purchase.	
s5_q231	Please take nothing from the respondant.	
s5_q3 *(required)*	did random draw result in purchase?	1 Yes 2 No
s5_q4 *(required)*	If bid is positive, why are these masks valuable?	
s5_q5 *(required)*	If bid is zero, why are these masks not valuable?	
s5_q6 *(required)*	How often have you seen people wearing such masks?	1 Never 2 Not very often 3 Often, but not every day 4 Every day 888 Don't know 999 Refused
s5_q7 *(required)*	Do you believe these masks work?	1 Yes 2 No 888 Don't know 999 Refused
s5_q8 *(required)*	Do you think these masks are ugly?	1 Yes 2 No 888 Don't know 999 Refused
s5_q9 *(required)*	Do you think these masks are comfortable? *Make the respondent wear the mask*	1 Yes 2 No 888 Don't know 999 Refused
s5_q10 *(required)*	Are there other characteristics (incl. non-monetary) of these masks that are important for your decision about whether to buy and wear them?	
s5_q11 *(required)*	Do you know of a convenient place to purchase masks?	1 Yes 2 No 888 Don't know 999 Refused
s5_q12 *(required)*	Please expalin	
survey > consent_yes > Time Travel Forecast		
s6_note	Enumerator: Now we are going to think about forecasting. Let us begin with a practice forecast on a topic from everyday life; we will return to air pollution in a moment. Explain to the subject that this map depicts two locations (refer to laminated map provided to enumerator): Koray Stop in Walton and Daewoo Station in Thokar. We would like you to forecast the minimum time for a trip on a motorbike from Koray Stop in Walton to the Daewoo Station in Thokar at 7 P.M. tomorrow. Please take a minute to think about this. If your guess is within +/- 2.5 minutes of the Google Maps's minimum suggested time at 7pm tomorrow, you will receive 250PKR; if within +/- 5minutes then 100 PKR. You will receive this payment via mobile credit in 5 days from now. After 3 months we will return for another survey. At that time we will ask you to make another set of forecasts. *Show map to the respondent*	
s6_q1 *(required)*	Please give us your forecast in minutes required to travel between Koray Stop and at the Daewoo stop Thokar at 7 p.m. tomorrow.	
s6_q2 *(required)*	How confident are you that your forecast will turn out to be within +-2.5 mins of actual time at t+1? *Response should be form 0-100%.*	
s6_q3 *(required)*	Before you go to bed at night, can you form a reasonable guess at what tomorrow's air quality will be like?	1 Yes 2 No 888 Don't know

		999 Refused
Field	Question	Answer
s6_q3a *(required)*	If yes, why might you make this guess? *Source of forecast*	
s6_q4 *(required)*	If no, why do you not want to make the guess?	
s6_q5 *(required)*	How would you describe yesterday's air pollution?	1 below average 2 average 3 above average 888 Don't know 999 Refused
s6_q6 *(required)*	How do you think air quality will be tomorrow?	1 better than today 2 about the same as today 3 worse than today 888 Don't know 999 Refused
s6_q7 *(required)*	How do you think air quality will be 3 days from today?	1 better than today 2 about the same as today 3 worse than today 888 Don't know 999 Refused
survey > consent_yes > Time Travel Forecast > Air Pollution Forecast		
forcast_note0	Enumerator: Please have the respondent take a look at the (i) PAMPHLET (ii) FORECAST DATA, Ask the subject to forecast pollution levels for TOMORROW (t+1) and THREE DAYS FROM NOW (t+3). If they want they can forecast pollution levels for the day after tomorrow (t+2) as well. Explain to the subject that while forecasting pollution levels they should answer in particles per meter cube which is the same unit as the historical forecast. If either of your guess about (t+1) or (t+3) is within 5% of the actual pollution level you will receive 250PKR; if within 10% then 150 PKR; if within 20% then 50 PKR. This payment will be sent to you via mobile credit 5 days from now. Before you make these air pollution forecasts, you will have an option of viewing the weather forecast. Enumerator: If the subject declines, do not try to persuade the subject to view the weather forecast. Please take a minute to think about this. After 3 months we will return for another survey. At that time we will ask you to make another set of forecasts. اگر جواب دهنده موسم کی پیشینگوئی دیکھنے سے منع کر دے تو دباؤ نا ڈالیں .	
forcast_note	If either of your guess about (t+1) or (t+3) is within 5% of the actual pollution level you will receive 250PKR; if within 10% then 150 PKR; if within 20% then 50 PKR. This payment will be sent to you via mobile credit. After 3 months we will return for another survey. At that time we will ask you to make another set of forecasts.	
s6f_q1 *(required)*	Would you like to take a look at the weather forecast for t+1?	1 Yes 2 No
s6f_q2	Lowest temperature: [s1_t1_q1] centi-celsius Highest temperature: [s1_t1_q2] centi-celsius Chances of rain: [s1_t1_q3] percentage Windspeed: [s1_t1_q4] KM/h	
survey > consent_yes > Time Travel Forecast > Air Pollution Forecast > s6f_g1		
s6f_q3 *(required)*	Please fill out pollution forecast for TOMORROW (t+1) on average. *In particles per meter cube. Enumerator: please use pamphlet to explain.*	
s6f_q4 *(required)*	How confident are you that your forecast will turn out to be within 10% of actual pollution at t+1? *Please answer in percentages from 0 to 100*	
s6f_q5 *(required)*	Would you like to take a look at the weather forecast for t+3?	1 Yes 2 No
s6f_q6	Lowest temperature: [s1_t3_q1] centi-celsius Highest temperature: [s1_t3_q2] centi-celsius Chances of rain: [s1_t3_q3] percentage Windspeed: [s1_t3_q4] KM/h	
survey > consent_yes > Time Travel Forecast > Air Pollution Forecast > s6f_g2		
s6f_q7 *(required)*	Please fill out pollution forecast for (t+3) on average. *In particles per meter cube. Enumerator: please use pamphlet to explain.*	
s6f_q8 *(required)*	How confident are you that your forecast will turn out to be within 10% of actual pollution at t+3? *Please answer in percentages from 0 to 100*	
s6f_q10 *(required)*	Did the respondent want to voluntarily give forecast for t+2?	1 Yes 2 No
s6f_q101 *(required)*	Would you like to take a look at the weather forecast for t+2?	1 Yes 2 No
s6f_q102	Show text for weather forecast for t+2.	
survey > consent_yes > Time Travel Forecast > Air Pollution Forecast > s6f_g3		
s6f_q11 *(required)*	Please fill out pollution forecast for (t+2) on average. *In particles per meter cube. Enumerator: please use pamphlet to explain.*	
s6f_q12 *(required)*	How confident are you that your forecast will turn out to be within 10% of actual pollution at t+2? *Please answer in percentages from 0 to 100*	
survey > consent_yes > sec7		
s7_note	I will be asking you questions relating to air quality and pollution.	

Field	Question	Answer	
s7_q1 *(required)*	Does anyone in your household have a respiratory condition, that is, have trouble breathing?	1	Yes
		2	No

s7_q1a *(required)*	Relation	1	self
		2	sister
		3	mother
		4	grandmother
		5	sister-in-law (younger brother's wife)
		6	sister-in-law (elder brother's wife)
		7	brother's wife
		8	cousin
		9	mother-in-law
		10	daughter-in-law
		11	daughter
		12	she does not live in this house
		13	brother
		14	father
		15	grandfather
		16	brother-in-law (husband's younger brother)
		17	brother-in-law (husband's elder brother)
		18	father-in-law
		19	sister's husband
		20	son-in-law
		21	son
		22	cousin
		23	he does not live in this house
		24	Hum-Zulf
		777	Other
		888	Don't know
		999	Refused
s7_q1a_0 *(required)*	Please specify		
s7_note1	Note Agree/Disagree		
s7_q2 *(required)*	In the past week, I have been concerned about air quality in general?	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q3 *(required)*	In the past week, I have been satisfied with indoor air quality at home?	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q4 *(required)*	In the past week, I have been satisfied with outdoor air quality at home?	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q8 *(required)*	In the past week, I have been satisfied with indoor air quality at work/school?	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused

Field	Question	Answer	
s7_q9 *(required)*	In the past week, I have been satisfied with outdoor air quality at work/school	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q10 *(required)*	Of the past seven days in Lahore, including today, how many had satisfactory outdoor air quality?	1	One
		2	two
		3	three
		4	four
		5	five
		6	six
		7	seven
		888	Don't know
		999	Refused
s7_q12 *(required)*	Air quality significantly affects my quality of life at home	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q13 *(required)*	Air quality significantly affects my performance at work or school.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q14 *(required)*	In the past week, poor air quality has affected my ability to sleep.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q14a *(required)*	In the past week, noise from outside has affected my ability to sleep.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q15 *(required)*	In the past week, I reduced the number of hours I spent on non-work outdoor activities in response to poor air quality	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q16 *(required)*	In the past week, I reduced the number of hours I worked significantly in response to poor air quality.	1	Strongly Agree
		2	Agree
		3	Neither agree or disagree
		4	Disagree
		5	Strongly Disagree
		888	Don't know
		999	Refused
s7_q18 *(required)*	In the past week, I have rescheduled activities across days in response to poor air quality?	1	Yes
		2	No
		888	Don't know
		999	Refused
s7_q19 *(required)*	If yes, please describe		
s7_q21	Enum Note		
survey > consent_yes > sec7 > Best Hours			

	s7_q23 *(required)*	Best Hour: 1	
Field	s7_q24 *(required)*	Question	Answer
		Best Hour: 2	

survey > consent_yes > sec7 > Worst Hours				
s7_q26 *(required)*	Worst Hour: 1			
s7_q27 *(required)*	Worst Hour: 2			
survey > consent_yes > sec7 > Note for the time use battery				
time_h1 *(required)*	8 am- 9 am		1	Sleep Inside
			2	Sleep Outside
			3	Paid indoor work
			4	Paid outdoor work
			5	Home indoor work
			6	Home outdoor work
			7	Indoor Leisure
			8	Outdoor Leisure
			9	Travel
			10	Other Indoor
			11	Other Outdoor
			999	Refuse to answer
time_h2 *(required)*	9 am- 10 am		1	Sleep Inside
			2	Sleep Outside
			3	Paid indoor work
			4	Paid outdoor work
			5	Home indoor work
			6	Home outdoor work
			7	Indoor Leisure
			8	Outdoor Leisure
			9	Travel
			10	Other Indoor
			11	Other Outdoor
			999	Refuse to answer
time_h3 *(required)*	10 am- 11 am		1	Sleep Inside
			2	Sleep Outside
			3	Paid indoor work
			4	Paid outdoor work
			5	Home indoor work
			6	Home outdoor work
			7	Indoor Leisure
			8	Outdoor Leisure
			9	Travel
			10	Other Indoor
			11	Other Outdoor
			999	Refuse to answer
time_h4 *(required)*	11 am- 12 pm		1	Sleep Inside
			2	Sleep Outside
			3	Paid indoor work
			4	Paid outdoor work
			5	Home indoor work
			6	Home outdoor work
			7	Indoor Leisure
			8	Outdoor Leisure
			9	Travel
			10	Other Indoor
			11	Other Outdoor
			999	Refuse to answer
time_h5 *(required)*	12 pm- 1 pm		1	Sleep Inside
			2	Sleep Outside
			3	Paid indoor work
			4	Paid outdoor work
			5	Home indoor work
			6	Home outdoor work
			7	Indoor Leisure
			8	Outdoor Leisure
			9	Travel
			10	Other Indoor
			11	Other Outdoor
			999	Refuse to answer

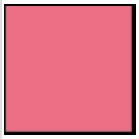
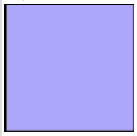
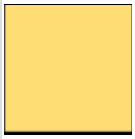
Field	Question	Answer	
time_h6 *(required)*	1 pm- 2 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h7 *(required)*	2 pm- 3 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h8 *(required)*	3 pm- 4 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h9 *(required)*	4 pm- 5 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h10 *(required)*	5 pm- 6 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer

Field	Question	Answer	
time_h11 *(required)*	6 pm- 7 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h12 *(required)*	7 pm- 8 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h13 *(required)*	8 pm- 9 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h14 *(required)*	9 pm- 10 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h15 *(required)*	10 pm- 11 pm	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer

Field	Question	Answer	
time_h16 *(required)*	11 pm- 12 am	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h17 *(required)*	12 am- 1 am	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h18 *(required)*	1 am- 2 am	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h19 *(required)*	2 am- 3 am	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer
time_h20 *(required)*	3 am- 4 am	1	Sleep Inside
		2	Sleep Outside
		3	Paid indoor work
		4	Paid outdoor work
		5	Home indoor work
		6	Home outdoor work
		7	Indoor Leisure
		8	Outdoor Leisure
		9	Travel
		10	Other Indoor
		11	Other Outdoor
		999	Refuse to answer

Field	Question	Answer
time_h21 *(required)*	4 am- 5 am	1 Sleep Inside 2 Sleep Outside 3 Paid indoor work 4 Paid outdoor work 5 Home indoor work 6 Home outdoor work 7 Indoor Leisure 8 Outdoor Leisure 9 Travel 10 Other Indoor 11 Other Outdoor 999 Refuse to answer
time_h22 *(required)*	5 am- 6 am	1 Sleep Inside 2 Sleep Outside 3 Paid indoor work 4 Paid outdoor work 5 Home indoor work 6 Home outdoor work 7 Indoor Leisure 8 Outdoor Leisure 9 Travel 10 Other Indoor 11 Other Outdoor 999 Refuse to answer
time_h23 *(required)*	6 am- 7 am	1 Sleep Inside 2 Sleep Outside 3 Paid indoor work 4 Paid outdoor work 5 Home indoor work 6 Home outdoor work 7 Indoor Leisure 8 Outdoor Leisure 9 Travel 10 Other Indoor 11 Other Outdoor 999 Refuse to answer
time_h24 *(required)*	7 am- 8 am	1 Sleep Inside 2 Sleep Outside 3 Paid indoor work 4 Paid outdoor work 5 Home indoor work 6 Home outdoor work 7 Indoor Leisure 8 Outdoor Leisure 9 Travel 10 Other Indoor 11 Other Outdoor 999 Refuse to answer
s7_q31 *(required)*	In the past week, have you restricted your children from going outside in response to poor air quality?	1 Yes 2 No 3 No Child 888 Don't know 999 Refused
s7_q31a	In the past week, have you restricted your children from going outside in response to any other reasons?	1 Yes 2 No 3 No Child 888 Don't know 999 Refused
s7_q34 *(required)*	Have you changed anything else about your activities or purchases in response to poor air quality?	1 Yes 2 No
s7_q34a	If yes, what have you changed?	

Field	Question	Answer	
h_q1 *(required)*	How variable has your level of happiness been over the past month?	1	Almost the same everyday
		2	Small changes from day to day
		3	Moderate changes from day to day
		4	Large changes from day to day
		5	Very Large changes from day to day
		6	Don't know
		7	Did not answer
survey > consent_yes > Risk Aversion			
s8_q1 *(required)*	How do you see yourself: Are you in general a person who takes health risk or do you try to evade health risks?	1	completely unwilling to take health risk
		2	somewhat unwilling to take health risk
		3	neither willing nor unwilling to take health risk
		4	somewhat willing to take health risk
		5	fully willing to take health risk
		888	Don't know
		999	Refused
survey > consent_yes > Risk Aversion > Please imagine the following situation: You can choose between a sure payment of a particular amount of money, or a lottery, where you would have an equal chance of getting Rs. 100 or getting nothing. We will present to you five different situations			
s8_2	First option is "50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing" vs second option is "100% chance of receiving nothing". Therefore, we have selected first option for you.	1	50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing
		2	A hundred percent chance of getting Rs. 0 right now?
s8_55 *(required)*	Selection 2	1	50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing
		2	A hundred percent chance of getting Rs. 30 right now?
s8_3 *(required)*	Selection 3	1	50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing
		2	A hundred percent chance of getting Rs. 60 right now?
s8_4 *(required)*	Selection 4	1	50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing
		2	A hundred percent chance of getting Rs. 90 right now?
s8_5 *(required)*	Selection 5	1	50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing
		2	A hundred percent chance of getting Rs. 120 right now?
s8_6	First option is "50 percent chance of receiving 150 rupees or 50 percent chance of receiving nothing" vs second option is "100% chance of receiving 150". Therefore, we have selected second option for you.		

Field	Question	Answer
s8_q7 *(required)*	Now you will get payment according to the selection you made in earlier questions. I am going to show you 5 different colors, one color represent 1 selection and we are not sure which color is associated with which particular selection. It's going to be completely random. Depending on the color you select, that selection will be shown which you made earlier and on that particluar selection you will get payment. Please select a color?	1 Pink Color  2 Green 3 Purple Color  4 Blue Color  5 Yellow Color  6 Black Color 
g1_deci1	[forum1]	
g1_deci2	[forum2]	
g1_deci3	150	
g1_deci4	[forum4]	
g1_deci5	[forum5]	
g1_deci6	[forum6]	
g2_d1_1_a	You have won 150 Rupees	
g2_d1_1_b	You have won 0 Rupees	
g2_d1_1_c	You have won 120 Rupees	
g2_d1_6_b	You have won 0 Rupees	
g2_d1_6_c	You have won 30 Rupees	
g2_d1_6_a	You have won 150 Rupees	
g2_d1_2_a	You have won 150 Rupees	
g2_d1_2_b	You have won 0 Rupees	
g2_d1_2_c	You have won 60 Rupees	
g2_d2_3_c	You have won 150 Rupees	
g2_d2_4_a	You have won 150 Rupees	
g2_d2_4_b	You have won 0 Rupees	
g2_d2_4_c	You have won 90 Rupees	
g2_d2_5_a	You have won 150 Rupees	
g2_d2_5_b	You have won 0 Rupees	
enum	ENUM Only: Please note the amount you have given to respondent in this game	0 0 30 30 60 60 90 90 120 120

Field	Question	Answer	
		150	150
h_q2 *(required)*	How variable has your level of income been over the past month?	1	Almost the same everyday
		2	Small changes from day to day
		3	Moderate changes from day to day
		4	Large changes from day to day
		5	Very Large changes from day to day
		6	Don't know
		7	Did not answer
survey > consent_yes > Social Networks			
s9_q1 *(required)*	Are you part of any Facebook or whatsapp groups or others in which members share information about Walton.	1	Yes
		2	No
		888	Don't know
		999	Refused
s9_q2 *(required)*	If yes, how many?		
survey > consent_yes > Social Networks > Please list the groups and its platform, please be specific in the name of the groups. (1)		(Repeated group)	
s9_q2_1 *(required)*	Platform 1	1	WhatsApp
		2	Facebook
		3	Emo
		4	Instagram
		5	Twitter
s9_q2_2 *(required)*	Group Name 1		
s9_q3 *(required)*	Are you part of part of any community groups in which members share information about Walton.	1	Yes
		2	No
		888	Don't know
		999	Refused
s9_q4 *(required)*	If yes,how many?		
survey > consent_yes > Social Networks > Please list the groups and its platform, please be specific in the name of the groups. (1)		(Repeated group)	
s9_q3_1 *(required)*	Platform 1		
s9_q3_2 *(required)*	Group Name 1		
survey > consent_yes > demo			
dem_q1 *(required)*	Respondent's household status	1	head of household
		2	spouse of household head
		3	brother of household head
		4	sister of household head
		5	son of household head
		6	daughter of household head
		7	son in law
		8	daughter in law
		777	Other
		888	Don't know
		999	Refused
dem_q1_o *(required)*	Please specify other		
dem_q2 *(required)*	Total members of this household		
dem_q3 *(required)*	Are there any elderly individuals living with you whose care you are responsible for?	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q4 *(required)*	If so, how many?		
dem_q5 *(required)*	Are there any young children (under 15) living with you whose care you are responsible for?	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q6 *(required)*	If so, how many?		

Field	Question	Answer	
dem_q7 *(required)*	Education of Respondent	0	Less than first grade
		1	First grade
		2	Second grade
		3	Third grade
		4	Fourth grade
		5	Fifth grade
		6	Sixth grade
		7	Seventh grade
		8	Eighth grade
		9	Ninth grade
		10	Matric
		11	Intermediate
		12	Graduate/ MBBS/LLB
		13	MA/ MPHIL/ MS or above
		14	Vocational Diploma
		15	Did not attain a formal education but knows how to read and write
		16	Went to Madrassa
		17	Never went to school
		888	Don't know
		999	Refused
dem_q8 *(required)*	Number of HH members that are employed.		
dem_q9 *(required)*	Is the house you live in owned by you personally, someone else in your household/family or rented?	1	Owned
		2	Rented
		888	Don't know
		999	Refused
dem_q11 *(required)*	Do you expect to still be living in this house for the remainder of the year?	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q12 *(required)*	How long have you lived in this neighborhood? *Write in years. As in 2013 should be written as 5.*		
survey > consent_yes > demo > Does your household own any of the following items, that are fully functioning / working?			
dem_q13 *(required)*	Electricity	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q14 *(required)*	Sewing Machine	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q15 *(required)*	Camera	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q16 *(required)*	Radio/tape recorder	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q17 *(required)*	Refrigerator	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q18 *(required)*	Land line telephone	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q19 *(required)*	Washing machine	1	Yes
		2	No
		888	Don't know
		999	Refused
dem_q20 *(required)*	Jeep/car	1	Yes
		2	No
		888	Don't know
		999	Refused

Field	Question	Answer	
dem_q21 *(required)*	Computer	1	Yes
		2	No
		888	Don't know
		999	Refused
survey > consent_yes > demo > Does your household own any of the following items, that are fully functioning / working?			
dem_q22 *(required)*	UPS		
dem_q23 *(required)*	Generator		
dem_q24 *(required)*	Motorcycle		
dem_q25 *(required)*	Mobile Phones		
dem_q26 *(required)*	Televisions		
dem_q27 *(required)*	Air Conditioners		
dem_q28 *(required)*	Bicycle		
dem_q29 *(required)*	Rooms		
dem_q30 *(required)*	Fans		
dem_q31 *(required)*	What is the main source of income for your household?	1	Pension - Government
		2	Pension - Private
		3	Current government job
		4	Private job with a salary
		5	Private job with self-employment
		6	Remittance from abroad
		7	Earnings from industry
		8	Earnings from trade
		9	Daily labour
		10	Earnings from agricultural land
		11	Rent from agricultural land
		12	Rent from property in city
		777	Other
		888	Don't know
		999	Refused
dem_q31_o *(required)*	Please specify other		
pamphlet_accept	Did the respondant accept the pamphlets?	1	Yes
		2	No
note_a1	Total amount given [amount3]		
note_a2	Total amount given [amount4]		
note_a3	Total amount given [amount5]		
note_a4	Total amount given [amount6]		
image_hh	Please take picture of the HH.		

7.3 Telephone Survey

7.4 TBD: Intervention Manual

7.5 TBD: Endline Survey