

**Up in Smoke:
The Influence of Household Behavior
on the Long-Run Impact of Improved Cooking Stoves ***

Rema Hanna
Esther Duflo
Michael Greenstone

WEB APPENDIX

NOT FOR PUBLICATION

A. Data Collection

In this section, we provide a comprehensive description of our data collection processes. As shown in Appendix Figure 3, we collected baseline data from January to July 2006, prior to the rollout of the intervention.¹ The baseline survey consisted of several modules. First, we conducted a comprehensive household module to collect data on household composition (size, as well as each member's age, sex, and relationship to the household head), demographics (education levels, caste, religion), economic indicators (asset ownership, indebtedness), and consumption patterns. As part of this module, we also collected information on the households' stove types, stove usage, housing construction, and fuel use. After the household module was administered, each member of the family was individually interviewed. For each child under the age of 14, his or her primary care-giver answered a child module on his or her behalf. In this module, we collected detailed data on stove use, such as how many meals an individual cooked that week, as well as a series of recall questions that were designed to gauge both respiratory and general health. For example, we collected data on whether one had a cough in the last 30 days, whether one had a fever in the last 30 days, and health expenditures. In addition, to understand the relationship between indoor air pollution and productivity, we collected detailed data on employment status and time-use patterns for adults over the last 24-hours, and school enrollment and attendance for children.

In the third, and last, component of the baseline survey, a specially trained enumeration

¹ From June to November 2007, we conducted the baseline for the five villages that we added to the study.

team conducted a physical health check for each household member (both adults and children).² The examination included detailed biometric measurements, such as height, weight, and arm circumference. Most importantly, the examination included two tests designed to gauge exposure to smoke and respiratory functioning. First, to gauge smoke exposure, the team measured carbon monoxide (CO) in exhaled breath with a Micro Medical CO monitor.³ CO is a biomarker of recent exposure to air pollution from biomass combustion, and therefore it can be used to proxy an individual's personal exposure to smoke from cooking stoves.

Second, we administered spirometry tests, which are designed to gauge respiratory health by measuring how much air the lungs can hold and how well the respiratory system can move air in and out of the lungs.⁴ The tests were conducted using guidelines from both the equipment directions and American Association for Respiratory Care.⁵

After the initial lotteries were conducted and the stoves were built, we conducted the Continuous Health Survey (CHS) from January 2007 to June 2008. Each household was visited once. The survey consisted of two key modules. The first module was a household survey, in which we collected data on whether individuals used the new stoves, whether the stoves were used properly, whether individuals cleaned the stoves, and questions to gauge user satisfaction with the stoves. This module also included recall questions on health for each household member. Finally, we collected information on employment and school attendance in the last 30

² The baseline survey was conducted by an outside survey company, while the baseline health checks were conducted by an internally hired and trained team. Therefore, the health checks were conducted on a different schedule as the main survey.

³ Note that we did not measure ambient pollutants (either CO or PM). Ambient measures are less interesting to measure than exposure measures, as individuals may undertake fewer behaviors to protect themselves from smoke if ambient measures fall and could, in fact, end up with a higher level of exposure. If we conducted only ambient measures we would see a decline, even though their actual exposure may not have decreased due to behavioral changes. We focused on CO, which has been argued to be a good proxy for PM. Collecting data on PM exposure is difficult in this setting: tubes must be attached to the subjects for 24 hours and the equipment requires controlled temperature, careful transferring of samples, and proper laboratories for testing. Given the conditions of rural Orissa, controlling the samples would be near impossible at such a large scale. However, McCracken and Smith (1998) report a strong correlation between the average concentrations of CO and PM_{2.5} in the kitchen during water boiling tests. They conclude that this implies “the usefulness of CO measurements as an inexpensive way of estimating PM_{2.5} concentrations,” even if it is not an exact proxy (see Ezzati [2002] for a discussion of this).

⁴ In contrast to peak flow tests, which are easier to administer, spirometry readings can be used to diagnose obstructive lung disorders (such as chronic obstructive pulmonary disease [COPD] and asthma), and also restrictive lung disorders. Further, they are the only way to obtain measurements of lung function that are comparable across individuals (Beers et al., 1999).

⁵ A manual spirometer was used in the baseline, continuous health survey (CHS), and a portion of the midline. The enumerators would take up to seven readings for each individual, until there were at least three satisfactory readings and at least two FEV1 readings within 100mL or 5 percent of each other. Electronic spirometers were adopted halfway through the midline. The new machines indicated when satisfactory readings had been completed and saved the best reading for each individual.

days to gauge the impact of the respiratory health on productivity. The second module consisted of the same physical health exam used in the baseline survey. However, for this survey, we only conducted the health exam for women and children.⁶

From May 2008 to December 2009, we conducted the midline survey. This survey replicated the baseline survey, collecting data on stove use, recall health, and productivity. As part of this survey, we also conducted the health examination for all household members (men, women, and children). Finally, the endline survey was conducted from February to December 2010. The endline survey was very similar to the baseline and midline, covering most of the questions that were in these surveys, with some modifications based on our experiences in the last two surveys. Specifically, we shortened the time use and household sections, and we added more comprehensive questions on infant mortality and pregnancy outcomes. Most importantly, we added a section on cooking and maintenance practices with the improved stoves (e.g., do households clean the stove, do households cover both pots when cooking, do households clean the chimney) and beliefs about the stove (e.g., whether they used more fuel, why they would recommend it).

In addition to the main surveys, we conducted village sweeps from May 2007 to January 2010 to collect data on recent births. Specifically, we tracked pregnancies that occurred during the scope of the study and then followed up on birth outcomes. However, we were often prevented from gathering data soon after each birth because many women relocate to their parents' home in the late stages of pregnancy and road conditions were poor during periods of monsoons. Therefore, we suspended the pregnancy sweeps before the endline survey (that started in February 2010) and instead collected the rest of these data during the endline survey.

Besides the large-scale surveys, we conducted a number of shorter surveys to assess stove ownership, repairs, and costs more frequently. In March and July of 2007, we conducted our first sweeps to assess which households built a stove after Lottery 1 and whether that stove was in good condition. We conducted these surveys and the two other similar stove surveys at the same time as the CHS. The first Chulha Monitoring Survey (CMS) was administered from August 2007 to January 2008 and the first Stove Survey (SS) was conducted in April 2008. Both surveys asked households if they had built an improved stove, why they did not build one if they

⁶ Given that we were only able to visit each household once and that men are more difficult to find at home, including men would have been a challenge due to attrition.

had not, and the current condition of the stove if they had. The CMS additionally obtained information on whether stove owners used their stove properly and their perception of fuel and time efficiency of the stove compared to the traditional stove. The second round of the CMS overlapped with the midline survey administration and was conducted between March and December 2009. Finally, the second round of the SS was completed between January and May 2010, during the beginning of the endline survey administration.

Note that we also meticulously collected data on stove breakages, repairs and costs for both traditional and improved stoves in a stove cost survey that was administered concurrently with both the midline and endline surveys.⁷

Lastly, throughout the project we also collected administrative data on the functioning of this Gram Vikas program. Specifically, we collected data on lottery participation and the lottery outcomes in each village.

B. Experimental Validity: Details

In this section, we provide a more detailed description of experimental validity tests. Appendix Table 2A and 2B provide a test of the randomization for the baseline demographics, stove and fuel use, and health for those identified as primary cooks and children in the baseline. In Columns 1, 2, and 3 of both tables, we present the mean of each variable for the households that were assigned to the pure control group (those who never won a lottery), Lottery 1 winners, and Lottery 2 winners, respectively. Standard deviations are listed below the means in parentheses. The difference in means between the Lottery 1 winners and the control group are presented in Column 4, differences between Lottery 2 winners and the control group are listed in Column 5, and differences between Lottery 1 and Lottery 2 winners are presented in Column 6, conditional on village fixed effects. Standard errors that are clustered at the household level are shown in parentheses in Columns 4–6. In the final row of each panel we provide the p-value for a test of joint significance of the difference across each outcome variable.

The treatment groups appear to be generally well-balanced across the 59 baseline characteristics that we consider. Out of the 177 differences in Columns 4–6 of both tables, only

⁷ We additionally administered a cost survey to shopkeepers to collect information on the market price, product life, and repair costs for other clean stoves (i.e., LPG, mini-LPG, kerosene, and electric heaters). The addition of the Gram Vikas cost survey in the endline provides additional data on the price of different pipes used for constructing the improved stoves, and how much each household pays construction workers for their services.

19 (or 10 percent) are significant at the 10 percent level or more, as would be predicted by chance. There are some notable differences in health characteristics: difference in any illness for primary cooks between Lottery 2 and the control (Column 5) and Lottery 1 and Lottery 2 (Column 6), as well as differences in whether a child had a cough in the last 30 days between Lottery 1 and both the control (Column 1) and Lottery 2 (Column 6). However, in testing the joint significance of health differences for primary cooks and children, only one of the set of six differences is significant at the 10 percent level or more (the difference between Lottery 1 and Lottery 2 for primary cooks). Despite the fact that the data appear well-balanced, to increase precision in the ensuing analysis on the effect of the stoves on CO exposure and health, we will condition the regressions on the baseline values (although note that, in practice, controlling for the baseline values does not alter the magnitude nor significance of our estimates).⁸

In Appendix Table 3, we test for differential attrition in each of the four main surveys (baseline, CHS, midline, and endline). In each of the odd columns, we present the coefficient estimates when we regress a dummy variable for survey attrition on the treatment dummy. In the even columns, we present coefficient estimates from regressing an interaction of the treatment dummy with a set of indicator variables for survey round. In Columns 1 and 2, we study household attrition, while in the remaining columns we test for attrition within the sample of individuals. All regressions are clustered at the household level and include village by survey fixed effects. On average, we do not observe a significant difference in survey attrition for households (Column 1) and note that the magnitude of this coefficient estimate is also near zero. Further, we do not observe significant differences across any of the four main survey waves (Column 2). For individuals (females, primary cooks and children), we only observe a small, significant difference in attrition for primary cooks in the CHS and children in the baseline (significant at the 10 percent level). In total, out of the twenty differences that we explore in this table only two are significant at the 10 percent level, which is what one would expect by chance. These findings suggest that differential attrition is not a source of bias in the analysis.

⁸ The results for women are similar to those of primary cooks. Out of the 39 differences (13 variables times three differences) we explore for women, only four are significant (or 10 percent, which is what would be predicted by chance). We omit them for brevity, as our subsequent health analysis will be primarily centered on primary cooks. However, they are available upon request.

Appendix Table 1: Cross-Sectional Analysis between the Number of Meals Cooked during Last Week with a Clean Stove and Baseline Smoke Exposure and Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
<i>Panel A: Primary Cooks</i>															
	Carbon Monoxide	FEV1	FEV1/FVC * 100	BMI	Cough or Cold	Sore Eyes	Headache	Phlegm	Wheeze	Tight Chest	Any Illness	Health Exp.			
Meals	-0.008 (0.039)	0.004 (0.003)	0.100** (0.042)	0.062*** (0.017)	-0.005 (0.003)	-0.009*** (0.002)	0.002 (0.003)	-0.000 (0.002)	-0.001** (0.000)	-0.001 (0.001)	-0.000 (0.002)	1.830 (1.365)			
N	2,001	1,685	1,646	2,127	2,464	2,464	2,464	2,463	2,463	2,463	2,464	2,214			
<i>Panel B: Children Aged 13 and Under in the Baseline</i>															
	Carbon Monoxide	BMI	Cough	Consult for Fever	Skin Earache	Skin Infection	Vomit	Weakness	Abdominal Pain	Hearing Problems	Vision Problems	Worms	Diarrhea	Any Illness	Health Exp.
Meals	-0.124*** (0.047)	0.006 (0.009)	-0.003 (0.003)	0.000 (0.003)	0.002 (0.002)	0.000 (0.002)	0.000 (0.001)	-0.000 (0.003)	0.000 (0.002)	0.000 (0.000)	0.001 (0.001)	0.004* (0.002)	-0.001 (0.001)	-0.002 (0.003)	0.010 (0.562)
N	507	2,659	3,293	3,232	3,293	3,292	3,293	3,292	3,292	3,293	3,293	3,289	3,293	3,293	3,199

Notes: This table provides the coefficients from a regression of each variable listed in the table on the number of meals cooked with a clean stove at time of baseline. All regressions are estimated using OLS, include village x month of survey x year of survey fixed effects, and standard errors are clustered at the household level. For continuous variables, the top 1 percent of values are dropped. BMI for children is standardized using values from the 2000 US CDC Population of Children. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2A: Randomization Check for Baseline Demographic Characteristics and Stove Use

	Means			Differences, Conditional on Village FE		
	Control (1)	Lottery1 (2)	Lottery2 (3)	Lottery1 - Control (4)	Lottery2 - Control (5)	Lottery1 - Lottery2 (6)
<i>Panel A: Demographics</i>						
Household Size	6.41 [3.18]	6.73 [3.78]	6.58 [3.52]	0.3548** (0.1591)	0.2979* (0.1634)	0.1802 (0.1787)
Monthly Per Capita Household Expenditures	470.10 [295.12]	475.05 [306.29]	483.36 [296.15]	9.5308 (13.8150)	16.3650 (14.6623)	-10.3258 (14.9032)
Minority Household (Scheduled Caste or Tribe)	0.40 [0.49]	0.42 [0.49]	0.48 [0.50]	-0.0225** (0.0114)	0.0006 (0.0124)	-0.0241* (0.0125)
Has Electricity in Household	0.47 [0.50]	0.48 [0.50]	0.46 [0.50]	0.0262 (0.0204)	0.0180 (0.0212)	0.0102 (0.0211)
Male Head Ever Attended School	0.71 [0.45]	0.71 [0.45]	0.66 [0.47]	0.0093 (0.0217)	-0.0239 (0.0248)	0.0264 (0.0245)
Male Head Literate	0.62 [0.49]	0.58 [0.49]	0.54 [0.50]	-0.0178 (0.0249)	-0.0433 (0.0270)	0.0183 (0.0273)
Female Head Ever Attended School	0.31 [0.46]	0.34 [0.47]	0.30 [0.46]	0.0401* (0.0224)	-0.0030 (0.0232)	0.0319 (0.0233)
Female Head Literate	0.21 [0.40]	0.21 [0.41]	0.18 [0.39]	0.0086 (0.0201)	-0.0193 (0.0204)	0.0156 (0.0204)
Female Has a Savings Account	0.64 [0.48]	0.69 [0.46]	0.70 [0.46]	0.0353 (0.0222)	0.0311 (0.0229)	0.0012 (0.0228)
P-value from Joint Test				0.09	0.79	0.31
<i>Panel B: Baseline Stove Characteristics and Fuel Use</i>						
Traditional Stove	0.989865 [0.10]	1.00 [0.07]	0.99 [0.10]	0.0047 (0.0042)	-0.0014 (0.0052)	0.0051 (0.0044)
Any Type of "Clean Stove"	0.228604 [0.42]	0.24 [0.43]	0.23 [0.42]	0.0176 (0.0192)	0.0041 (0.0199)	0.0028 (0.0199)
Improved Stove	0.012387 [0.11]	0.01 [0.10]	0.01 [0.07]	-0.0012 (0.0051)	-0.0026 (0.0049)	0.0038 (0.0044)
Kerosene	0.109234 [0.31]	0.10 [0.31]	0.10 [0.29]	-0.0034 (0.0148)	-0.0156 (0.0153)	0.0080 (0.0150)
Biogas	0.030405 [0.17]	0.03 [0.16]	0.03 [0.17]	-0.0045 (0.0070)	-0.0037 (0.0074)	-0.0049 (0.0072)
LPG	0.03491 [0.18]	0.05 [0.21]	0.05 [0.22]	0.0124 (0.0094)	0.0116 (0.0101)	0.0030 (0.0109)
Electric	0.095721 [0.29]	0.12 [0.32]	0.11 [0.31]	0.0270** (0.0137)	0.0144 (0.0141)	0.0079 (0.0147)
Coal	0.004505 [0.07]	0.00 [0.05]	0.01 [0.07]	-0.0022 (0.0029)	0.0002 (0.0036)	-0.0025 (0.0032)
Cooked Most Meals with Traditional Stove in Last Week	0.941379 [0.24]	0.93 [0.26]	0.92 [0.28]	-0.0135 (0.0115)	-0.0219* (0.0125)	0.0083 (0.0132)
Meals Cooked Last Week	13.64567 [4.34]	13.82 [4.02]	13.80 [3.77]	0.1659 (0.2018)	0.2457 (0.2069)	-0.0444 (0.1977)
Meals Cooked Last Week with Traditional Stove	12.63883 [4.82]	12.59 [4.53]	12.59 [4.57]	-0.0138 (0.2209)	0.0867 (0.2332)	-0.0994 (0.2260)
% Primary Cook Female	0.33 [0.47]	0.31 [0.46]	0.32 [0.47]	-0.0138 (0.0132)	-0.0078 (0.0141)	-0.0077 (0.0138)
Meals Cooked in Open Area Last Week	7.40 [7.06]	7.28 [7.17]	7.72 [7.31]	-0.0779 (0.3294)	0.4041 (0.3475)	-0.4473 (0.3524)
Meals Cooked in Semi-open Area Last Week	5.06 [7.03]	5.18 [6.84]	5.03 [6.68]	0.0744 (0.3140)	-0.0465 (0.3254)	0.1195 (0.3255)
Meals Cooked in Enclosed Area Last Week	0.83 [3.19]	0.94 [3.27]	0.79 [3.05]	0.0956 (0.1551)	-0.0781 (0.1578)	0.1429 (0.1605)
Ever Use Wood	0.98 [0.14]	0.99 [0.09]	0.99 [0.12]	0.0091 (0.0057)	0.0023 (0.0066)	0.0090* (0.0053)
Minutes Spent Gathering Wood Yesterday (if gathered wood)	39.17 [153.17]	34.49 [122.92]	30.85 [124.02]	-5.4793 (6.0091)	-8.6115 (6.2671)	2.5935 (5.0401)
Wood Used for Last Meal (in kg)	4.96 [6.13]	5.10 [7.04]	4.80 [5.57]	0.4617 (0.4799)	0.3894 (0.4716)	-0.3731 (0.5133)
Meals Per Bundle of Wood	5.19 [7.23]	5.04 [6.06]	4.88 [8.38]	-0.0204 (0.3554)	-0.0561 (0.4300)	-0.0551 (0.4002)
Household Gathers Wood	0.82 [0.39]	0.87 [0.34]	0.81 [0.39]	0.0369** (0.0162)	-0.0170 (0.0178)	0.0541*** (0.0170)
Ever Bought Wood	0.37 [0.48]	0.33 [0.47]	0.36 [0.48]	-0.0195 (0.0195)	0.0117 (0.0202)	-0.0199 (0.0203)
Ever Sold Wood	0.20 [0.40]	0.19 [0.39]	0.21 [0.41]	-0.0117 (0.0139)	-0.0100 (0.0146)	-0.0015 (0.0142)
P-values from Joint Test				0.23	0.90	0.29

Appendix Table 2B: Randomization Check for Baseline CO and Health

	Means			Differences, Conditional on Village FE		
	Control (1)	Lottery1 (2)	Lottery2 (3)	Lottery1 - Control (4)	Lottery2 - Control (5)	Lottery1 - Lottery2 (6)
<i>Panel A: Primary Cooks</i>						
Carbon Monoxide	7.91 [6.59]	7.53 [5.68]	7.88 [6.46]	-0.4293 (0.3313)	0.1240 (0.3749)	-0.6220* (0.3307)
FEV1	1.97 [0.37]	1.97 [0.37]	1.96 [0.37]	0.0102 (0.0219)	-0.0006 (0.0231)	0.0055 (0.0228)
FVC	2.30 [0.45]	2.32 [0.44]	2.28 [0.42]	0.0235 (0.0261)	0.0028 (0.0272)	0.0152 (0.0264)
FEV1/FVC	89.54 [5.92]	89.60 [6.52]	89.79 [5.89]	-0.0816 (0.3541)	-0.1892 (0.3612)	0.0325 (0.3786)
BMI	19.04 [2.49]	18.78 [2.55]	18.86 [2.50]	-0.1665 (0.1241)	0.0078 (0.1332)	-0.2254* (0.1293)
Cold or Cough	0.53 [0.50]	0.49 [0.50]	0.54 [0.50]	-0.0351 (0.0241)	0.0230 (0.0251)	-0.0513** (0.0249)
Any Illness	0.85 [0.36]	0.84 [0.36]	0.91 [0.29]	-0.0054 (0.0174)	0.0541*** (0.0166)	-0.0594*** (0.0164)
Phlegm	0.14 [0.35]	0.12 [0.32]	0.13 [0.34]	-0.0194 (0.0161)	-0.0008 (0.0174)	-0.0102 (0.0168)
Headache	0.51 [0.50]	0.48 [0.50]	0.49 [0.50]	-0.0316 (0.0237)	-0.0296 (0.0249)	0.0015 (0.0251)
Sore eyes	0.29 [0.46]	0.27 [0.45]	0.28 [0.45]	-0.0132 (0.0215)	0.0044 (0.0225)	-0.0095 (0.0224)
Wheezing	0.01 [0.12]	0.01 [0.10]	0.01 [0.10]	-0.0028 (0.0051)	-0.0013 (0.0053)	-0.0028 (0.0048)
Tightness in Chest	0.04 [0.20]	0.04 [0.21]	0.05 [0.21]	0.0028 (0.0099)	0.0030 (0.0105)	-0.0054 (0.0102)
Total Health Expenditures	70.49 [187.88]	73.68 [182.08]	66.38 [180.75]	4.8840 (9.5248)	-2.9045 (9.5478)	7.4965 (9.4762)
P-value from Joint Test				0.212	0.528	0.054
<i>Panel B: Children Under Aged 13</i>						
Carbon Monoxide	6.63 [5.48]	5.90 [4.74]	6.89 [5.55]	-0.4398 (0.5464)	0.2126 (0.7118)	-0.7463 (0.6406)
BMI	-1.82 [1.30]	-1.89 [1.30]	-1.85 [1.27]	-0.0479 (0.0704)	0.0342 (0.0732)	-0.0772 (0.0707)
Cough	0.39 [0.49]	0.42 [0.49]	0.38 [0.49]	0.0517** (0.0239)	-0.0026 (0.0255)	0.0590** (0.0243)
Consulted for Fever	0.28 [0.45]	0.25 [0.43]	0.28 [0.45]	-0.0256 (0.0202)	-0.0204 (0.0221)	-0.0137 (0.0212)
Earache	0.09 [0.28]	0.09 [0.29]	0.09 [0.28]	0.0102 (0.0130)	0.0024 (0.0139)	0.002 (0.0140)
Skin	0.13 [0.34]	0.14 [0.34]	0.13 [0.34]	0.0120 (0.0164)	0.0009 (0.0168)	0.0072 (0.0164)
Any Illness	0.73 [0.44]	0.73 [0.44]	0.74 [0.44]	-0.0007 (0.0222)	-0.0102 (0.0227)	-0.0032 (0.0222)
Vision Problems	0.01 [0.12]	0.01 [0.10]	0.01 [0.11]	-0.0038 (0.0046)	-0.0004 (0.0046)	-0.0011 (0.0046)
Hearing Problems	0.01 [0.11]	0.02 [0.12]	0.01 [0.10]	0.0031 (0.0049)	-0.0034 (0.0047)	0.0094* (0.0051)
Vomiting	0.07 [0.25]	0.08 [0.27]	0.09 [0.28]	0.0094 (0.0115)	0.0116 (0.0124)	-0.0026 (0.0129)
Diarrhea	0.07 [0.26]	0.08 [0.27]	0.08 [0.27]	-0.0022 (0.0118)	-0.0082 (0.0129)	0.0091 (0.0124)
Abdominal Pain	0.14 [0.35]	0.15 [0.35]	0.14 [0.35]	0.0039 (0.0162)	0.0008 (0.0172)	0.0078 (0.0166)
Worms	0.09 [0.28]	0.11 [0.31]	0.09 [0.28]	0.0165 (0.0144)	-0.0108 (0.0158)	0.0209 (0.0157)
Weakness	0.21 [0.41]	0.21 [0.41]	0.22 [0.42]	-0.0100 (0.0192)	-0.0062 (0.0215)	-0.0066 (0.0203)
Total Health Expenditures	44.61 [101.22]	48.89 [99.72]	45.26 [106.05]	4.9607 (4.6885)	0.7712 (5.2102)	3.7218 (5.0337)
P-value from Joint Test				0.777	0.834	0.775

Appendix Table 3: Testing for Survey Attrition

	<i>Household</i>		<i>Primary Cooks</i>		<i>Children</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.001 (0.006)		0.003 (0.008)		0.011 (0.010)	
Treat * Baseline		0.004 (0.006)		-0.001 (0.002)		0.031* (0.017)
Treat * CHS		0.011 (0.010)		0.030** (0.014)		-0.001 (0.012)
Treat * Midline		-0.007 (0.009)		-0.009 (0.016)		0.003 (0.017)
Treat * Endline		-0.004 (0.010)		-0.010 (0.017)		0.012 (0.016)
N	10,296	10,296	10,012	10,012	25,948	25,948
Control Group Mean	0.0670	0.0670	0.136	0.136	0.354	0.354

Notes: This table provides results on whether there exists differential survey attrition by treatment status. The dependent variable is a dummy variable that indicates whether the household (or individual) was not included in the survey. CHS is the continuous health survey conducted between the baseline and midline survey. All regressions include village x survey fixed effects and standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: Reasons for Not Having a Stove, by Year of Stove Being Offered in Your Village

	Year 1	Year 2	Year 3	Year 4
	(1)	(2)	(3)	(4)
Insufficient Kitchen Space/Family Size and Stove Do Not Match	0.28	0.34	0.22	0.19
Does Not Want A Double Pot	0.01	0.02	0.02	0.01
Already Owns a Better Stove	0.06	0.08	0.03	0.04
Will Build Soon	0.27	0.21	0.38	0.15
Not Interested in Building	0.07	0.15	0.06	0.26
Destroyed by User	0.02	0.06	0.23	0.32
Other	0.24	0.11	0.06	0.04

Notes: This table provides information on why households did not have a stove, by years since stove was offered in their village.

Appendix Table 5: Heterogeneity in Effects

	Carbon Monoxide			
	Gram Vikas Improved Stove at Time of Survey (1)	Number of Meals Cooked with any Good Condition, Low- Polluting Stove (2)	Primary Cooks (3)	Children (4)
<i>Panel A: Improved Stove in HH at Baseline</i>				
Treat * Stove in HH	-0.101*** (0.025)	-1.333*** (0.421)	0.514 (0.436)	-0.431 (0.416)
<i>Panel B: Below Median per capita Consumption</i>				
Treat * Below Median per capita Consumptio	-0.015 (0.021)	0.202 (0.334)	-0.138 (0.374)	0.426 (0.344)
<i>Panel C: HH Head Any Education</i>				
Treat * HH Head Any Education	-0.017*** (0.003)	-0.116** (0.052)	0.061 (0.053)	-0.001 (0.052)
<i>Panel D: HH Head Any Education (binary)</i>				
Treat * HH Head Any Education (binary)	-0.075*** (0.022)	-0.312 (0.349)	0.677* (0.378)	0.064 (0.350)
<i>Panel E: Low Caste/Tribe</i>				
Treat *Low Caste/Tribe	0.089*** (0.022)	1.610*** (0.348)	-0.208 (0.399)	-0.093 (0.371)

Appendix Table 6: Reduced Form Effect of Stoves on Male Smoking

	Male Smokes (1)
<i>Panel A: Overall Treatment Effect</i>	
Treat	0.009 (0.009)
<i>Panel B: By Months Since Stove Construction</i>	
Treat x I(0 to 12 mo)	0.012 (0.014)
Treat x I(13 to 24 mo)	-0.014 (0.020)
Treat x I(25 to 36 mo)	0.014 (0.013)
Treat x I(37 to 48 mo)	0.014 (0.015)
N	5,618
Control Group Mean	0.120

Appendix Table 7: Exploring Possible Spillovers

	Total Number of Meals Cooked (1)	Number of People Cooked for (2)	Number of Minutes Spent Cooking at Arm's Length (3)
Treat	-0.108 (0.392)	0.082 (0.112)	-0.431 (0.816)
N	4,663	2,677	2,625
Control Group Mean	19.86	4.742	31.84

Notes: Using data from the midline survey, we explore the effect of being on the treatment group on the number of minutes spent cooking at arm's length of the stove and the number of household members cooked for. We control for the baseline value of the variable for additional power. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 8: Reduced Form Effect of Program on the Health, Additional Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A: Primary Cooks</i>									
	Sore Eyes	Headache	Phlegm	Wheeze	Tight Chest	BP - Systolic	BP - Diastolic		
Treat	-0.005 (0.010)	-0.005 (0.015)	0.007 (0.008)	-0.001 (0.002)	-0.005 (0.004)	0.608 (0.656)	-0.013 (0.428)		
N	5,323	5,323	3,571	3,569	3,569	3,079	3,079		
Control Group Mean	0.111	0.358	0.0534	0.00495	0.0171	111.6	73.35		
<i>Panel B: Children Aged 13 and Under in the Baseline</i>									
	Earache	Skin Infection	Vomit	Weakness	Abdominal Pain	Hearing Problems	Vision Problems	Worms	Diarrhea
Treat	-0.004 (0.004)	0.001 (0.005)	0.008 (0.005)	-0.001 (0.008)	0.008 (0.008)	-0.000 (0.001)	0.004*** (0.001)	0.004 (0.005)	0.003 (0.008)
N	10,350	10,350	6,961	6,960	6,959	6,957	6,956	6,522	6,959
Control Group Mean	0.0346	0.0421	0.0343	0.0706	0.0764	0.00200	0.00143	0.0265	0.0718

Notes: This table provides the reduced form effect of being offered a GV stove on health. All regressions in Panel A - B are estimated using OLS, include village x month of survey x year of survey fixed effects, and standard errors are clustered at the household level. For all variables except blood pressure, we additionally include the baseline value. For continuous variables, the top 1 percent of values are dropped. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 9: Summary of RESPIRE Findings

Outcome (1)	Study (2)	Estimate			Adjusted Estimate			Imputed Data		
		Point Estimate (3)	P-Value (4)	95% Confidence Interval (5)	Point Estimate (6)	P-Value (7)	95% Confidence Interval (8)	Point Estimate (9)	P-Value (10)	95% Confidence Interval (11)
<i>A. Smoke Exposure</i>										
Carbon Monoxide Passive Diffusion Tubes: Child	(1)	-52%		[- 56, -47]						
Carbon Monoxide Passive Diffusion Tubes: Mother	(1)	-61%		[- 65, -57]						
Continuous Carbon Monoxide Monitors	(1)	-90%		[-92, -87]						
PM 2.5	(2)	-61%								
<i>B. Lung Functioning</i>										
FEV (6, 12 and 18 months) (5)	(5)	-0.02		[- 0.09, 0.04]						
FVC (6, 12 and 18 months) (5)	(5)	-0.04		[- 0.01, 0.03]						
(FEV1:FVC) *100 (6, 12, and 18 months) (5)	(5)	0.41		[-0.44, 1.27]						
<i>C. Blood Pressure</i>										
SBP Estimate (2)	(2)	-2.3	0.30	[-6.6, 2.0]	-3.7	0.10	[-8.1, 0.6]			
DBP Estimate (2)	(2)	-2.2	0.09	[-4.7, 0.3]	-3.0	0.02	[-5.7, -0.4]			
<i>D. Infant Outcomes</i>										
Mean Birth Weight (3)	(3)	68	0.28	[-56, 191]	89	0.13	[-27, 204]			
Low Birth Weight Odds Ratio (3)	(3)				0.74		[0.33, 1.66]			
<i>E. Pneumonia and RSV Incidence for Children</i>										
Field Worker Assessed Pneumonia Rate Ratio	(4)	0.91	0.39	[0.74, 1.13]						
Field Worker Assessed Severe Pneumonia Rate Ratio	(4)	0.56	0.04	[0.32, 0.97]						
Clinical Pneumonia Rate Ratio All	(4)	0.84	0.257	[0.63, 1.13]				0.78	0.095	[0.59, 1.06]
Clinical Pneumonia Rate Ratio hypoxemic	(4)	0.74	0.128	[0.50, 1.09]				0.67	0.042	[0.45, 0.98]
Clinical Pneumonia Rate Ratio CXR confirmed	(4)	0.87	0.586	[0.52, 1.45]				0.74	0.231	[0.42, 1.15]
Clinical Pneumonia Rate Ratio CXR hypoxemic	(4)	0.8	0.505	[0.41, 1.56]				0.68	0.234	[0.36, 1.33]
RSV(-)	(4)	0.91	0.598	[0.63, 1.30]				0.79	0.192	[0.53, 1.07]
RSV(-) hypoxemic	(4)	0.61	0.066	[0.35, 1.03]				0.54	0.026	[0.31, 0.91]
RSV(+)	(4)	0.94	0.801	[0.59, 1.49]				0.76	0.275	[0.42, 1.16]
RSV(+) hypoxemic	(4)	1.05	0.867	[0.60, 1.83]				0.87	0.633	[0.46, 1.51]
<i>F. Self Reported Symptoms</i>										
Cough (4) (7)	(5)			NS						
Chronic Cough (4) (7)	(5)			NS						
Phlegm (4) (7)	(5)			NS						
Chronic Phlegm (4) (7)	(5)			NS						
Wheeze (Relative Risk) (4)	(5)	0.42		[.25, .70]						
Tightness in Chest (4) (7)	(5)			NS						
Number of Symptoms (Odds Ratio)	(5)	0.7	0.03	[.50, .97]						
% Sore Eyes in Past Month (6 Month) (6) (7)	(6)	-19.00		S						
% Sore Eyes in Past Month (12 Month) (6) (7)	(6)	-26.10		S						
% Sore Eyes in Past Month (18 Month) (6) (7)	(6)	-26.20		S						
% Headache in Past Month (6 Month) (6) (7)	(6)	0.00		NS						
% Headache in Past Month (12 Month) (6) (7)	(6)	-7.10		NS						
% Headache in Past Month (18 Month) (6) (7)	(6)	-20.30		S						
% Back pain in Past Month (6 Month) (6) (7)	(6)	-0.20		NS						
% Back pain in Past Month (12 Month) (6) (7)	(6)	-2.00		NS						
% Back pain in Past Month (18 Month) (6) (7)	(6)	-7.30		NS						

Notes:

- (1) Adjusted implied controls for the number of minutes the tubes were worn.
- (2) Adjusted for age, BMI, daily average apparent temperature, rainy season, day of week, time of day, use of a temascal, having household electricity, an asset index, ever smoking, SHS exposure, and a random effect
- (3) Adjusted for maternal height, gravidity, maternal diastolic blood pressure, and season of birth.
- (4) Information on point estimate and p-values are unavailable.
- (5) Paper also reports results for just 12 and 18 months of follow-up and finds similar results. These are omitted from the table for brevity.
- (6) The Mann-Whitney U test was used for testing the significance of differences.
- (7) "NS" means not significant; "S" means significant.

Appendix Figure 1: Traditional and Gram Vikas Improved Stoves

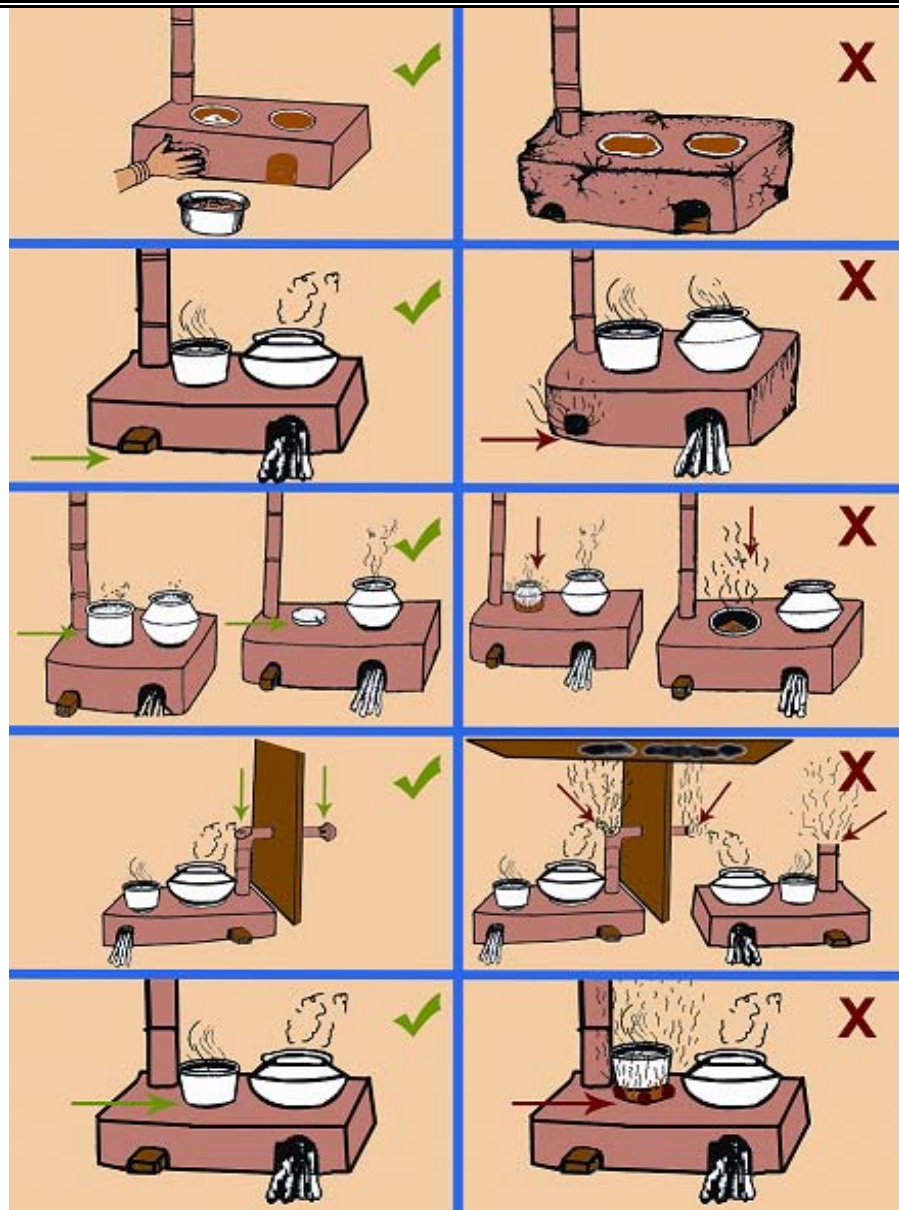
Panel A: Traditional Stove



Panel B: Gram Vikas Improved Stove



Appendix Figure 2: Example of Gram Vikas Training Material



Appendix Figure 3: Timeline of Major Surveys and Construction

	2006												2007											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Baseline																								
Lottery 1 Stove Construction																								
CHS																								
Pregnancy Survey																								
Midline																								
Lottery 2 Stove Construction																								
Endline																								

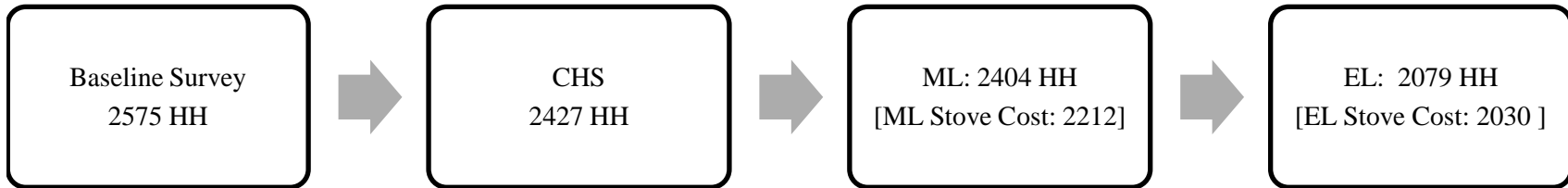
	2008												2009											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Baseline																								
Lottery 1 Stove Construction																								
CHS																								
Pregnancy Survey																								
Midline																								
Lottery 2 Stove Construction																								
Endline																								

	2010											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Baseline												
Lottery 1 Stove Construction												
CHS												
Pregnancy Survey												
Midline												
Lottery 2 Stove Construction												
Endline												

Notes: This table provides a timeline of each major survey we conducted during the course of the project, as well as a timeline of the lotteries and intervention. CHS is the continuous health survey that we conducted between the baseline and midline surveys.

Appendix Figure 4: Household Sample Sizes, By Survey

Panel A: Primary Household and Health Surveys

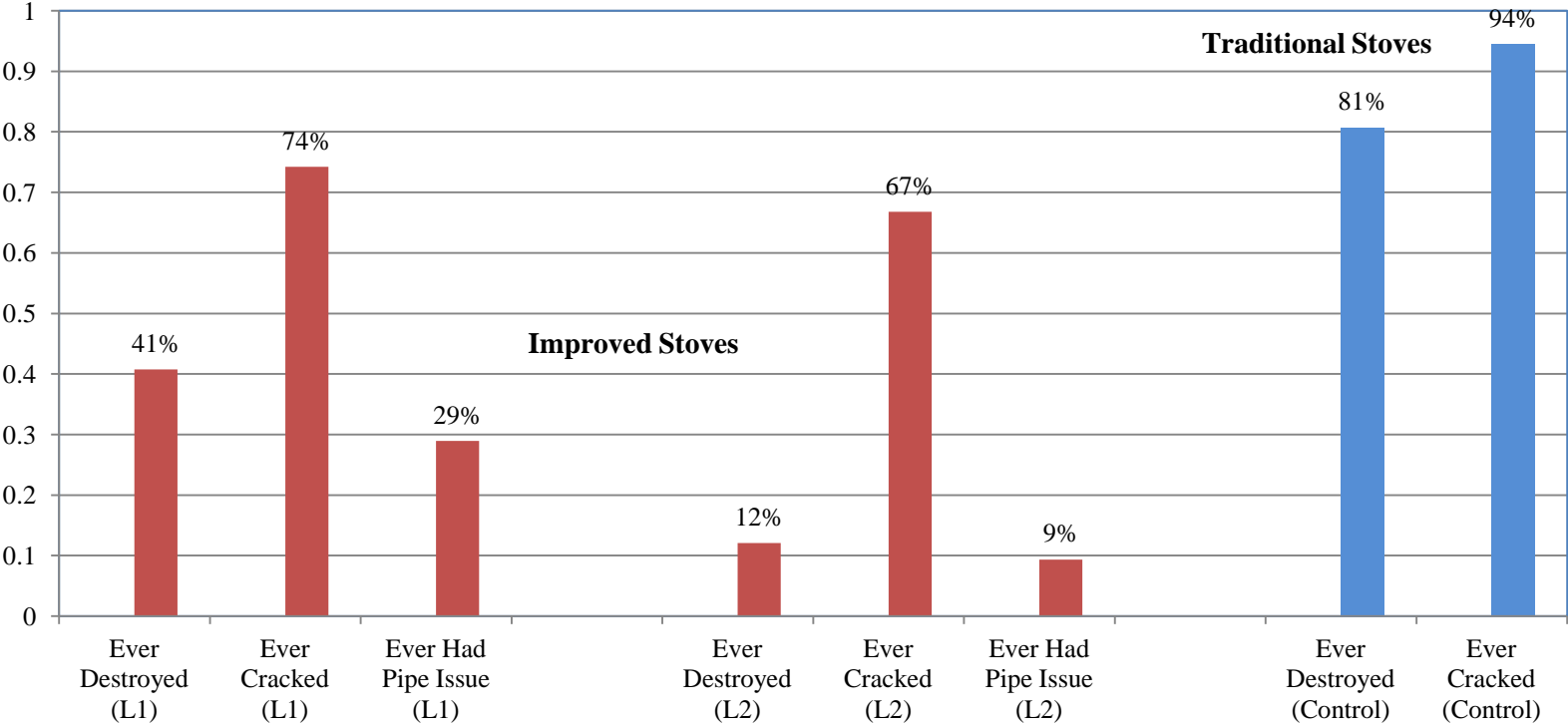


Panel B: Primary Surveys on the Condition of the Stove

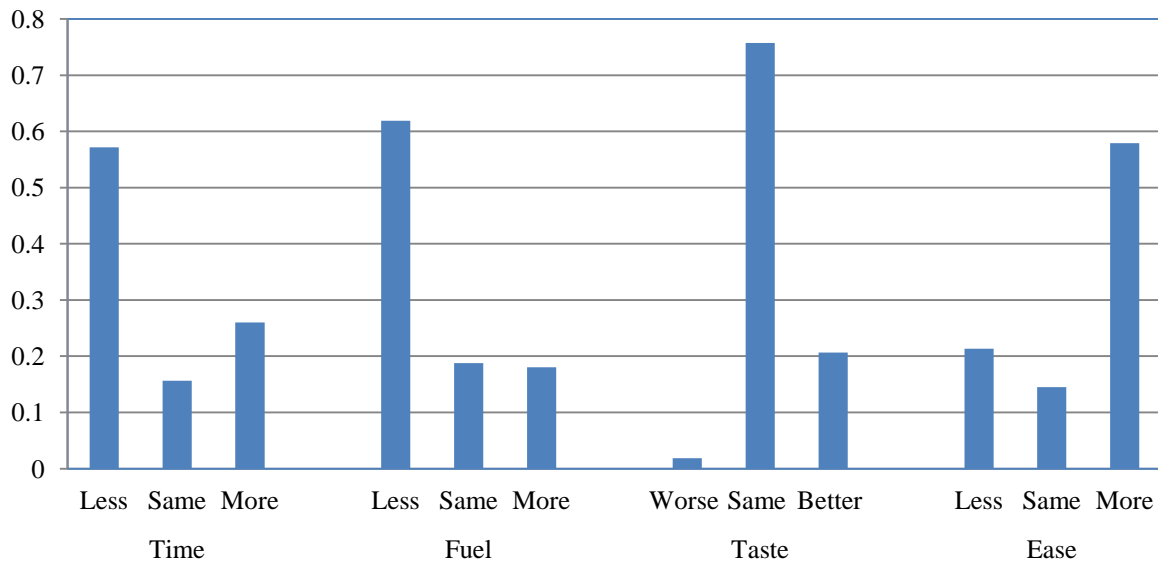


Notes: This table documents the majority of surveys that were conducted during the course of the study. HH is the number of participating households. CHS is the continuous health survey that we conducted between the baseline and midline surveys. ML is the midline survey, while EL is the endline survey. We conducted the stove costs survey in conjunction with the midline and endline. Stove status surveys provide basic information on the stoves, while stove monitoring is a more in-depth survey of use.

Appendix Figure 5: Ever Had a Stove Break



Appendix Figure 6: Beliefs on Stove Quality



Notes: This table provide sample statistics on self-reported beliefs with the GV improved cooking stoves for those who own one.