Female Control of Household Resources and Cooking Behaviors in Rural India

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Executive Summary

Indoor air pollution due to traditional biomass-burning stoves poses a major respiratory health risk in the developing world. Children, in particular, disproportionately bear the burden of disease caused by this problem. One way to directly address this issue is through increasing access to "cleaner" cooking technology, whether in the form of "improved" biomass-burning cookstoves that reduce exposure to emissions, or in the use of cleaner, non-biomass fuels such as liquid petroleum gas. Existing research suggests that when women in less-developed countries enjoy more "bargaining power"—control over household resources—outcomes favorable to women and children are more likely.

I attempt to determine whether this conclusion can also be applied to cooking behaviors, using a data set drawn from approximately 2,000 household-level surveys in the Indian states of Uttarakhand and Uttar Pradesh. I use linear regression to estimate the effect on use of such fuels of four factors that could conceivably proxy for women's control over household resources: relative ages of a husband and wife, husbands' and wives' relative years of education, female household headship, and whether or not a wife engages in an income-generating occupation outside of housework.

My results show a clear positive correlation between both wives' and husbands' years of education and improved stove ownership; when regressed together, however, wives' years of education are correlated with improved stove ownership by a greater magnitude than their husbands' years of education. This suggests that education may have a stronger effect on women's preferences for improved cooking technology and/or their ability to exercise these preferences. In contrast, age, female headship, and wives' income generation did not show a

significant correlation with improved stove ownership, and had ambiguous correlations with related outcomes, such as time spent cooking and preparing fuel. This indicates a need for more qualitative and narrative studies in this field, as well as more direct empirical inquiries into gendered preferences, to better understand these relationships and their effect on indoor air pollution.

Research Question

Does female control over household resources, proxied by age, education, female household headship, and wive's income generation, have a significant correlation with the use of "cleaner" (e.g., non-biomass burning) fuels and improved stoves in rural Indian households?

Introduction

Indoor Air Pollution and Improved Cookstoves

Indoor air pollution (IAP) created by traditional biomass-burning stoves poses a major health risk in the developing world. This is mainly due to IAP's contribution to acute respiratory disease (ARI) and chronic obstructive pulmonary disease (COPD). Indoor air pollution is responsible for an estimated 2.7% of the global burden of disease; in low income countries, this figure is as high as 4% (WHO, 2011). In 2004, indoor air pollution was the proximate cause of some 2 million deaths, with young children disproportionately affected; children under the age of five are particularly succeptible to respiratory infections, especially pneumonia (WHO, 2011). Multiple studies have shown a significant correlation between levels of IAP and incidence of pneumonia in young children (Dherani et al, 2008) and an estimated 900,000 children die from pneumonia caused by IAP, annually (WHO, 2011).

In addition to disproportionate health effects on children, it is most often women who bear the burden of collecting solid fuel for cooking, and for the cooking, itself (WHO, 2011)—

while IAP may be perceived as disproportionately affecting women, as well (Miller and Mobarak, 2013), the existing literature has not yet proven conclusively that adult women suffer worse health outcomes than men as a result of indoor biomass combustion (Das and Pattanyak, 2012) or worse outcomes in general (Kohlin et al., 2011).

Female Control of Household Resources and Adoption of Health-Saving Technologies

Regardless , the question of the relationship between gender and household cooking behaviors is still an interesting one, in light of a growing literature examining the relationship of women's control over household resources, and women and children's welfare outcomes. Alam (2012) finds that Bangladeshi women gain welfare in the form of resource allocation when they have access to micro-credit. Barber and Gertler (2008) find that women participating in Mexico's *Oportunidades* CCT program have better outcomes in the form of pre-natal healthcare than do non-participant women. In a study of the same program, Rubalcava, Teruel and Thomas (2009) conclude that women's bargaining power and household expenditures on education increase with women's cash transfer income. Gitter and Barham (2008) conclude that the children Nicaraguan women who are the beneficiaries of a social safety-net conditional cash transfer program benefit from greater educational investment than do the children of non-participants. Overall, these program findings suggest that increased relative bargaining power for women, in the form of added income, is correlated with better material and non-material outcomes for women and children. In addition to this, many studies also treat women's relative education level and earned income as proxies for control over household resources.

Although the direct relationship between female control of household resources and cooking practices has not been extensively studied, we might infer from the existing body of literature that greater female control over household resources may be correlated with cooking

practices and technology perceived to benefit women's and children's health. These may include the use of improved cookstoves (ICS), a general category of relatively "improved" biomass-burning stoves that may produce less smoke than traditional stoves, or which feature chimney attachments or exhaust-clearing fans that may direct smoke elsewhere, reducing IAP. Other "cleaner" cooking practices include the use of non-biomass fuels, such as liquid petroleum gas (LPG), kerosene-burning, or electricity. Because ICS were virtually non-existant in the data used here, this paper focuses almost exclusively on the use of non-biomass fuels as an indicator of "cleaner" cooking behaviors.

2. Data Set

My data comes from 2,120 household surveys conducted in the Indian states of Uttar Pradesh and Uttarakhand during the summer of 2012, as the baseline study for a randomized controlled trial on determinants of ICS adoption (Pattanayak et al, 2012). Surveys were conducted in Hindi by trained enumerators recruited from the local community. (For survey locations, see Figure 1.) A total of 66 survey villages were chosen by first identifying villages with an NGO presence, and using nearest-neighbor propensity score matching to select non-NGO villages with similar characteristics based on the 2001 Indian National Census in order to ensure balance in the sample. Within villages, survey households were chosen on a random basis that ensured that households would be spatially distributed in an even manner throughout the village rather than clustered in a single area; this is especially important as households of similar income and especially caste tend to be clustered together.

The baseline survey instrument was intended to be asked in part to the primary cook, and in part to the head of household (defined to survey respondents as the person in charge of making

major household decisions). The survey contained an extensive range of questions, including sections on preferences and beliefs about stoves and cooking behaviors; education, occupation, and health status for every household member; type of stoves owned, and types and quantities of fuel consumed; socio-economic status, assets, and consumption; and time-risk preferences. As such, the data obtained from the survey represent a rich source of information for multiple individuals in multiple households.

A note on terms used: For the purposes of my analysis, I define the terms "husband" and "wife" as follows: if the household has a male head, then the male head of household is identified as the husband and his spouse (if he has one) is identified as the wife. Conversely, in female-headed households, the female head of household is defined as the wife, while her spouse is coded as the husband. Headship as defined by the survey, and "husband" and "wife" defined by my analysis may not accurately capture the true family structure and decision-making power in every household—indeed, the individuals termed "husbands" and "wives" might not even be married. However such broad definitions are necessary for the purpose of analysis and comparison of large amounts of survey data.

3. Empirical Model

Sample household demographics

Survey households are split almost evenly between the states of Uttarakhand and Uttar Pradesh; likewise, the split is nearly even between households in villages that have the presence of NGOs (e.g., TERI or CHIRAG). A sizeable minority, about 18% of households reported having a female household head; however, only a much smaller minority (less than 1% of the entire sample) report having a female household head who is currently married. The vast majority of female household heads are either widowed or divorced.

Survey households have a median size of five. Households are majority Hindu (nearly 93%); the remaining minority are Muslim. Statistically, the sample as a whole tends towards lower socio-economic status; about one-quarter of households reported themselves as being scheduled caste members, and nearly 60% of households identified themselves as being below the national poverty line (BPL). The median per capita monthly expenditure, 1000 rupees, is equivalent to about US$18. Only a minority of households have access to saving account facilities, and of these an even smaller minority have reported saving money in these accounts in the previous twelve months. Approximately twice the number of households using saving accounts, have taken out a loan in the past year. The most common occupation for adults is agricultural labor, either on one's own or on another person's farm.

Beliefs and perceptions

Before we discuss how male and female bargaining power might affect cooking behaviors, it's important to consider whether men and women have significantly different preferences in this area. One of the first sections of the survey instrument asks a number of questions about the messages respondents have heard about negative impacts of cooking behaviors, and if they believe that some practices can mitigate these negative impacts (Table 1).

Dependent variable: Ownership of "improved" cookstove

In our sample, improved or "clean" cookstoves are defined as either stoves that do not burn solid biomass fuel, or biomass-burning stoves specially designed to be more efficient. These include kerosene, LPG, electric and biogas stoves, as well as commercial improved

cookstoves. Of the 2,120 households in the sample, 450 owned clean stoves. (See Table 7 for breakdown of different stove types in the sample.)

"Non-clean" or traditional stoves include *mitti ka chulha* (mud stoves), three-stone stoves, coal stoves and cast-iron biomass stoves. Traditional stoves are used with a variety of solid fuels; in addition to firewood, these fuels can also include straw, crop residue, leaves, and dung cakes. Nearly every household in the sample owned some type of traditional stove; only 54 households reported not owning one.

Dependent variable: Stove use and fuel gathering patterns

In addition to stove type ownership, this analysis also examines patterns in stove use and time spent gathering and preparing different types of fuel. Time spent using stoves and preparing and gathering fuel is important for two main reasons. First, fuel gathering and preparation can be difficult and time intensive; this "drudgery" is often shouldered by women and children (WHO, 2011); time and energy spent on these chores might otherwise be spent on some sort of income-generating activity or on education and study. Time spent on fuel is one of the opportunity costs involved in the use of traditional biofuels and stoves. Secondly, stove use time is particularly important because of exposure to indoor air pollution, especially in the case of traditional stoves. More time spent using a traditional stove might result in more risk of household members developing respiratory illnesses (WHO, 2011).

Independent variables: Female power proxies

Female head of household. My first independent variable to proxy for female bargaining power is a yes/no indicator for whether or not the head of a given household is female, based on whether or not a female survey respondent named herself as head of household, or if another household member named her as such. Having a female as an acknowledged head of household is a significant variable because Indian culture, particularly in rural and low-income areas, is still strongly patriarchal; female heads of household are unusual in this sample.

Education. A second set of proxies for control over household resources revolves around years of education. Overall, husbands have more years of education than do their wives (Table 11). The gap is particularly striking in the difference between the medians for wives' and husbands' respective years of education: 7 for men, and 0 for women. Within households, however, the difference is not quite so great, with a husband having two more years of education than his wife at the median. Education is an important potential proxy for control over household resources; women with literacy and numeracy skills have better employment prospects, and woman's education may lend her increased credibility and authority when dealing with her husband and family. Furthermore, in a setting in which educational disparities break down so starkly along gender lines, a woman who has the same, or more, education as her husband is probably different from the norm in a number of ways.

Age. Another potentially important power proxy is age, and particularly the age difference between the husband and wife in the household. Among sample households, the median age difference is five years (the husband is older). An especially large age difference between

spouses could conceivably play a large part in household power dynamics, with the older spouse wielding more power, experience and influence (Miller and Mobarak, 2013).

Income generation. A final potential power proxy is income generation. I define "income generating" occupations as those occupations which bring in a monetary wage—in other words, I excluded "Laborer on one's own farm," "Student," or "Housework" (this last being the most common occupation for wives of households). Having an outside wage may increase an individual's decision-making power within the household, giving them more independence and allowing them to take some of the credit for "supporting" the family (Anderson and Eswaran, 2008).

Covariates

State (Dummy for Uttarakhand)

A state covariate is included to capture differences that may exist between households in Uttar Pradesh and Uttarakhand; in general, villages in Uttarakhand were more remote and difficult to access than their Uttar Pradesh counterparts. LPG subsidies are also more readily available in Uttarakhand.

Natural log of monthly per capita household expenditure

This covariate captures household size, which may impact the household's income, the time spent cooking, and the amount of fuel needed. It also captures differences in household expenditure; this serves as an approximate indicator of household income, one of the major determinants of improved stove adoption.

Caste (Dummy for scheduled caste)

The caste covariate also serves as a socio-economic indicator; historically, members of scheduled castes tend to be more needy. This category may also include members of the *harijan* caste (formerly called "untouchables"), who are still strictly segregated from other castes much of the time. About 25% of all households in the sample identified themselves as belonging to scheduled castes.

Religion (Dummy for Hinduism)

Whether a household is Hindu or Muslim may affect their food consumption and work patterns. Furthermore, Muslims do not observe the caste system and so are less affected by it; Muslim households may also be more strict about gender roles and segregation of the sexes. In this sample, a large majority—93%--of households were Hindu.

NGO presence

Approximately half of the households in the sample are located in a village with an established NGO presence. Having an NGO in the vicinity may affect work opportunities, education, medical care and awareness of health and environmental issues.

Access to sanitation facilities (toilet)

Access to a toilet is another potential indicator of socio-economic status; it may also indicate an increased awareness of sanitation and health issues on the part of the household.

Model

Because stove and fuel use is likely to be affected by the covariates listed above in addition to female control proxies discussed above, I conduct the basic regression analysis as described below:

$$\textit{Stove/Fuel Use} = \beta_0 + \beta_x(\text{Female Control Proxy}) + \beta_1(\text{Uttarakhand}) + \beta_2(\ln \text{ per capita expenditure}) + \beta_3(\text{scheduled caste}) + \beta_4(\text{Hindu}) + \beta_5(\text{NGO}) + \beta_6(\text{Toilet}) + \varepsilon$$

Standard errors are clustered at the village level. In models using imputed data, an additional dummy to indicate imputed data points is also included in the regression.

4. Results

In this section I will first present the results of simple means comparisons along independent variable categories by way of two-sided T-tests. I will then present the results of regression analysis.

a. Simple means comparisons

Beliefs and perceptions

Male and female respondents differed significantly in a few aspects. Women were more likely than men to have heard that cooking behaviors can have a negative impact on forests and watersheds, as well as climate and air pollution. In contrast, men and women did not differ significantly as to whether they had heard that cooking behaviors could have negative health impacts. Women were also somewhat more pessimistic than men when asked how much they believed "your use of improved stoves and clean fuels" could help modify all of the negative impacts discussed. While males and females were about equally likely to have heard of improved cookstoves, females were significantly more likely to be aware of "fuels [that] produce less smoke than others." However, when asked to rank the perceived safety of cooking smoke on a scale of 1 to 10 (with 10 as the safest), men and women had the same average response of 4.23. Throughout the beliefs and preferences section of the survey, female respondents outnumbered males on a nearly three-to-one basis; it's not clear how the results might have been different had the sample been more balanced. In addition, a small number of surveys had this

section answered by both a man and a woman—the head of household and the primary cook. I have left these households out of the sample here.

When asked to rank the two best and worst attributes of traditional stoves, men and women also responded mostly in kind, with a few notable differences (Tables 3 and 4). The most popular "best" attributes of traditional stoves for both males and females were stove cost, and the taste of the food. (Each respondent was allowed to list two best and two worst attributes, which is why the means in the tables add up to greater than 100%). Men were significantly more likely than women to list "ability to cook all foods" as a positive attribute of traditional stoves.

When asked about the worst qualities of traditional stoves (Table 4), men were significantly more likely than women to list "speed of cooking" as a drawback. In turn, women were much more likely than men to list "cleaning requirements" and "heat." While agreeing on many attributes, men's and women's opinions of traditional stoves seemed to diverge slightly, with men more likely to think of the type and speed of the cooking, and women more likely to think about the unpleasantness of having to clean a mud stove and to sit in its heat while cooking. Overall, the data from this section indicate that men and women differ significantly in the messages they have heard about air pollution, their beliefs about its mitigation, and the way they value different attributes of traditional stoves.[1]

Improved cookstove ownership

Households that own clean cookstoves differ significantly on several characteristics from households that do not own such stoves (Table 8). Clean cookstove owners are more likely to live in Uttarakhand, and also more likely to have a female household head. An LPG or kerosene stove incurs significantly more cost than does a traditional mud or stone stove, which can be

[1] Respondents were also asked about the best and worst attributes of improved stoves (Tables 5 and 6), but only a limited number of respondents had heard of such stove, and of these, very few were able to think of what their positive and negative qualities might be. The data in this section was so sparse as to not be of any use.

constructed for free; as we might expect, some of the most striking differences between the stove ownership groups are in socio-economic indicators. Clean stove-owning households have higher per capita monthly expenditures, on average; they are also less likely to be members of a scheduled caste, more likely to have access to a toilet, and more likely to have saved money at a bank in the past year. Husbands and wives in clean stove-owning households are also on average older and more educated than their counterparts in non-clean-stove owning households.

Stove use and fuel-gathering patterns

The average household spends about 80 minutes each week preparing cooking fuel, both biomass and "clean." (Table 9) The average household also spends a little over two hours a week gathering traditional biomass fuel. Households with traditional stoves reported spending an average of about 190 minutes per day using their traditional stoves, while households with clean stoves reported spending just slightly less time than this on average.

Male- and female-headed households

Not surprisingly, female-headed households on average have one fewer member than do male-headed households, and the wives in female-headed households were on average older than wives in male-headed households (Table 10). In our sample, female headed households were far more likely to be in the state of Uttarakhand than in Uttar Pradesh. This may reflect a greater incidence of widowhood and lower incidence of remarriage in Uttarakhand. It may also reflect the fact that many of the Uttarakhand villages were more remote than many of the Uttar Pradesh villages, suggesting that Uttarakhand husbands may have a greater tendency to have to look for work outside of their home village, leaving the main decision-making responsibilities to their

wives in their absence. Female-headed households are also a small (4%) but statistically significant amount more likely to be Hindu than Muslim.

Surprisingly, however, there is no statistically significant difference between per-capita monthly expenditures in the two types of households; one might expect expenditures in female-headed households to be lower because most female household heads are unmarried, and households which potentially lack an adult male working member would be therefore take in less income. This is also interesting in light of the fact that female-headed households are significantly more likely to have saved money in the past year, and less likely to have taken out a loan, than are their male-headed counterparts. The lack of difference in expenditure level may reflect the fact that female-headed households have the same de facto income as male-headed households because of the interest gained on savings accounts, and the lack of having to make interest payments on loans.

There are also significant differences between household technology ownership and use. Female-headed households are also significantly more likely to have access to toilet facilities (67% of female-headed households versus 42% of male-headed households). Finally, female-headed households are significantly more likely to both own and used a clean stove. Female-headed households also spend less time per week preparing and collecting fuel. Interestingly, however, female-headed households also use *both* types of stoves—both traditional and "improved"—than do male-headed households.

Education

For the purpose of a T-test comparison (Table 12), I created a categorical variable to divide households based on the wife's education. The first category was for households with

wives at or below the median level of education in the sample—that is, 0 years of education. The second group of households, then, had wives with one or more years of education. There were many significant differences between the two groups; households with educated wives were much more likely to be located in Uttarakhand, and on average had fewer members. Not surprisingly, socio-economic indicators were higher for households with educated wives. In addition, both husbands and wives in these households were, on average, younger. They were also far more likely to own an improved cookstove—and, interestingly enough, they also spent more time on average using traditional stoves than did the other group of households.

Due to missing values, the number of observations for all education variables is significantly less than the total sample size. In order to address the issue of statistical power, I also created imputed education variables, in which I made the (very broad) assumption of assigning 0 years of education to every wife and husband for whom this data is missing. Predictably, imputation reduces the magnitude of both mean and median values and lowers the within-household education gap to 0. (In all regression analyses that contain imputed variables I include a dummy variable for to indicate missing values).

Age

Households with a spousal age difference less than the median (husband is less than 5 years older than wife) have, on average, smaller families (Table 13). They are also much more likely to have a female head of household, and on average have higher per capita expenditures. While households with a median or greater spousal age difference spent more time on average both collecting and preparing fuel, there was no significant difference in stove ownership between the two groups.

Income generation

The number of households in which the wife engaged in an income-generating occupation was very low overall; only 88 in the entire sample. (It should also be noted that fewer than half of the households in the sample had a husband engaged in an income-generating occupation, as "Laborer on one's own farm" was the most prevalent choice for adults.) Households with income-earning wives were significantly more likely to belong to a scheduled caste (Table 14); other than that, there was no significant difference in many socio-economic indicators between the two household types. There was no significant difference in average household expenditure, and income-generating wives tend to be less educated than their non-income-earning counterparts, perhaps indicating that high-skilled jobs were not the norm for these working women. Households with working wives were far more likely to be located in villages that had an NGO presence, which may indicate that at least some of the women's jobs were associated with NGOs. There were no significant differences in stove ownership or fuel and cooking patterns.

b. Linear regression results

Table 15 shows a summary of the coefficients for the female bargaining proxy in each different model. The full set of results – i.e., coefficients and p-values for all variables in each model and N – are presented in Appendix A.

The "Education" category contains two models using only reported values. In Model 3, husbands' and wives' ages are regressed together. In Column 4, the difference between wives' and husbands' years of education is used as the independent variable. Column 5 and Column 6 represent models that are analogous to those in Columns 3 and 4; these, however, also use imputed education data, in which any missing values for husbands' or wives' years of education were presumed to be 0.

Age

There were no statistically significant results for any of the age variable models; in addition, the magnitude of the coefficients for ICS use and ownership (Rows A and B) are very close to zero.

Years of education

Both husbands' and wives' years of education (reported data only, Columns 3 and 4) are signficantly positively correlated with ICS use and ownership; the magnitude for the wife's education coefficient is twice that of the coefficient for husbands' education (0.02 and 0.01, respectively). While the wife's years of education are associated with decreases in both traditional stove use time and time spent gathering traditional fuel (Rows C and D), husbands' education is positively correlated with ICS use time, and time spent cooking on all stoves (Rows D and E). Meanwhile, the difference between wives' and husbands' years of education (Column 4) is similarly negatively correlated to ICS cooking time and all cooking time, as with husband's education in the Column 3 model.

For the models using imputed education values (Column 5), the results for ICS ownership and use are similar to the models using only reported data. In this instance, however, both husbands' and wives' years of education are significantly correlated with a decrease in

traditional stove cooking time, whereas husbands' education, including imputed values, is significantly positively correlated with an increase in ICS cooking time. Difference between wives' and husbands' education, including imputed data, is significantly negatively correlated with ICS cooking time (Column 6).

Education is a crucial factor in predicting improved stove ownership; therefore the regression results for education are not surprising, as education is also strongly correlated with income. Worth noting, however, is the relative magnitudes of the coefficients for husbands' and wives' years of education; a wife's education predicts ICS ownership at twice the "strength" that her husband's schooling does. For each additional year of the wife's education, the average likelihood of owning an ICS increases about 2%, compared to 1% for each additional year of the husband's education. This suggests that, all other things being equal, educated women may have a greater preference for improved cooking technology compared to their husbands; furthermore, they may be in a better position to realize this preference. The decrease in time spent using traditional stoves that is also correlated with an increase in wives' education is probably reflective of the increased ownership of improved stoves in this model, as is the decrease in time spent collecting traditional fuel.

Female household headship

Having a female head is not significantly correlated with ICS ownership or ICS use (Column 7, Rows A and B). It is, however, significantly positively correlated—at a relatively large coefficient magnitude—for time spent cooking on traditional stoves (Column C). Meanwhile, it is also significantly negatively correlated with time spent preparing all fuel (Column F).

Wife earns income

Having a wife in an income-generating occupation is significantly negatively correlated (once again, at a relatively large magnitude), with time spent using an ICS and traditional fuel collection time.

Unlike the T-tests, regression of ICS ownership and use on female headship does not show significant associations. While, as a group, female-headed houses are more likely to own improved stoves than male-headed households, this is probably do to a cluster of factors associated with female headship rather than female headship, itself (at least in this analysis). For some reason, the female-headed households in this sample spend more time using all types of stoves, overall. This could be reflective of the fact that, overall, female heads of household tend to be older, and are therefore more likely to have more younger relatives (particularly daughters, daughters-in-law, or grandchildren) who can devote more time to cooking responsibilities as a whole.

As a whole, the number of households in this sample in which the wife has an income-generating occupation is very small—only 88 households in an entire sample of over 2,000. Therefore, the results must be approached with caution, keeping this very small sample size in mind. With that said, the significantly negative coefficients for cooking time on ICS and fuel preparation are perhaps indicative of the fact that, if a woman works outside of her home, she will have less time to devote to cooking than she would if housework were her main occupation. Whether this is simply incidental, or a conscious assertion of bargaining power on the part of a wife for any given household is impossible to tell from this data alone. At any rate, in this sample, there is no significant correlation between a wife's outside earnings and the likelihood of the household owning or using an improved cookstove.

Policy implications

It is unclear from these results whether or not men and women in this sample differ significantly in their preferences for certain types of stoves, or in their appreciation of the health consequences of indoor air pollution. Unlike in Miller and Mobarak's study, there is no indication that women gravitate more towards health-saving technology but are unable to exercise this preference due to a lack of female bargaining power (although, unlike in that study, the respondents in our sample were not primed with different messages regarding the stoves. In light of this uncertainty, it would make sense not to focus disproportionately on either gender in education or social media campaigns regarding stoves and household air pollution. It is still worth studying, however, whether men and women react differently to messages such as these.

If there is any indication in these results that female bargaining power proxies may indeed be correlated with "healthier" stove and fuel choices, it is in the fact that wives' education seems to have double the predictive power of their husbands' education on the likelihood of improved stove ownership. Even if this trend were to prove universal, however, it is not really a groundbreaking piece of evidence in support of increased women's education in India; it has long been known that better education for women is correlated with better health outcomes for females in the developing world. In my opinion, we must pursue better education access and outcomes for both men and women for its own sake, and not on the strength or weakness of quantitative social science results. (Unfortunately, female household headship in India seems to be predicated largely on widowhood, which is not really a policy lever).

Although the narrative in these results is not yet totally clear, it *is* clear that the numbers nevertheless tell a story. While useful, bargaining power proxies such as education, household

headship, and earning power tell only a small piece of the story of household dynamics and decision-making. In order to better understand the relationships between these variables, empirical studies of a more focused nature are needed—these could include survey questions with questions that simply ask household members to rate how much power they believe they have when it comes to decision making, and what types of decisions they most often make in their household. Qualitative studies are necessary as a complement to empirical analyses such as this one; they are necessary, for example, to understand individual women's paths to household headship, and what this entails in her day-to-day responsibilities. Overall, the results available in this study are more suggestive than conclusive; more precise and detailed assessments of both a quantitative and a qualitative nature will be necessary in the future to better understand the intersection of gendered bargaining power and cooking behaviors.

Tables and Figures

Figure 1. Map of survey sites in Uttar Pradesh and Uttarakhand, India

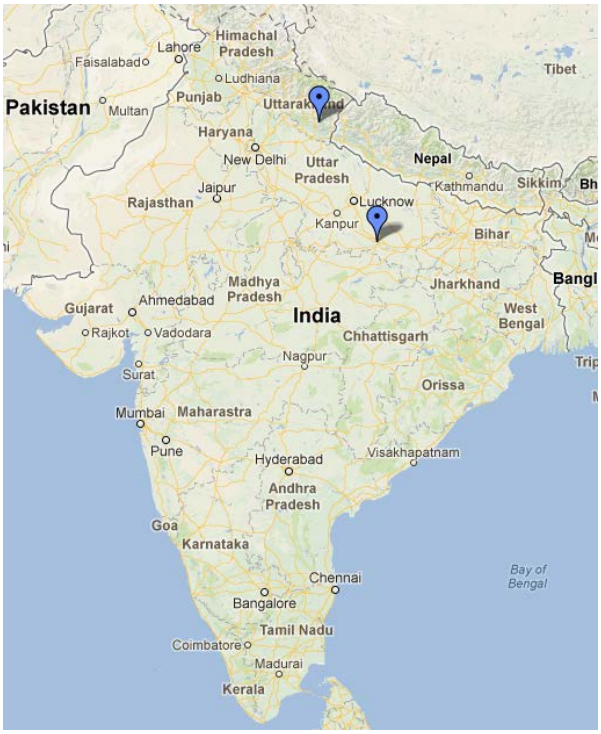

Table 1: Sample summary statistics

	N	Mean (%)	Median	Minimum	Maximum	St Dev
State: Uttar Pradesh	1,057	49.86				
State: Uttarakhand	1,063	50.14				
Household size		5.24	5	1	20	2.45
Household head is female—all	370	17.45				
Household head is married female	33	0.02				
% Scheduled caste	576	25.76				
% Scheduled tribe	15	0.66				
%Below poverty line (Self-identified)	1,219	57.72				
Monthly per capita expenditure (Rs.)		1285	1000	0	25000	1221
% Hindu	1,961	92.59				
% Muslim	156	7.37				
Lives in village with TERI and/or CHIRAG presence	1,082	51.16				
Has access to toilet facilities	988	46.60				
Has access to savings facilities	323	15.38				
Has used savings account in past year	148	6.98				
Has taken loan in past year	293	13.82				

Table 2: Beliefs and and information regarding cooking behaviors, by gender (Two-sided T-test)

	Male Respondents		Female Respondents			
	N	Mean (Standard Error)	N	Mean (Standard Error)	Difference (Male – Female)	(P-value)
1. Have you ever heard about how your cooking practices negatively impact your family's health—especially young children? (Yes=1, No=0)	508	66% (2%)	1445	70% (1%)	-4%	0.15
[If you have heard Message 1] On a scale of 1-5, how much do you believe	203	3.09 (0.08)	640	2.88 (0.05)	0.21	0.02

your use of improved stoves and clean fuels can modify negative HEALTH impacts?						
2. Have you ever heard about how your cooking practices negatively impact local forests and watersheds?	508	50% (2%)	1445	57% (1%)	-7%	0.01
[If you have heard Message 2] On a scale of 1-5, how much do you believe your use of improved stoves and clean fuels can modify negative FOREST AND WATERSHED impacts?	146	3.33 (0.08)	504	3.06 (0.04)	0.27	0.01
3. Have you ever heard about how your cooking practices negatively impact local air quality and climate change?	508	35% (2%)	1445	40% (1%)	-5%	0.03
[If you have heard Message 3] On a scale of 1-5, how much do you believe your use of improved stoves and clean fuels can modify negative AIRE QUALITY AND CLIMATE CHANGE impacts?	93	3.55 (0.13)	307	3.25 (0.07)	0.30	0.04
"Have you heard of some stoves that produce less smoke than others?"	508	52% (3%)	1445	55% (2%)	-3%	0.26
"Do you think some fuels produce less smoke than others?"	508	54% (3%)	1445	59% (2%)	-5%	0.09
On a scale of 0-10, how do you feel smoke from traditional stoves will affect your health? (10=Safest, 0=Not	507	4.23 (0.10)	1436	4.23 (0.06)	0.00	0.95

safe at all)						

Table 3: Best attributes of traditional stoves, by gender of respondent: Two-sided T-test

	Male Respondents		**Female Respondents**			
	N	**Mean (Standard Error)**	**N**	**Mean (Standard Error)**	**Difference (Male – Female)**	**(P-value)**
Cost	508	0.46 (0.02)	1445	0.47 (0.01)	-0.10	0.66
Smoke	508	0.01 (0.00)	1445	0.01 (0.00)	0.00	0.65
Speed of Cooking	508	0.07 (0.01)	1445	0.08 (0.00)	-0.01	0.35
Ability to cook all foods	508	0.14 (0.02)	1445	0.10	0.04	0.01
Taste of the foods	508	0.85 (0.02)	1445	0.87 (0.01)	-0.02	0.31
Number of dishes that can be prepared	508	0.02 (0.01)	1445	0.02 (0.00)	0.00	0.89
Number of people the stove can feed	508	0.01 (0.01)	1445	0.02 (0.00)	-0.01	0.41
Amount of fuel required	508	0.02 (0.01)	1445	0.02 (0.00)	0.00	0.57
Type of fuel required	508	0.00 (0.00)	1445	0.01 (0.00)	-0.01	0.25
Maintenance and repair cost of stove	508	0.02 (0.01)	1445	0.03 (0.00)	-0.01	0.22
Cleaning requirement	508	0.02 (0.01)	1445	0.02 (0.00)	0.00	0.54
Portability	508	0.03 (0.01)	1445	0.02 (0.00)	0.01	0.59
Heat	508	0.00 (0.00)	1445	0.00 (0.00)	0.00	0.60

Table 4: Worst attributes of traditional stoves, by gender of respondent: Two-sided T-test

	Male Respondents		**Female Respondents**			
	N	**Mean (Standard Error)**	**N**	**Mean (Standard Error)**	**Difference (Male – Female)**	**(P-value)**
Cost	508	0.03 (0.01)	1445	0.02 (0.00)	0.01	0.20
Smoke	508	0.77 (0.02)	1445	0.74 (0.01)	0.03	0.18
Speed of Cooking	508	0.24 (0.02)	1445	0.17 (0.01)	0.07	0.00

Ability to cook all foods	508	0.01 (0.00)	1445	0.01 (0.00)	0.00	0.70
Taste of the foods	508	0.00 (0.00)	1445	0.00 (0.00)	0.00	0.48
Number of dishes that can be prepared	508	0.00 (0.00)	1445	0.00 (0.00)	0.00	0.88
Number of people the stove can feed	508	0.01 (0.00)	1445	0.00 (0.00)	0.01	0.77
Amount of fuel required	508	0.21 (0.02)	1445	0.20 (0.01)	0.01	0.61
Type of fuel required	508	0.02 (0.01)	1445	0.01 (0.00)	0.01	0.53
Maintenance and repair cost of stove	508	0.00 (0.00)	1445	0.01 (0.00)	-0.01	0.22
Cleaning requirement	508	0.21 (0.2)	1445	0.29 (0.01)	-0.08	0.00
Portability	508	0.02 (0.01)	1445	0.02 (0.00)	0.00	0.61
Heat	508	0.30 (0.02)	1445	0.38 (0.01)	-0.08	0.00

Table 5: Best attributes of improved stoves, by gender of respondent: Two-sided T-test

	Male Respondents		**Female Respondents**			
	N	**Mean (Standard Error)**	**N**	**Mean (Standard Error)**	**Difference (Male – Female)**	**(P-value)**
Cost	184	0 (0)	588	0 (0)	0	--
Smoke	184	0.01 (0.01)	588	0.02 (0.01)	-0.01	0.66
Speed of Cooking	184	0.01 (0.01)	588	0.00 (0.00)	0.01	0.70
Ability to cook all foods	184	0 (0)	588	0.00 (0.00)	0.00	0.58
Taste of the foods	184	0 (0)	588	0.00 (0.00)	0.00	0.58
Number of dishes that can be prepared	184	0.01 (0.01)	588	0.00 (0.00)	0.01	0.39
Number of people the stove can feed	184	0.01 (0.01)	588	0.00 (0.00)	0.01	0.39

Amount of fuel required	184	0.02 (0.01)	588	0.00 (0.00)	0.02	0.06
Type of fuel required	184	0 (0)	588	0 (0)	0	--
Maintenance and repair cost of stove	184	0 (0)	588	0 (0)	0	--
Cleaning requirement	184	0.01 (0.01)	588	0 (0)	0.01	0.07
Portability	184	0.02 (0.01)	588	0.02 (0.01)	0.00	0.73
Heat	184	0 (0)	588	0.01 (0.00)	-0.01	0.17

Table 6: Worst attributes of improved stoves, by gender of respondent: Two-sided T-test

	Male Respondents		**Female Respondents**			
	N	**Mean (Standard Error)**	**N**	**Mean (Standard Error)**	**Difference (Male – Female)**	**(P-value)**
Cost	184	0.02 (0.01)	588	0.02 (0.01)	0.00	0.91
Smoke	184	0.01 (0.01)	588	0 (0)	0.01	0.07
Speed of Cooking	184	0 (0)	588	0 (0)	0	--
Ability to cook all foods	184	0 (0)	588	0 (0)	0	--
Taste of the foods	184	0 (0)	588	0 (0)	0	--
Number of dishes that can be prepared	184	0 (0)	588	0 (0)	0	--
Number of people the stove can feed	184	0 (0)	588	0.00 (0.00)	0.00	0.58
Amount of fuel required	184	0 (0)	588	0 (0)	0	--
Type of fuel required	184	0 (0)	588	0.01 (0.00)	-0.01	0.21
Maintenance and repair cost of stove	184	0 (0)	588	0.01 (0.00)	-0.01	0.33
Cleaning requirement	184	0 (0)	588	0.00 (0.00)	0.00	0.58
Portability	184	0 (0)	588	0.00 (0.00)	0.00	0.58
Heat	184	0.02 (0.01)	588	0.00 (0.00)	0.02	0.02

Table 7: Breakdown of all stoves owned by households in sample (some households own more than one stove)

Households owning "non-clean" stoves	2,066
Mud stove (single pot)	1,264
Mud stove (multiple pots)	206
Traditional 3-stone stove	509
Coal stove	2
Cast iron biomass stove	212
Households owning "clean" stoves	450
Kerosene stove--pump	14
Kerosene stove--wick	3
LPG stove	423
Electric	7
Biogas/Gobar gas	11
Commerical "improved" cookstove	4
Other	3
Households **not** owning "non-clean" stove	54
Households **not** owning "clean" stove	1,621

Table 8: Comparison of clean-stove owning households versus non-clean-stove owning households: Two-sided T-test

	Household Does Not Own Clean Stove		**Household Owns Clean Stove**		**Difference (Doesn't own - Own)**	**P-value**
	N	Mean (Std error)	N	Mean (Std error)		
Uttarakhand	1621	0.44 (0.01)	450	0.72 (0.02)	-0.28	0.00
Household size	1621	5.32 (0.06)	450	5.16 (0.11)	0.16	0.23
Female household head	1621	0.16 (0.01)	450	0.23 (0.02)	-0.07	0.00
Per cap monthly expenditure (Rs.)	1528	1190.95 (30.14)	431	1536.91 (59.02)	-345.96	0.00
Scheduled caste	1621	0.31 (0.01)	450	0.14 (0.02)	0.16	0.00
Household has saved money at bank or	1621	0.05 (0.01)	450	0.13 (0.02)	-0.08	0.00

other facility in past year						
Household has taken loan in past year	1621	0.14 (0.01)	450	0.12 (0.02)	0.02	0.23
Hindu	1619	0.92 (0.01)	450	0.96 (0.01)	-0.04	0.00
NGO in village	1617	0.50 (0.01)	449	0.53 (0.02)	-0.03	0.27
Access to toilet	1621	0.36 (0.01)	450	0.83 (0.02)	-0.47	0.00
Wife's years of ed	1291	1.93 (0.09)	372	4.91 (0.23)	-2.98	0.00
Husband's years of ed	1263	5.17 (0.13)	339	9.35 (0.22)	-4.18	0.00
Difference in ed (wife - husband)	1072	-3.10 (0.13)	289	-4.12 (0.27)	1.01	0.00
Wife's age	1479	43.87 (0.35)	428	47.95	-4.08	0.00
Husband's age	1352	48.59 (0.38)	353	52.23 (0.78)	-3.64	0.00
Difference in age (wife - husband)	1229	-5.40 (0.17)	332	-5.89 (0.38)	-5.51	0.20
Wife generates income	1476	0.05 (0.01)	427	0.03 (0.01)	0.02	0.18
Husband generates income	1358	0.44 (0.01)	353	0.39 (0.03)	0.05	0.13

Table 9: Stove ownership and use patterns, entire sample

	N	Mean (%)	Median	Minimum	Maximum	St. Dev
Owns traditional stove	2,066	97.45				
Owns "clean" stove	450	21.73				
Has used clean stove in the past 2 weeks	425	20.05				
Minutes spent preparing cooking fuel per week (all types)		81.05	25	0	3001	153.45
Minutes spent gathering traditional biomass fuel per week		130.19	120	0	840	120.06
Minutes/day spent using traditional stove		194.21	180	0	1440	168.59
Minutes/day spent using "clean" stove		39.7	0	0	1500	156.27
Minutes/day spent using "clean" stove, clean stove owners only	450	185.70	120	0	1550	296.16

Total minutes/day spent using all stoves		233.91	200	0	1740	221.69

Table 10: Characteristics of Male- and Female-Headed Households: Two-sided T-test

	Female Household Head		**Male Household Head**		**Difference (M-F)**	**P-value**
	N	Mean (Std error)	N	Mean (Std error)		
Uttarakhand	370	0.78 (0.02)	1750	0.55 (0.01)	-0.33	0.00
Household size	370	4.44 (0.12)	1750	5.45 (0.06)	1.02	0.00
Per cap monthly expenditure (Rs.)	355	1304.19 (55.54)	1652	1257.14 (30.17)	-47.04	0.50
Scheduled caste	370	0.24 (0.02)	1750	0.28 (0.01)	0.04	0.11
Household has saved money at bank or other facility in past year	370	0.09 (0.02)	1750	0.07 (0.01)	-0.02	0.07
Household has taken loan in past year	370	0.09 (0.01)	1750	0.15 (0.01)	0.06	0.00
Hindu	369	0.96 (0.01)	1749	0.92 (0.01)	-0.04	0.00
NGO in village	367	0.53 (0.03)	1748	0.51 (0.01)	-0.03	0.34
Access to toilet	370	0.67 (0.02)	1750	0.42 (0.01)	-0.25	0.00
Wife's years of ed	310	2.15 (0.20)	1389	2.68 (0.10)	0.53	0.03
Husband's years of ed	32	6.13 (0.90)	1610	6.04 (0.12)	-0.08	0.92
Difference in ed (wife - husband)	28	-3.82 (0.97)	1366	-3.31 (0.12)	0.51	0.53
Wife's age	366	53.53 (0.77)	1587	42.80 (0.32)	-10.73	0.00
Husband's age	33	41.81 (2.88)	1716	49.53 (0.34)	7.71	0.00
Difference in age (wife - husband)	33	9.45 (3.28)	1569	-5.88 (0.13)	-15.31	0.00
Wife generates income	368	0.05 (0.01)	1581	0.04 (0.01)	-0.00	0.70
Husband generates income	33	0.33 (0.08)	1722	0.43 (0.01)	0.10	0.27
Owns improved stove	363	0.27 (0.02)	1708	0.20 (0.01)	-0.08	0.00
Used improved stove	370	0.28 (0.02)	1750	0.18 (0.01)	-0.09	0.00
Total Fuel prep time/day (mins)	370	66.71 (5.28)	1750	84.09 (3.88)	17.37	0.05
Total Fuel collection time/day (Traditional)	370	111.26 (5.94)	1750	134.20 (2.89)	22.94	0.00
Traditional stove use (min/day)	370	263.71 (10.60)	1750	179.52 (3.74)	-84.19	0.00

Improved stove use (min/day)	370	47.56 (6.14)	1750	38.04 (3.90)	-9.52	0.00

Table 11: Descriptive statistics, education

	N	Mean (%)	Median	Minimum	Maximum	St. Dev
Husband years of education	1642	6.04	7	0	23	4.77
Wife years of education	1699	2.59	0	0	18	3.77
Difference in years of education (Wife's – Husband's)	1394	-3.32	-2	-13	14	4.29
Husband years of education, including imputed values	2120	4.68	5	0	23	4.90
Wife years of education, including imputed values	2120	2.07	0	0	18	3.53
Difference in years of education (Wife's – Husband's), including imputed values	2120	-2.60	0	-13	16	4.66

Table 12: Household characteristics, divided by wife's years of education (Two-sided T-test)

	Wife has median or below years education (0)		Wife has above median years education (>0)		Difference (No ed – Ed)	P-value
	N	Mean (Std error)	N	Mean (Std error)		
Uttarakhand	1063	0.38 (0.01)	636	0.69 (0.02)	-0.31	0.00
Household size	1063	5.49 (0.08)	636	5.08 (0.09)	0.41	0.00
Female head of household	1063	0.19 (0.01)	636	0.16 (0.01)	0.03	0.12
Per cap monthly expenditure (Rs.)	1007	1216.61 (34.15)	606	1357.18 (59.19)	-140.57	0.03
Scheduled caste	1063	0.31 (0.01)	636	0.21 (0.02)	0.10	0.00
Household has saved money at bank or other facility in past year	1063	0.05 (0.01)	636	0.09 (0.01)	-0.04	0.00
Household has taken loan in past year	1063	0.13 (0.01)	636	0.15 (0.01)	-0.02	0.47
Hindu	1061	0.91 (0.01)	636	0.96 (0.01)	-0.05	0.00
NGO in village	1060	0.51 (0.02)	634	0.53 (0.02)	-0.02	0.37
Access to toilet	1063	0.33 (0.01)	636	0.69 (0.02)	-0.36	0.00
Wife's years of ed	1063	0 (0)	636	6.91 (0.11)	-6.91	0.00
Husband's years of ed	865	4.04 (0.15)	527	9.24 (0.16)	-5.20	0.00
Difference in ed (wife - husband)	865	-4.04 (0.15)	529	-2.16 (0.16)	-1.88	0.00
Wife's age	1055	47.35 (0.43)	635	39.29 (0.49)	8.06	0.00
Husband's age	861	50.62 (0.48)	535	44.19 (0.54)	6.43	0.00
Difference in age (wife - husband)	861	-5.12 (0.21)	535	-6.15 (0.28)	1.03	0.00
Wife generates income	1056	0.04 (0.01)	631	0.06 (0.01)	-0.02	0.05
Husband generates income	866	0.46 (0.02)	536	0.41 (0.02)	0.05	0.07
Owns improved stove	1039	0.13 (0.01)	624	0.39 (0.02)	-0.26	0.00
Used improved stove	1063	0.11 (0.01)	636	0.36 (0.02)	-0.25	0.00
Used traditional stove	1038	0.98 (0.00)	609	0.97 (0.01)	0.01	0.06
Total Fuel prep time/day (mins)	1063	79.04 (3.50)	636	96.65 (8.43)	-17.61	0.03
Total Fuel collection time/day (Traditional)	1063	137.54 (3.76)	636	112.07 (4.03)	25.47	0.00
Traditional stove use (min/day)	1063	180.91 (5.03)	636	216.29 (6.37)	-35.38	0.00

Improved stove use (min/day) (if own clean stove)	131	201.73 (29.00)	241	170.41 (17.37)	31.32	0.32
Traditional stove use if also own clean stove (min/day)	131	185.04 (14.28)	241	177.20 (9.46)	7.83	0.64

Table 13: Household characteristics, by husband's and wife's age difference: Two-sided T-test

	Husband is 5 years or older than wife (Median or greater age difference)		Lower than median age difference		Difference (Median – Lower)	P-value
	N	Mean (Std error)	N	Mean (Std error)		
Uttarakhand	1030	0.50 (0.02)	1090	0.51 (0.02)	-0.01	0.64
Household size	1030	5.59 (0.08)	1090	4.98 (0.07)	0.60	0.00
Female head of household	1030	0.01 (0.00)	1090	0.33 (0.01)	-0.32	0.00
Per cap monthly expenditure (Rs.)	973	1207.69 (36.78)	1034	1319.83 (38.53)	-112.13	0.04
Scheduled caste	1030	0.28 (0.01)	1090	0.27 (0.01)	0.01	0.49
Household has saved money at bank or other facility in past year	1030	0.07 (0.01)	1090	0.07 (0.01)	0.00	0.75
Household has taken loan in past year	1030	0.15 (0.01)	1090	0.13 (0.01)	0.02	0.14
Hindu	1029	0.91 (0.01)	1089	0.94 (0.01)	-0.03	0.01
NGO in village	1029	0.52 (0.02)	1086	0.51 (0.02)	0.01	0.63
Access to toilet	1030	0.46 (0.02)	1090	0.47 (0.02)	-0.01	0.73
Wife's years of ed	884	2.49 (0.12)	815	2.69 (0.13)	-0.20	0.26
Husband's years of ed	955	5.70 (0.15)	687	6.52 (0.18)	-0.82	0.00
Difference in ed (wife - husband)	878	-3.00 (0.14)	516	-3.88 (0.20)	0.88	0.00
Wife's age	1030	44.14 (0.39)	923	45.56 (0.50)	-1.42	0.02
Husband's age	1030	51.94 (0.41)	719	45.71 (0.57)	6.23	0.00
Difference in age (wife - husband)	1030	-7.80 (0.16)	572	-1.48 (0.25)	-6.32	0.00
Wife generates income	1024	0.04 (0.01)	925	0.05 (0.01)	-0.01	0.63
Husband generates income	1029	0.40 (0.02)	726	0.47 (0.02)	-0.07	0.00
Owns improved stove	1002	0.21 (0.01)	1069	0.23 (0.01)	-0.02	0.25

Used improved stove	1030	0.19 (0.01)	1090	0.21 (0.01)	-0.02	0.14
Used traditional stove	1003	0.97 (0.01)	1055	0.98 (0.00)	-0.01	0.31
Total Fuel prep time/day (mins)	1030	87.47 (4.91)	1090	74.99 (4.52)	12.48	0.06
Total Fuel collection time/day (Traditional)	1030	135.39 (3.78)	1090	125.28 (3.59)	10.11	0.05
Traditional stove use (min/day)	1030	196.14 (5.03)	1090	192.40 (5.31)	3.74	0.61
Improved stove use (min/day) (if own clean stove)	407	44.26 (8.95)	427	47.22 (8.83)	-2.94	0.81
Traditional stove use if also own clean stove (min/day)	407	186.34 (7.62)	427	164.20 (7.84)	22.14	0.04

Table 14: Household characteristics based on wife's income generating activites: Two-sided T-test

	Wife does not earn income		**Wife earns income**		**Difference (Doesn't earn – earn)**	**P-value**
	N	Mean (Std error)	N	Mean (Std error)		
Uttarakhand	1861	0.51 (0.01)	88	0.42 (0.05)	0.09	0.09
Household size	1861	5.27 (0.06)	88	5.43 (0.30)	-0.16	0.54
Female head of household	1861	0.19 (0.01)	88	0.20 (0.04)	-0.02	0.70
Per cap monthly expenditure (Rs.)	1754	1263.56 (29.00)	88	1206.26 (103.54)	57.20	0.66
Scheduled caste	1861	0.26 (0.01)	88	0.53 (0.05)	-0.27	0.00
Household has saved money at bank or other facility in past year	1861	0.07 (0.01)	88	0.09 (0.03)	-0.02	0.48
Household has taken loan in past year	1861	0.14 (0.01)	88	0.17 (0.04)	-0.03	0.41
Hindu	1860	0.92 (0.01)	87	0.98 (0.02)	-0.06	0.06
NGO in village	1857	0.51 (0.01)	87	0.68 (0.05)	-0.17	0.00
Access to toilet	1861	0.48 (0.01)	88	0.32 (0.05)	0.16	0.00
Wife's years of ed	1605	2.50 (0.10)	82	4.15 (0.55)	-1.65	0.00
Husband's years of ed	1434	6.21 (0.13)	65	5.40 (0.63)	0.81	0.18

Difference in ed (wife - husband)	1319	-3.44 (0.12)	65	-0.85 (0.42)	-2.59	0.00
Wife's age	1851	45.02 (0.33)	87	40.89 (1.06)	4.13	0.01
Husband's age	1517	48.65 (0.36)	72	46.54 (1.37)	2.11	0.21
Difference in age (wife - husband)	1517	-5.49 (0.16)	72	-6.83 (1.02)	1.34	0.07
Husband generates income	1524	0.43 (0.01)	72	0.69 (0.05)	-0.26	0.00
Owns improved stove	1818	0.22 (0.01)	85	0.16 (0.04)	0.06	0.18
Used improved stove	1861	0.21 (0.01)	88	0.14 (0.04)	0.07	0.09
Used traditional stove	1804	0.97	87	0.99	-0.02	0.43
Total Fuel prep time/day (mins)	1861	82.80 (3.71)	88	63.04 (8.09)	19.76	0.25
Total Fuel collection time/day (Traditional)	1861	129.57 (2.76)	88	128.84 (14.04)	0.73	0.96
Traditional stove use (min/day)	1804	0.98 (0.00)	87	0.99 (0.01)	-0.01	0.43
Improved stove use (min/day) (if own clean stove)	413	0.95 (0.01)	14	0.86 (0.10)	0.09	0.15
Traditional stove use if also own clean stove (min/day)	365	0.93 (0.01)	13	1 (0)	-0.07	0.33

Table 15: Coefficient values for female bargaining proxy variable

	Age		Years of education				Female headship	Wife earns income
	MODEL 1[*]	MODEL 2[†]	MODEL 3[‡]	MODEL 4[§]	MODEL 5[**]	MODEL 6[††]	MODEL 7[‡‡]	MODEL 8[§§]
Own ICS (A)	0.00	-0.00	0.02***	-0.00	0.02***	-0.00	0.01	0.02
Used ICS (B)	0.00	0.00	0.02***	-0.00	0.02***	-0.00	0.03	0.03
Minutes cooking, trad stove (C)	-0.49		-4.41***	-0.36	-2.85***	0.45	22.70*	-19.02
Minutes cooking, ICS (D)	1.28	0.65	1.51	-1.92**	1.50	-1.90**	5.65	-15.18**
Minutes cooking, all stoves (E)	0.79	0.03	-1.90	-2.29*	-1.35	-1.45	28.35**	-34.20*
Total fuel prep time (min) (F)	-0.90	-0.63	1.16	0.46	1.58	0.67	-15.07***	-23.93**
Total trad. fuel collection time (G)	0.13	-0.03	-2.42*	-0.88	-1.69	-0.59	-10.14	-9.06

[*] FBP = Wife's age
[†] FBP = Age diff wife - husb
[‡] FBP = Wife's yrs ed
[§] FBP = Diff yrs ed wife - husb
[**] FBP = Wife's yrs ed, including imputed values
[††] FBP = Diff yrs ed wife – husb, inc. imputed values
[‡‡] FBP = Female HH head
[§§] FBP = Wife earns income

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