Health impact of using wood fuel for cooking in rural settings: case in Karametiya Divisional Secretariat, Sri Lanka

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Introduction

More than half of the developing world's population, particularly rural poor households depends on solid fuels such as agricultural residues, green waste, wood and wood derivatives, charcoal, coal, crop waste, and dung for their primary cooking (Malla & Timilsina, 2014). Their larger reliance on traditional, inefficient and dirty energy sources has been identified as a major threat to the economic development specifically in developing countries (Barnes & Floor, 1996). The hazardous effects of biomass consumption challenge the standards of living, education, health, employment and many economic aspects of the humans. Sri Lankan households use wood than any other fuel source. Approximately 65percent of households are cooking inside the main household structure while only 9percent had a separate building for cooking.

The type of cooking fuel source used by individuals is determined based on factors such as socio- economic conditions, energy use patterns, housing characteristics, cooking behavior, cultural factors, government policies and people's willingness to reduce the impact of indoor air pollution etc. (Malla & Timilsina., 2014, Laxmi et al., 2003). Most Precisely Indoor Air Pollution (IAP) caused by wood fuel used in cooking has been identified to be a major threat in developing nations with numerous adverse effects (Banerjee et al., 2012). The magnitude of health risk is expected to be influenced through above factors, specifically with the type of fuel depending on its rank in energy ladder along with many social, economic, behavioral and housing characteristics. Moreover, health risk is always a health cost which will finally add up to the economic cost of the rural households. This study examines factors affecting health risk of rural households, emphasizing the significant positive impact of wood fuel used in cooking

Methodology

Health risk is interpreted based on presence of cough, phlegm, red eye and eye itching among household members. Principle Component Analysis reduced the dimensionality of health index related data, involving a replacement of a set of correlated variables with a set of uncorrelated principle components that

represent unobserved characteristics of the population. Thus the dependent variable is binary which takes value 1 for risky group with presence of any of these illnesses and 0 otherwise. Independent variables were mainly awareness on cleaner fuel benefits, fuel type used for cooking, per head income; mean age of household, time spent on cooking and collecting firewood and education level of the head of the household.

Because of the dichotomous dependent variable, Binary Logit Regression Model was utilized in analyzing data. These models are appropriate when the response variable takes only two values representing presence and absence of a particular characteristic in the variable which the researcher is interested in.

$$y_i = \sum_{j=0}^{k} X_{ij}\beta_j + \varepsilon_i$$

We consider the case where the response Yi is binary, assuming only two values can be taken by the dependent variable as one or zero. For example;

$$Y_i \begin{cases} 1 \text{ if } i^{th} \text{ person has biomass cooking related health issue} \\ 0 \text{ otherwise} \end{cases}$$

$$ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 + \beta_2 Edu\_spou + \beta_3 fue\_type + \beta_4 awareness + \beta_5 tym\_2p + \beta_6 time\_cook + \beta_9 perHd\_Inc + \beta_9 years\_cook + \varepsilon$$

Results and discussion

Almost 70 percent of the households use wood fuel as their main source of energy in daily cooking while nearly half (48%) of the sample was using biomass for cooking. More than a half (69%) of households in Karametiya area uses wood fuel for cooking as their main fuel choice. The next most used fuel type is electricity which is used by 16 percent of the households. Gas was used as a main cooking fuel by 14 percent of the households. Kerosene was used by negligible number of households. Alongside 68.5percent of the households were not aware of the cleaner fuel sources and the hazardous health effects of indoor air pollution. The most of the household heads (98.5%) was employed in a wider range of occupations including farming (56.7) while 94percent of the women were unemployed. About 93percent of households are having their kitchen inside the house.

Except per head income of the household, time spent on cooking and collecting firewood, all the other variables were significant having the expected signs. Fuel type and mean age of household showed a significant positive relation under 0.05 significant levels confirming; higher the age, the higher will be the risk of having a health issue. Fuel type being significant for wood fuel, it confirmed that the wood fuel usage at home as the main cooking energy source increases the odds of having a wood fuel consumption related health risk ($p < 0.05$). Awareness

showed a negative relation confirming that better awareness on cleaner fuel and negative health effects of biomass use and indoor air pollution have a low risk of falling in to biomass cooking related health issues.

Table 1 Determinants of Health Risk Index of biomass cooking: Regression results

Variable	Coefficient	sd	Odds Ratio	Wald	Sig.
Fuel type				19.535	.000
Wood fuel	3.422*	0.918	30.634	13.901	.000
Kerosene	0.861	1.704	2.364	0.255	.614
Gas	-0.198	0.910	0.821	0.047	.828
Mean_ageH	0.091*	0.026	1.095	12.670	.000
Awareness (1)	-0.937*	0.475	0.392	3.894	.048
Perhd_Inc	0.000	0.000	1.000	0.010	.922
Time_cook	0.012	0.647	1.012	0.000	.985
Time_2p	0.003	0.224	1.003	0.000	.990
Constant	-4.900	1.552	0.007	9.969	.002

*$p < 0.05$

For example; regarding wood fuel users, it is 30.96 times more likely to be in health risk than for other fuel type users while aged groups were more likely to be in biomass cooking related health risk 1.095 times.

Conclusion and recommendations

Concluding the findings of the research, fuel type being wood fuel, unawareness and higher mean age were to be the significant factors that have affected in presence of health risk associated with use of biomass in cooking in rural Sri Lanka. With the kitchen type considered, low rate of outside kitchens is surprisingly noticed while Karametiya being a rural area. This implies the need of sufficient ventilation to the kitchen for those who are not in the safe conditions. When wood fuel was used, health cost was higher than the direct cost incurred in monetary terms. Indirectly, using the biomass for cooking costs the rural community more than what is actually felt by them in day to day life. This strengthens the idea that the increase in numbers of people who suffer from indoor air pollution related health issues or other physical discomforts will add up barriers to development.

Changing the fuel type used at home through awareness programme on risks of dirty fuel consumption will be helpful in improving the knowledge about health effects of indoor air pollution. Changing attitudes of the people will also be beneficial. Increasing women employment and the capacity to engage in self-employment activities will reduce the extra time left for them at homes and there by encouraging them to shift on the efficient energy sources, is beneficial since the opportunity cost of time would be higher when women are employed.

Keywords: *Biomass, health risk, Logit Model, wood fuel cooking.*

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