Annex 19: Adjustment for confounding factors: multivariate linear regression analysis

Introduction
The approach taken to the analysis of the study has been to first examine the actual observed changes in pollution, exposure and fuel costs ('univariate' analysis), and the to examine whether confounding factors may have played a part in either over or under-estimating the observed effects of the interventions. The observed (univariate) changes have been reported in Chapter 7. In this Annex, we examine the effect of taking account of confounding factors. Overall, these appear to make little difference to the conclusions we drew from the initial analysis. Given this conclusion, and some of the complexity in carrying out and interpreting the adjusted analyses given the nature of the data and the relatively small numbers, the results of this stage are reported in this Annex.

Steps in carrying out the adjusted analysis
The first step in this process was to identify all factors that might be expected to have an influence on the outcomes. These have been tabulated for each round in the confounder tables (Annex 17). These tables allow assessment of whether, and by home much, each of these factors changed over the course of the study.

Any potential confounders that showed evidence of change over the rounds, and particularly between the baseline rounds (1 and 2) and the post-intervention rounds (3 and 4) were examined to determine whether these were indeed associated with levels of the main outcome variables. These associations were studied independent of the intervention, that is, within the pre-intervention (rounds 1 and 2) and post-intervention (rounds 3 and 4) separately.

Factors found to vary across rounds (pre- to post-intervention), **and** be associated significantly with any of the main outcome variables, could have been confounding the association between the intervention and the outcomes (levels of pollution, etc). These factors were therefore entered into multiple regression models. Few models had more than two such confounding factors, and in Sudan no adjustment was required.

Where there was uncertainty about the consistency of effect and distribution of variables, stepwise methods (adding one variable at a time) were used to determine the effect of each and the contribution to variance explained.

Use of transformed outcome variables
Regression modelling was carried out using un-transformed[1] variables for PM_{resp}, minutes and cost, and log(e) transformed variables for all measures derived from the T82 carbon monoxide monitor. The decision to use transformed or untransformed variables followed careful assessment of the distributions of all outcome variables, although given the relatively small numbers of homes, and the impact of some high outliers (thought to be genuine data points, and to be expected from time to time in some houses) it was not always possible to obtain near-normal distributions in all rounds.

Limitations of regression analysis
This approach to analysis recognises the limitations of multiple regression modelling given the following conditions:

[1] Transformation of variables involves carrying out a mathematical procedure, most commonly taking the natural logarithm (e), to obtain a more normal (symmetrical) distribution for data which is very 'skewed'. Skewing occurs with data such as pollution measurements, where some homes tend to have high or very high values. The problem with skewed data is that many statistical methods, including regression, become invalid if highly skewed data are used. For this study, it was found that log(e) transformation of the CO variables generally improved the distributions, making these more normal.

- Relatively small numbers of homes which are subject to instability in the distribution of variables
- The difficulty of capturing the impact of confounding factors: this was particularly thought to have occurred in Nepal with a number of activities requiring stove use occurring in round 4 (brewing, preparing additional food for road-building labourers, higher than average rainfall), not all of which were anticipated and hence not adequately reported.

Overall conclusion
Although we believe that overall the analysis highlights, and takes some account, of the most important influences on pre- and post-intervention outcome variables, it is important to recognise that the statistical methods cannot capture and address these in their entirety. Nevertheless, the results do accord well with the observations of the project teams and the comments from individual and group discussion with project participants.

Results
Results of multiple regression analysis for the three countries are presented in the following tables.

For untransformed variables (PM_{resp}, durations of time above threshold values, and costs), the regression produces estimates of the actual effect. Percentage changes have been calculated based on the pre-intervention averages for Rounds 1 and 2.

For transformed variables (CO measures), regression analysis produces the proportionate change in geometric means[2], which are shown here as percentages. The actual changes have been calculated by applying these percentage changes to the pre-intervention average of the geometric means for Rounds 1 and 2.

Kenya
For Kenya, analysis is shown for (a) all homes, and (b) for those where the intervention 'package' include the smoke hood and flue.

Nepal
For Nepal, analysis is shown for (a) all homes, and (b) excluding those where other cooking activities (mainly brewing) was being carried out.

Sudan
For Sudan, the analysis was more straightforward, with no adjustment for confounding judged necessary. Estimates are included her for ease of comparison with the other countries.

[2] Geometric means are derived from exponentiating (taking the antilog of) the average of log values calculated from the transformed values.

Kenya:

Tables K7.4.1 to K7.5.6 show the impact of the intervention 'package' (n=25) for all households, including those who did not install a smoke hood. The numbers in the same cell, labelled 'hood only' relate to those households which included a smoke hood in their interventions - hood, flue and Upesi stove (n=18). All values of regression coefficients ('Effect') are **reductions** in outcomes associated with the intervention. Adjustment has been made for rainfall (wet/dry). .

Table K7.5.1 Room measures (% reduction in pollution levels before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} ($\mu g/m^3$) *	Whole intervention	45.4%	24.8%	65.9%	
	Hood only	52.3%	28.4%	76.2%	
24-hr mean CO in kitchen (ppm) **	Whole intervention	54.8%	42.9%	64.1%	<0.0005
	Hood only	60.1%	50.0%	68.9%	<0.0005
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention	61.3%	50.7%	69.6%	<0.0005
	Hood only	65.4%	57.7%	72.4%	<0.0005
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention	65.8%	53.8%	74.7%	<0.0005
	Hood only	70.6%	61.0%	77.8%	<0.0005
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention	66.0%	53.5%	75.2%	<0.0005
	Hood only	71.3%	61.1%	78.8%	<0.0005
Number of minutes CO room above 3 ppm*	Whole intervention	30.6%	17.1%	44.1%	
	Hood only	40.2%	25.6%	54.7%	
Number of minutes CO room above 9 ppm *	Whole intervention	65.8%	49.0%	82.6%	
	Hood only	77.7%	60.2%	95.2%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table K7.5.2 Room measures (difference in pollution levels before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} ($\mu g/m^3$) *	Whole intervention	-243.8	-354.3	-133.3	<0.0005
	Hood only	-267.5	-413.8	-121.3	<0.0005
24-hr mean CO in kitchen (ppm) **	Whole intervention	-3.7	-4.3	-2.9	
	Hood only	-3.8	-4.3	-3.1	
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention	-11.7	-13.2	-9.6	
	Hood only	-11.5	-12.7	-10.1	
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention	-24.4	-27.7	-19.9	
	Hood only	-24.0	-26.4	-20.7	
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention	-29.1	-33.2	-23.6	
	Hood only	-29.2	-32.3	-25.0	
Number of minutes CO room above 3 ppm**	Whole intervention	-219.1	-316.2	-122.0	<0.0005
	Hood only	-287.6	-392.0	-183.3	<0.0005
Number of minutes CO room above 9 ppm **	Whole intervention	-208.0	-261.1	-155.0	<0.0005
	Hood only	-239.4	-293.5	-185.4	<0.0005

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table K7.5.3 Women's exposure (% reduction in pollution levels before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	Whole intervention	29.7%	13.7%	42.7%	0.001
	Hood only	32.0%	17.6%	44.4%	0.003
24-hr 90th centile CO for woman (ppm) **	Whole intervention	39.1%	25.2%	50.4%	<0.0005
	Hood only	44.1%	31.5%	54.3%	<0.0005
24-hr 98th centile CO for woman (ppm) **	Whole intervention	49.2%	34.0%	61.0%	<0.0005
	Hood only	52.0%	38.6%	62.6%	<0.0005
24-hr 99th centile CO for woman (ppm) **	Whole intervention	50.1%	34.0%	62.2%	<0.0005
	Hood only	50.3%	35.2%	61.9%	<0.0005
24-hr mean CO for woman where room >3ppm**	Whole intervention	51.6%	37.1%	62.8%	<0.0005
	Hood only	57.6%	44.1%	67.9%	<0.0005
Number of minutes for woman CO > 9ppm *	Whole intervention	58.2%	34.5%	81.9%	
	Hood only	67.3%	41.4%	93.1%	
Number of minutes for woman CO > 9ppm, where room > 3ppm *	Whole intervention	58.4%	34.4%	82.4%	
	Hood only	72.8%	51.4%	94.2%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table K7.5.4 Women's exposure (difference in pollution levels before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	Whole intervention	-1.1	-1.5	-0.5	
	Hood only	-1.6	-2.2	-0.9	
24-hr 90th centile CO for woman (ppm) **	Whole intervention	-3.7	-4.8	-2.4	
	Hood only	-3.9	-4.8	-2.8	
24-hr 98th centile CO for woman (ppm) **	Whole intervention	-10.5	-13.0	-7.2	
	Hood only	-9.5	-11.4	-7.0	
24-hr 99th centile CO for woman (ppm) **	Whole intervention	-13.5	-16.7	-9.1	
	Hood only	-11.2	-13.8	-7.8	
24-hr mean CO for woman where room >3ppm**	Whole intervention	-1.5	-1.9	-1.1	
	Hood only	-1.5	-1.8	-1.2	
Number of minutes for woman CO > 9ppm *	Whole intervention	-85.9	-120.9	-50.9	<0.0005
	Hood only	-90.0	-124.5	-55.4	0.001
Number of minutes for woman CO > 9ppm, where room >3ppm *	Whole intervention	-79.5	-112.1	-46.8	<0.0005
	Hood only	-89.9	-116.3	-63.5	<0.0005

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table K7.5.5 Fuel costs (% reduction before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (KSh/-)*	Whole intervention	-60.4	-123.1	2.4	0.059
	Hood only	-40.8	-109.1	27.5	0.237

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table K7.5.6 Fuel costs (difference before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (KSh/-)*	Whole intervention	19.0%	-0.7%	38.7%	
	Hood only	12.6%	-8.5%	33.8%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Nepal

These estimates are adjusted for rain (last 24 hours), number of meals cooked over the 24-hour air pollution monitoring period calculated as Adult Male Equivalents (AME), and the maximum temperature. Due to no brewing taking place during round 3, a separate analysis looked at the impacts associated with the interventions for those households that did not brew. It was not possible to look at the households that brewed, as there were insufficient numbers in this group. In each household, the 'intervention' comprised insulated walls, improved stove and smoke hood.

Table N7.5.1 Room measures (% reduction in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	Whole intervention	34.8%	-19.4%	89.1%	
24-hr mean CO in kitchen (ppm) **	Whole intervention	45.7%	21.6%	61.1%	0.001
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention	33.3%	7.1%	51.7%	0.017
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention	32.9%	6.7%	51.6%	0.018
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention	32.1%	7.2%	50.2%	0.015
Number of minutes CO room above 3 ppm*	Whole intervention	29.2%	15.2%	43.2%	
Number of minutes CO room above 9 ppm *	Whole intervention	38.4%	15.8%	61.0%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.2 Room measures (difference in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	Whole intervention	-319.3	-816.8	178.2	0.21
24-hr mean CO in kitchen (ppm) **	Whole intervention	-3.3	-4.4	-1.5	
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention	-6.4	-9.9	-1.4	
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention	-12.0	-18.9	-2.5	
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention	-14.3	-22.4	-3.2	
Number of minutes CO room above 3 ppm*	Whole intervention	-200.6	-296.9	-104.4	<0.0005
Number of minutes CO room above 9 ppm *	Whole intervention	-145.7	-231.3	-60.0	0.001

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.3 Women's exposure (% reduction in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	Whole intervention	13.7%	-13.1%	35.1%	0.33
24-hr 90th centile CO for woman (ppm) **	Whole intervention	10.1%	-14.5%	30.8%	0.42

24-hr 98th centile CO for woman (ppm) **	Whole intervention	18.7%	-6.5%	38.2%	0.14
24-hr 99th centile CO for woman (ppm) **	Whole intervention	20.3%	-5.9%	40.2%	0.12
24-hr mean CO for woman where room >3ppm**	Whole intervention	29.2%	-3.3%	51.5%	0.07
Number of minutes for woman CO > 9ppm *	Whole intervention	53.6%	21.8%	85.4%	
Number of minutes for woman CO > 9ppm, where room > 3ppm *	Whole intervention	55.3%	10.9%	66.9%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.4 Women's exposure (difference in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	Whole intervention	-0.5	-1.2	0.4	
24-hr 90th centile CO for woman (ppm) **	Whole intervention	-0.8	-2.5	1.2	
24-hr 98th centile CO for woman (ppm) **	Whole intervention	-3.1	-6.3	1.1	
24-hr 99th centile CO for woman (ppm) **	Whole intervention	-4.3	-8.5	1.2	
24-hr mean CO for woman where room >3ppm**	Whole intervention	-0.7	-1.2	0.1	
Number of minutes for woman CO > 9ppm *	Whole intervention	-128.6	-205.0	-52.3	0.001
Number of minutes for woman CO > 9ppm, where room > 3ppm *	Whole intervention	-89.1	-160.6	-17.6	0.015

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.5 Fuel costs (% reduction pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	Whole intervention	28.6%	11.9%	45.2%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.6 Fuel costs (difference pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	Whole intervention	-26.1	-41.3	-10.9	0.001

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Nepal (analysis excluding houses where other cooking/ brewing took place)

These estimates are adjusted for rain (last 24 hours) and number of meals cooked over the 24-hour air pollution monitoring period calculated as Adult Male Equivalents (AME)

Table N7.5.8 Room measures (% reduction in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	Whole intervention – no brewing	43.8%	1.1%	86.6%	
24-hr mean CO in kitchen (ppm) **	Whole intervention – no brewing	43.9%	18.9%	61.2%	0.002
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	32.8%	6.0%	52.0%	0.021
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	32.4%	4.6%	52.1%	0.026
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	30.8%	3.8%	50.2%	0.029
Number of minutes CO room above 3 ppm*	Whole intervention – no brewing	27.9%	12.7%	43.1%	
Number of minutes CO room above 9 ppm *	Whole intervention – no brewing	39.8%	16.4%	63.1%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.9 Room measures (difference in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	Whole intervention – no brewing	-333.8	-659.4	-8.240	0.045
24-hr mean CO in kitchen (ppm) **	Whole intervention – no brewing	-3.7	-4.3	-2.9	
24-hr 90th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	-11.1	-12.6	-9.2	
24-hr 98th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	-22.7	-25.8	-18.6	
24-hr 99th centile for CO in kitchen (ppm) **	Whole intervention – no brewing	-27.8	-31.7	-22.6	
Number of minutes CO room above 3 ppm*	Whole intervention – no brewing	-191.8	-296.5	-87.213	<0.0005
Number of minutes CO room above 9 ppm *	Whole intervention – no brewing	-150.9	-239.5	-62.283	0.001

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.10 Women's exposure (% reduction in pollution levels pre/post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm)**	Whole intervention – no brewing	6.9%	-26.7%	31.7%	0.644
24-hr 90th centile CO for woman (ppm)**	Whole intervention – no brewing	6.8%	-21.5%	28.5%	0.601
24-hr 98th centile CO for woman (ppm)**	Whole intervention – no brewing	13.6%	-14.6%	34.9%	0.307
24-hr 99th centile CO for woman (ppm)**	Whole intervention – no brewing	14.4%	-15.1%	36.4%	0.301
24-hr mean CO for woman where room >3ppm**	Whole intervention – no brewing	20.0%	-20.8%	47.1%	0.285
Number of minutes for woman CO > 9ppm *	Whole intervention – no brewing	46.1%	10.8%	81.4%	
Number of minutes for woman CO > 9ppm, where room > 3ppm*	Whole intervention – no brewing	50.9%	1.5%	100%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.11 Women's exposure (difference in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm)**	Whole intervention – no brewing	-1.0	-0.4	-1.4	
24-hr 90th centile CO for woman (ppm)**	Whole intervention – no brewing	-3.1	-2.0	-4.0	
24-hr 98th centile CO for woman (ppm)**	Whole intervention – no brewing	-7.6	-5.2	-9.4	
24-hr 99th centile CO for woman (ppm)**	Whole intervention – no brewing	-9.8	-6.6	-12.2	
24-hr mean CO for woman where room >3ppm**	Whole intervention – no brewing	-1.1	-0.8	-1.3	
Number of minutes for woman CO > 9ppm *	Whole intervention – no brewing	-110.6	-195.3	-25.8	0.011
Number of minutes for woman CO > 9ppm, where room > 3ppm*	Whole intervention – no brewing	-82.1	-161.9	-2.4	0.044

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.12 Fuel costs (% reduction pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	Whole intervention – no brewing	27.4%	10.2%	44.7%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table N7.5.13 Fuel costs (difference pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	Whole intervention – no brewing	-25.042	-40.768	-9.316	0.002

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Sudan

It was not found necessary to adjust for confounding factors as those which changed over the course of the study were not associated with the main outcomes.

Table S7.5.1 Room measures (% reduction in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	LPG stove, kisra plate and cylinder	67.4%	42.1%	92.7%	
24-hr mean CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	83.1%	73.7%	89.1%	<0.0005
24-hr 90th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	89.2%	78.9%	94.5%	<0.0005
24-hr 98th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	83.4%	73.4%	89.7%	<0.0005
24-hr 99th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	83.0%	72.4%	89.5%	<0.0005
Number of minutes CO room above 3 ppm*	LPG stove, kisra plate and cylinder	63.9%	46.2%	81.6%	
Number of minutes CO room above 9 ppm *	LPG stove, kisra plate and cylinder	73.5%	52.2%	94.9%	

** Derived from regression on un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table S7.5.2 Room measures (difference in pollution levels before and after intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean PM_{resp} (µg/m^3) *	LPG stove, kisra plate and cylinder	-551.2	-758.3	-344.0	<0.0005
24-hr mean CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	-6.2	-6.7	-5.5	
24-hr 90th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	-17.8	-18.8	-15.7	
24-hr 98th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	-45.4	-48.8	-39.9	
24-hr 99th centile for CO in kitchen (ppm) **	LPG stove, kisra plate and cylinder	-56.2	-60.6	-49.0	
Number of minutes CO room above 3 ppm*	LPG stove, kisra plate and cylinder	-353.4	-451.4	-255.5	<0.0005
Number of minutes CO room above 9 ppm *	LPG stove, kisra plate and cylinder	-244.8	-315.8	-173.7	<0.0005

** Derived from regression on un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table S7.5.3 Women's exposure (% reduction in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	LPG stove, kisra plate and cylinder	71.3%	61.8%	78.5%	<0.0005
24-hr 90th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	70.5%	59.7%	78.4%	<0.0005
24-hr 98th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	75.9%	67.2%	82.4%	<0.0005
24-hr 99th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	77.9%	68.6%	84.5%	<0.0005
24-hr mean CO for woman where room >3ppm**	LPG stove, kisra plate and cylinder	94.8%	89.4%	97.4%	<0.0005
Number of minutes for woman CO > 9ppm *	LPG stove, kisra plate and cylinder	75.2%	59.2%	91.3%	
Number of minutes for woman CO > 9ppm, where room > 3ppm *	LPG stove, kisra plate and cylinder	80.3%	59.9%	100%	

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table S7.5.4 Women's exposure (difference in pollution levels pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
24-hr mean CO for woman (ppm) **	LPG stove, kisra plate and cylinder	-3.6	-3.9	-3.1	
24-hr 90th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	-8.7	-9.7	-7.4	
24-hr 98th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	-30.4	-33.0	-26.9	
24-hr 99th centile CO for woman (ppm) **	LPG stove, kisra plate and cylinder	-45.7	-49.5	-40.2	
24-hr mean CO for woman where room >3ppm**	LPG stove, kisra plate and cylinder	-3.0	-3.1	-2.8	
Number of minutes for woman CO > 9ppm *	LPG stove, kisra plate and cylinder	-145.4	-176.4	-114.5	<0.0005
Number of minutes for woman CO > 9ppm, where room > 3ppm *	LPG stove, kisra plate and cylinder	-118.9	-148.9	-88.8	<0.0005

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table S7.5.6 Fuel costs (% reduction pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	LPG stove, kisra plate and cylinder	35.2%	20.3%	50.1%	<0.0005

** Derived from regression on un-transformed data ** Derived from log(e) transformed data (anti-log shown)*

Table S7.5.7 Fuel costs (difference pre / post intervention)

Outcome measure	Adjusted effect of intervention		95% CI		p-value
	Intervention	Effect	Lower	Upper	
Total cost of all fuels per week (Rupees) *	LPG stove, kisra plate and cylinder	-476.4	-677.7	-275.1	<0.0005

** Derived from un-transformed data ** Derived from log(e) transformed data (anti-log shown)*