

Hardships and health impacts on women due to traditional cooking fuels: A case study of Himachal Pradesh, India

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ARTICLE INFO

Article history:

Received 13 July 2010

Accepted 25 May 2011

Available online 8 July 2011

Keywords:

Gender
Biomass fuels
Hardships

ABSTRACT

This paper explores the inter-linkages of gender, energy use, health and hardships in the Himalayan State of Himachal Pradesh in India. It brings out a gender-differentiated and age-differentiated picture of hardships and health impact on the use of traditional biofuels. The study is based on survey with questionnaires covering 4296 individuals, 729 households, 84 villages and 9 districts where biomass fuels meet 70% of household fuel needs. On an average, women walk 30 km each month taking 2.7 h per trip for fuel wood collection over hilly terrain, often at high altitudes and undergo stress like stiff-neck, backache, headache and loss of work days. Girls below 5 and females in 30–60 age-groups have higher proportion of respiratory symptoms than males of similar age-groups. While many studies are done on the health impact of cooking fuels, very little quantitative work is done on the other aspects of the fuel chain viz. collection, transportation and processing of fuels. Such studies would guide energy policy and health policy to improve the lives of women.

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1. Introduction

It is estimated that about 3 billion people have little or no access to modern energy services (UNDP, 2009). This problem is particularly acute in sub-Saharan Africa and South Asia where rural and peri-urban populations often rely on traditional biomass fuels (wood, dung and/or agricultural residues) for their energy needs. These fuels account for more than 70–90% of rural energy consumption of which wood is the main component (Malla, 2009; WHO, 2006; Nankhani and Findeis, 2003; Wickramasinghe, 2001; Parikh et al., 1999; Natarajan, 1995). The biomass chain viz. gathering, transportation, processing and combustion is predominantly managed by women where they work as gatherers, processors, carriers or transporters and also as end-users or cooks. Thus, they suffer health hazards at all stages. The health impact on women from exposure to smoke from cooking is a well researched area and has received the attention of policy makers both at national and international levels. But the stress and economic loss due to fuel wood collection and transporting long distance is not yet examined in quantitative terms and details (Wickramasinghe, 2001; Parikh, 1995, 1999; Laxmi et al., 2003). Non-commercial fuels, such as wood and cow dung, may not have any monetary value associated with them but there is still an opportunity cost in terms of the value of the time spent in collection of fuel wood (Pachauri and Spreng, 2003). The state of Himachal Pradesh in India is taken as a case to establish the

linkages among gender, energy use, hardships and health issues. The state was selected because

- (i) There is much physical effort and time involved in carrying heavy fuel head loads over the hilly terrain.
- (ii) It is a mountainous state having cold climate and good forest cover requiring more energy for both space and water heating for which biomass fuels are the primary source of energy.

There is evidence that women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary diseases (COPD) such as chronic bronchitis or emphysema than women who cook with electricity, gas or other clean fuel (Malla, 2009; Naeher et al., 2001). We present below a brief review of literature followed by the description of an analytical framework, the surveys conducted, the results and finally, the policy recommendations emerging from the analysis.

2. Review of literature

The increase in prices of fossil fuels and the energy crisis of 1970s drew the world's attention to various issues relating to fuel wood such as sustainability, the demand, the supply, the health issues, the gender perspective, etc. This was analysed either from the view points of tenurial relation or proximity to forests (John Soussan et al., 1991) or from the view points of controlling deforestation (Amcher et al., 1996) or managing the forest sustainably (Osei, 1996), or to see women's labour allocation for other family work (Lori-Ann, 1982) but

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not from the point of view of physical stress that women undergo as the main protagonist of the fuel wood cycle. Some recent work from South Asia highlights this issue (Wickramasinghe, 2001; Dara, 2001; Laxmi et al., 2003; Parikh and Laxmi, 2000; Parikh, 2000, 1995). From the survey results on urban, rural and plantation dwellers in Sri Lanka, Wickramasinghe (2001) identifies different types of physical ailments women suffered due to fuel wood. She describes how the bio-fuel cycle imposes hardship, stress and physical discomfort for women. Dara (2001) echoes similar experiences of women involved in fuel wood collection and use in Cambodia. Laxmi et al. (2003), Parikh and Laxmi (2000) and Parikh (2000) present case studies from the states of Rajasthan, Tamil Nadu and Uttar Pradesh of India, respectively. They focussed mainly on respiratory symptoms and on the stress in terms of distance travelled by women to collect fuel wood. There is ample evidence that indoor air pollution due to burning of solid biomass fuels causes health hazards for women and children under 5 years of age when they happen to be with their mothers during cooking periods (Siddique et al., 2008; Boadi and Kuitunen, 2006; WHO, 2006; Ezzati and Kammen 2002; Smith, 2002). These studies quote evidences from different parts of the world.

Access to efficient energy sources implies a higher level of energy services associated with a lower level of energy use, and leads to many other benefits such as improved indoor air quality, more time for productive or recreational activities, time that is freed up from collecting biomass energy, etc. (Pachauri and Spreng, 2003). The present paper explores the various physical stresses and hardships arising out of the fuel wood chain due to collection, processing and transport in the mountainous state of Himachal Pradesh in India.

3. The analytical framework

The bio-fuel chain has four stages: searching and gathering or collection, processing, transportation and cooking (Parikh, 1995; Wickramasinghe, 2001). The flow diagram below (Fig. 1) identifies the bio-fuel chain and the corresponding health impacts on women at each of the stages.

The first stage in the chain is the 'search and collection or gathering of biomass' that involves activities like walking up to woods, fields and surrounding areas that have the potential of inflicting bruises, snake bites and insect bites. The second step 'processing, stacking' involves work like bundling and stacking that results in health problems like allergy, rashes and chapped hands. Processing is sometimes done after going home or before. The third step, due to absence of transportation facilities, is to transport heavy head loads. This is the most strenuous task that could lead to headache, backache, knee pain, etc. The final step of the bio-fuel chain is cooking indoors with inefficient stoves in un-ventilated houses that are sometimes connected with health hazards like respiratory problems, eye diseases, infant mortality, adverse pregnancy, etc.

Fig. 1 captures the activities and the health impacts or hardships associated with each.

In the hilly state of Himachal Pradesh, women face health impacts at each stage of the fuel cycle, rather more intensively, due to the typical topography and altitude of the state. This is analysed with the help of data collected through two questionnaire surveys that were undertaken in the state.

3.1. The questionnaire survey, study area and data

The study uses information collected in two different surveys on Himachal Pradesh, which are compiled as Database A and Database B.

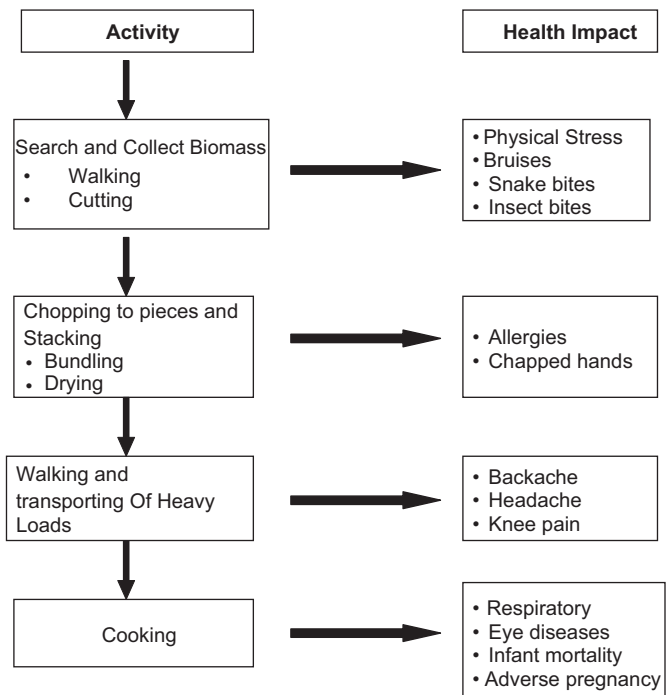


Fig. 1. Bio-fuel chain and health impacts.

3.1.1. Database A

Database A is the survey that covered 9 districts, 54 villages, 712 households and 4100 individuals of the state and collected the following data: socio-economic characteristics (household assets), whether fuel wood was collected, types of fuels used (types of fuels used in cooking), individual characteristics (gender, age and height), symptoms of diseases, kitchen characteristics, measures of peak expiratory flow, expenditure on health and willingness to pay for cleaner fuels. According to the Census 2001 of Government of India, there were 1.10 million rural households in Himachal Pradesh living in 17,000 inhabited villages spread across the 12 districts of the state. The survey was carried out in 9 of the 12 districts (Bilaspur, Chamba, Hamirpur, Kangra, Mandi, Shimla, Sirmaur, Solan and Una) that covered 54% of the geographical area and 92% of the state's rural population. Districts were selected keeping in mind the socio-economic heterogeneity of the state. Selection of villages and households within a village was performed using systematic random sampling. Fig. 2 explains the sampling criteria used.

The following methods were used at the household level to collect information:

- (i) Face to face interview with the chief cooks.
- (ii) Inquiry about symptoms and health assessment with measurement of weight, height and lung capacity with peak flow metres.
- (iii) Diagnostic with medical professionals.

To validate household level data, surveys were conducted at the village levels and at the health centres situated near the villages to cross-check the household data.

3.1.2. Database B

Database B was a gender-specific dataset on indicators of women obtained through structured questionnaires and focus group discussions. Data was collected for a smaller sample in two

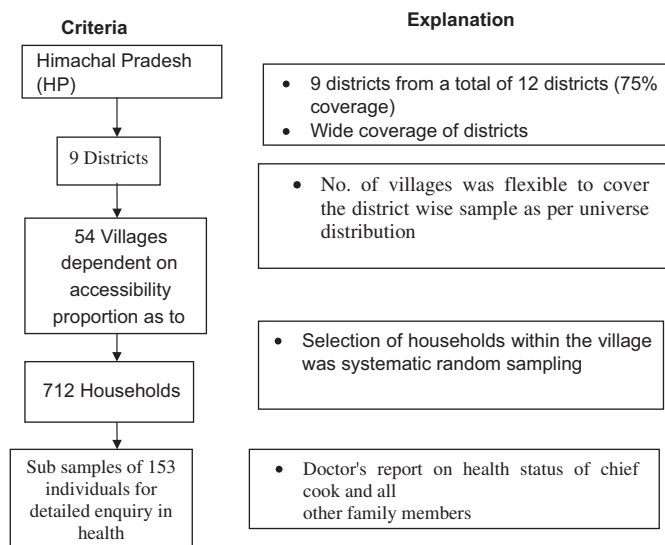


Fig. 2. Sampling procedure: case of Himachal Pradesh.

districts of the state Viz. Shimla and Sirmour. It included fuel related information such as hardships and health impacts of fuel wood collection, benefits of fuel types in terms of productivity (and income) gains, participation in community activities and accessibility to and use of clean fuels. The database A was more focused on cooking and indoor pollution aspects. As we found the need to examine the remaining parts of the chain, supplementary survey was done in 2 districts for that purpose. However, we also included questions regarding cooking to bring consistency along the whole chain and see how important is cooking in the chain. This additional survey was carried out especially to capture health impact from the three steps: collection, transportation and cooking. This survey covered 196 individuals from 80 households of 30 villages selected from Shimla and Sirmour districts (which are also covered in database A). Thus, the analysis of fuel use and health impacts due to indoor cooking is done based on database A, whereas hardships and health impacts from collection and transportation are based on database B (which repeated some questions on respiratory symptoms so as to compare with the other problems). To clarify, while database A (9 districts) is a survey where the medical professionals were present, the supplementary survey for database B (2 districts) was a socio-economic survey where women answered to the surveyors. Further, some secondary data sources like NFHS-2 (Second National and Family Health Survey of India, 1998–1999), Census of India (2001), etc. are used for comparative analysis and cross-checking of women empowerment indicators for the state of Himachal Pradesh with those of India as a whole.

4. Results

We discuss results under four different headings.

4.1. Fuel consumption

Fig. 3 and Table 1 describe the fuel consumption pattern of households from Database A.

In this grouping, kerosene, LPG, biogas and electricity are categorised as clean fuels and cooking fuels while fuel wood, dung cakes, crop residues, saw dust, etc. are referred as the traditional biofuels, which are solid biofuels are referred here as

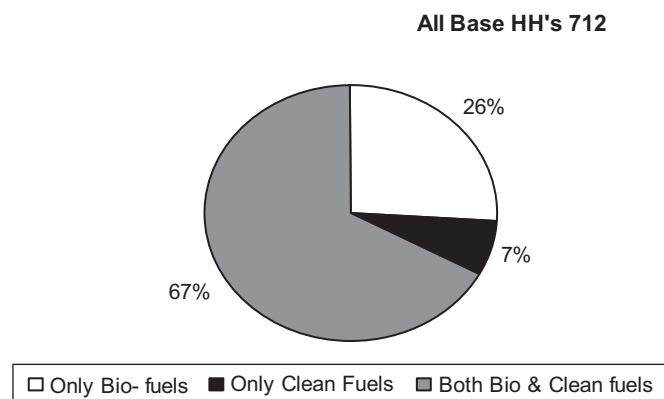


Fig. 3. Fuel consumption pattern.

biofuels (i.e. we are discussing traditional solid fuels and not modern liquid bio-fuels such as ethanols or methanols).

The survey results as seen from Fig. 3 show that 26% of the households use only biofuels, 67% use a mix of biofuels and clean fuels and 7% use only clean fuels. That is, 93% of the households use biomass fuels. Kerosene seems to be used either for lighting or for cooking of snacks or light meals, not for main meals. We draw this inference as the average consumption of fuel wood is reported to be high (7.4 kg/household/day) and a large number of households use a small amount of kerosene per month as observed from the information collected on use of kerosene. In all 227 households are reported of using kerosene. The consumption is less than 5 l per month for 145 households (63.9%), 5–10 l for 59 households (26%) and more than 10 l for only 23 households (10%).¹ Similarly 54% have access to LPG, but the actual use is insignificant. It could not be sufficient for regular cooking, but for occasional use, for special emergency situations or other than fuel wood, use of other biofuels is low, except for cow dung cakes that are also not so commonly used in these areas.

Columns in Table 1 show what percentage of the households use the type of fuel, say fuel wood, for cooking in different districts. They were allowed to tick more than one fuel up to 3 fuels if they used them. The last row shows the overall picture for all the 712 households surveyed in the 9 districts. As observed, almost all households seem to be using multiple fuels for cooking. Of the 712 households surveyed in the entire sample, 93% of the households reported using fuel wood, 54% LPG, 31% kerosene, 19% dung cake and 4% crop residue. Fuel wood is the most widely used cooking fuel across the state compared to other fuel types. The district-wise dependency on fuel wood ranges from 82% to 100% of the households surveyed. The comparatively lower dependency on fuel wood in Shimla and Hamirpur may be because of the fact that these districts are economically better off with wide industrialisation and alternative employment opportunities. Moreover, being more urbanized, access to fuel wood may not be easy. This likely creates a high opportunity cost of both fuel wood collection and burning, and households therefore go for clean fuels like LPG and kerosene. On the other extreme, fuel wood is used by almost all households in Chamba, Solan or even Una and Kangra (97%). This could be because of various reasons such as easy availability and low income so that the clean fuels may be beyond the reach of the households.

Though 54% of the surveyed households reported using LPG, the district dependency varied from as low as 2% in Chamba to as high as 81% in Bilaspur. This seems to corroborate the hypothesis that there exists a direct linkage between the use of clean fuels

¹ Based on results from Database A.

Table 1
Type of fuels used in cooking (total no. of HHs surveyed=712).

Districts	Base: all households	Fused by percentage (%) of households ^a							
		Fuel wood	LPG	Kerosene	Dung cake	Crop residue	Biogas	Electricity	Saw dust
Bilaspur	58	91	81	24	69	–	–	5	5
Solan	50	100	46	36	4	–	–	2	–
Hamirpur	66	88	50	64	5	6	–	–	3
Sirmaur	51	90	67	31	8	2	4	2	–
Una	62	97	56	40	21	8	–	–	–
Chamba	59	100	2	7	2	7	–	–	–
Shimla	79	82	72	13	–	–	6	3	1
Mandi	112	89	52	27	46	3	3	–	–
Kangra	175	97	53	34	12	7	4	–	–
Average/total	712	93	54	31	19	4	3	1	–

^a Multiple fuels are being used for cooking.

Table 2
Distance travelled for collection of fuel wood.

Districts	Number of HHs who always/mostly gather wood	Distance travelled by percentage (%) of HHs for collecting fuel wood			
		Up to 1 km	Between 1 and 2 km	Between 2 and 3 km	More than 3 km
Bilaspur	45	27	35	16	22
Solan	50	28	26	20	26
Hamirpur	51	65	22	7	6
Sirmaur	46	26	24	20	30
Una	53	21	51	17	11
Chamba	58	36	40	14	10
Shimla	65	23	40	18	19
Mandi	94	65	26	2	7
Kangra	155	52	28	8	12
Total/average	617	42	31	12	15

Table 3
Time spent for fuel wood collection.
Source: IRADe survey.

Districts	Average time spent per trip per household (h)	Average time spent per month per household (h)
Bilaspur	2.6	25.5
Solan	2.9	45
Hamirpur	2.5	34.3
Sirmaur	2.8	50.7
Una	2.8	29.7
Chamba	2.8	53.2
Shimla	3.2	57.3
Mandi	2.4	32.9
Kangra	2.5	37.8
Total	2.7	40.8

and the economic wellbeing as Shimla happens to be the most well-off district in the state. The other two important fuels are kerosene and dung cake, though kerosene seems to be more widely used than dung cake in all the districts except Bilaspur and Mandi. Fuel types like crop residue, biogas, electricity, saw dust, coal/lignite, charcoal, etc. are the least used.

4.2. Fuel wood collection

The households that use biomass fuel reported gathering fuel wood either from own/private or from government forests. It was observed that dependency on government forest is high in Chamba, Solan, Sirmaur, Kangra and Shimla districts whereas in districts like Bilaspur, Mandi, Hamirpur, Una and Kangra, households gather fuel wood mostly from their own field or private forest (Database A). Each household requires one or two persons to collect fuel wood and on an average made 15 trips in a month.

4.2.1. Distance travelled for collection

The distance travelled by percentage of households to collect fuel wood in each district is shown in Table 2.

The first column shows the number of households from among the households surveyed in the district who always or mostly collect fuel wood. The number is the highest for Kangra followed by Mandi and the least for Bilaspur. In Kangra 155 households go for fuel wood collection regularly, whereas the number of such households is only 45 in Bilaspur. Columns 2–5 show the percentage of households that travel the specific distance, say

up to 1 km or in between 1 and 2 km to collect fuel wood in different districts. All rows show these percentages for each district and the last row shows the average picture for the sample area. Despite high forest coverage in the state (more than 50%) the distances traversed are large. Of the 617 households who reported collecting fuel wood regularly, around 42% of them travel up to 1 km, 31% in between 1 and 2 km, 12% in between 2 and 3 km and 15% in more than 3 km distance to collect fuel wood in mountainous terrains. Hamirpur, Mandi and Kangra are the only districts where more than 50% of the households have to travel less than 1 km for this work. That is, more than 70% of the households travel more than 1 km to collect fuel wood in all other districts in this Himalayan state with 66.52% (legal area) forest cover (FSI Report, 2009). In Sirmaur district nearly 30% of the households travel more than 3 km for this work followed by Solan (26%) and then Bilaspur (22%). The reported average distance to collect fuel wood is about 2 km (Database A). This means that women in HP travel at 15 trips per household, a 30 km distance per month in a mountainous, climatically cruel high altitude environment to gather the required quantity of fuel wood.

4.2.2. Time spent for collection

Table 3 shows both the average time spent per trip per household and the average time spent per month per household in different districts to collect fuel wood.

The average distance travelled is 30 km and the time spent by a typical household is 40.8 h per month (@2.7 h per trip) in the state (last row of Table 3). Across districts the time spent varies

from 25.5 h per month for a family in Bilaspur district to as high as 57.3 h for a family in Shimla district. As a normal working day requires 8 h of work, households collecting fuel wood in Himachal Pradesh are losing 4–7 work days in a month—a very significant economic loss to the family.

4.2.3. Difficulties in collection of fuel wood

Results from the second survey for data compiled in Database B for 30 villages of Shimla and Sirmaur districts. Based on this

survey, the data is reported in Fig. 4. Asked what aspect concerns them the most among searching and gathering, stress and particularly carrying head loads or time taken, the answers were roughly equally divided in Shimla with about 6% for “others”. Sirmaur reported more difficulties about physical stress.

Women are losing the opportunities of being gainfully employed in other activities as they have to collect fuel wood. Searching and gathering and carrying heavy loads are ranked as the next two difficulties.

5. Who collects fuel wood?

In Fig. 5A and B we report on answers about the questions ‘who collects fuel and their age?’ One can see gender and age differentiation in fuel collection.

Fuel quality (in terms of heat value and ease of handling) increases from low to high in the following order: dung cakes, agriculture residues, fuel wood, kerosene & LPG. A clear pattern can be seen that as the fuel quality becomes superior, the role of women declines and that of men increases. The procurement of kerosene and LPG was largely the responsibility of young men, with no involvement of women in procuring LPG. The picture is the same in both the districts surveyed showing a higher role of women for inferior fuels. Age differentiation is also interesting, while older men help with collection of inferior fuels such as dung cakes & fuel wood. In both the districts collection of wood,

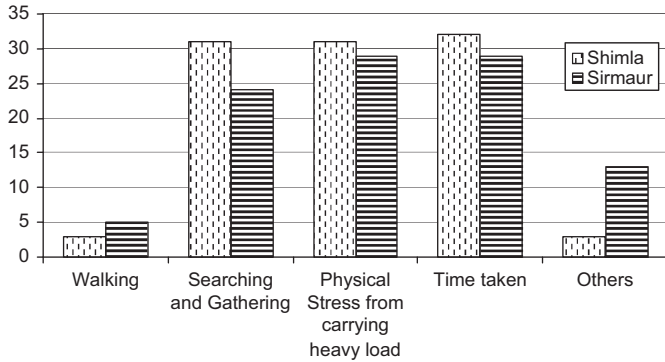


Fig. 4. Difficulties in wood collection.

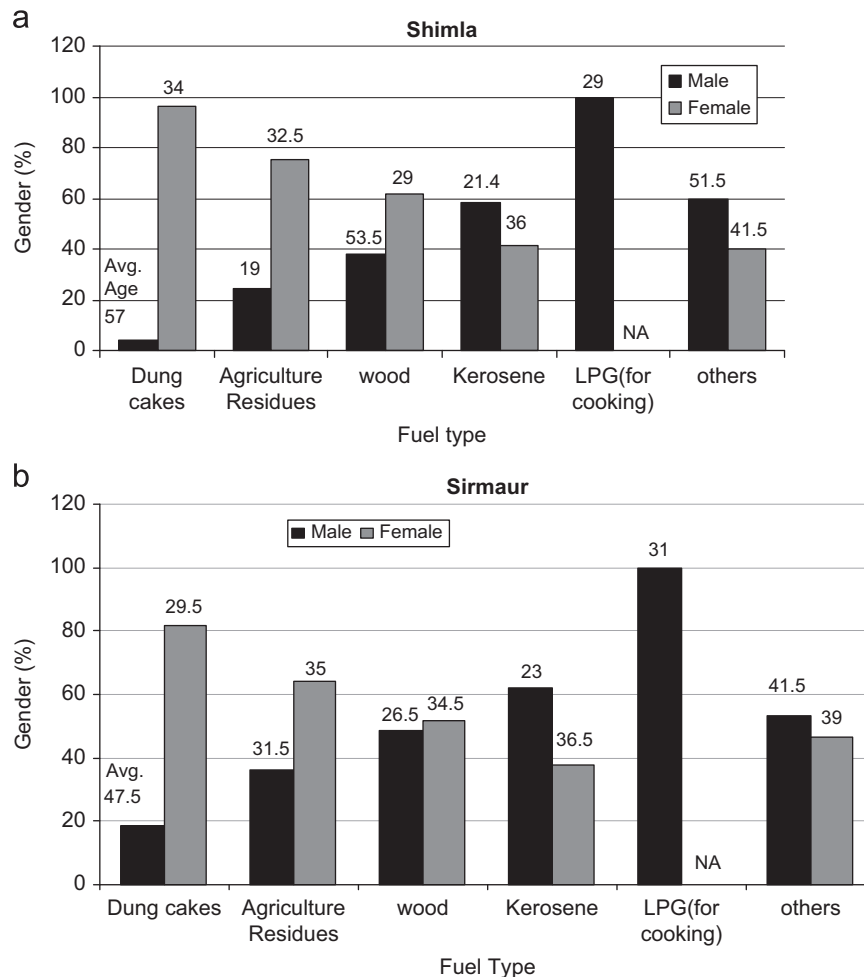


Fig. 5. (a) Fuel collection by gender and average age and (b) fuel collection by gender and average age.

agricultural residues and dung cakes was primarily the responsibility of women with an average age between 29 and 35 whereas the collection of wastes such as fodder and other waste food to be the responsibility of older men (more than 50 years in Shimla and 40 years in Sirmaur).

5.1. Health problems reported

Questions were asked about various impacts that they observed during the previous day, previous week and during the period of the past 3 months. There are wide variations in these answers in terms of frequency (which is quite plausible). For example, encounter with wild animals may not have happened on the previous day or previous week, but could be significant during the previous quarter. Similarly, coughing could be high due to some allergy or some weather conditions the previous day or previous week, but not so high in the previous quarter. The results reported describe such discrepancies. Although, recall of the previous day may be sharper, the recall of a quarter gives an averages of various occurrences.

The health problems were studied on a daily, weekly and quarterly basis for both Shimla and Sirmaur districts and are illustrated with the help of bar diagrams. Fig. 6 shows of the two districts studied, 64% and 39% of women suffered previous-day occurrences of backache compared to 42% and 65% who suffered coughing attacks.

Fig. 7 shows the weekly occurrences of bruising were more common (82% and 78%, respectively) than the comparable figures

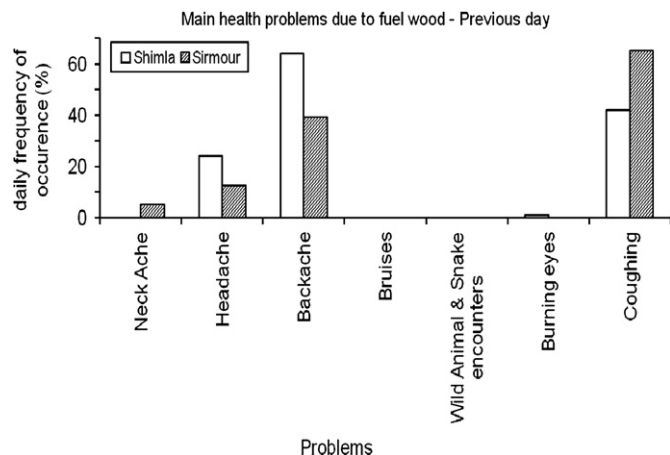


Fig. 6. Comparative graph of two districts of daily occurrence of health problems.

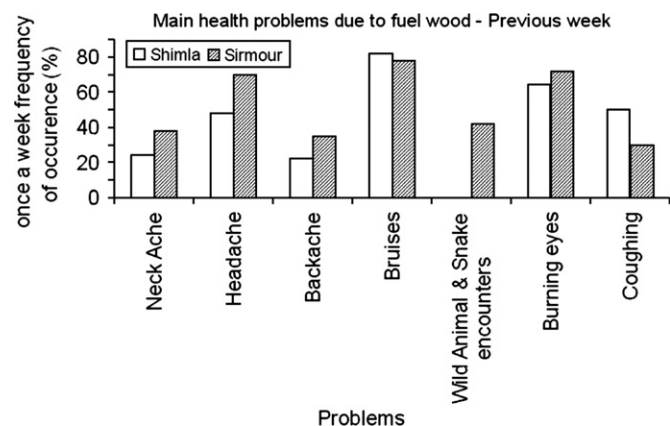


Fig. 7. Comparative graph of two districts of weekly occurrence of health problems.

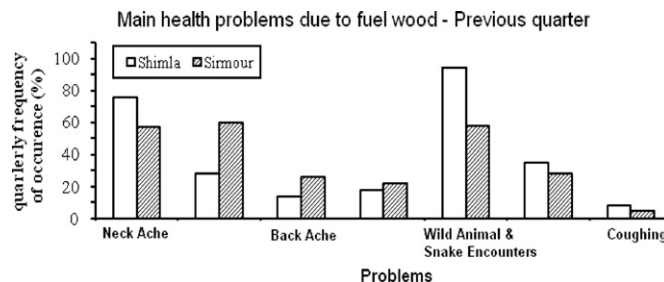


Fig. 8. Comparative graph of two districts of quarterly occurrence of health problems.

for headaches (48% and 70%, respectively). Fig. 8 shows the quarterly occurrence of health problems of two districts.

Encounters with wild animals and snakes were rarer on the previous day, although close to 97% in Shimla and 58% of those in Sirmaur reported this as a quarterly occurrence. Similarly, quarterly frequency with which neck ache is reported is 75.5% and 57%, respectively in the two districts. The quarterly occurrence frequency for health problems may depict a more general picture of the health impacts of fuel wood use. As reported, they indicate that neck ache, headache, back ache, bruises and animal attacks are more frequent than coughing. This suggests that hardships and health impacts of fuel wood collection, transportation and processing may be as serious, if not more serious, than the health impacts of smoke for women of Himachal Pradesh. Thus, more research is needed for examining these aspects in more detail as frequency is only one aspect, others being types of short term and long term effects of diseases and illnesses, medical verifications, expenditures incurred, time lost due to morbidity, old age infirmities, etc.

5.2. Health impacts from burning of fuel wood

Health effects from burning of fuel wood are well established and we only present the gender differentiated and age differentiated results for health impacts that may be due to high smoke exposure. Fig. 9 presents the proportion of symptomatic persons by age.

Health effect of the study as shown in Fig. 9 reveals that girls below the age of 5 and females in 30–60 age-groups (who are usually the chief cooks in a family) are at higher risks than males in the same age-groups. These findings are not new, but the gender difference between symptomatic persons in different age groups is the significant and new finding of the study. The group above 60 years of age shows anomalies because many effects at the highest age-groups are mixed up, e.g. the sample size is smaller due to deaths, women live longer, the fact that men smoke more often and the accumulated effects are usually visible at old age could be responsible for the anomalies. Data sets also get thinner beyond that age as life expectancy is short.

6. Way forward

This section reports on the comments from various stakeholders and our own thoughts during this work. Despite the development of the state of Himachal Pradesh, the problems for women persist and remain at the periphery of decision making. (Himachal Pradesh State Development Report, -2002). Though ownership of gas stoves has showed an increase as per the national surveys, biofuels still dominate the household energy needs.

Fuel wood collection and cooking done by poor, marginalised women is not a part of paid household activities. This responsibility reduces their opportunities to spend time meaningfully.

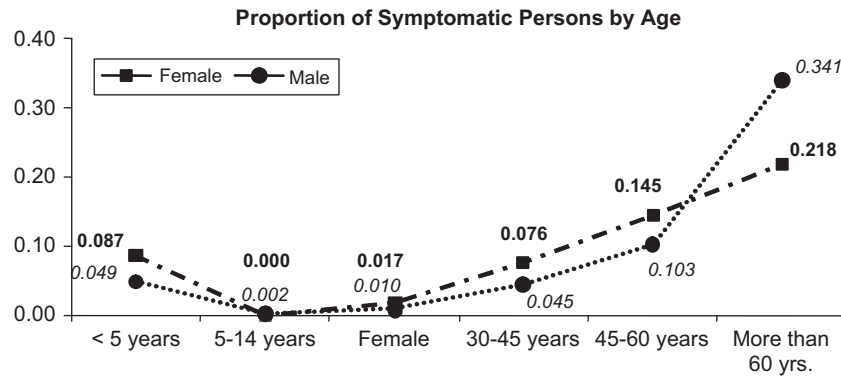


Fig. 9. Proportion of symptomatic persons by age.

This problem has not received attention from the policy makers. A paradigm shift in thinking of policy makers is needed along with the knowledge of dissemination and awareness generation:

- **Planning Commission (2006)** Govt. of India has recommended in the Integrated Economy Policy that “Availability of cooking fuels for rural women within one kilometre” is needed to reduce the hardships of carrying heavy loads. This needs to be implemented.
- Transportation should be made easier by enabling access to transportation solutions such as wheelbarrows, better pathways and small-motorised transport with community arrangements for carrying heavy bio-fuel loads. Another way out will be to help women form co-operatives to grow trees for fuel wood or plant oil seeds. This would reduce the efforts needed for searching and gathering by organising fuel biomass supply on a sustainable basis.
- Initiatives like development of micro-enterprises by interlinking micro-credit and energy programmes, and a shift from government initiatives to public–private partnerships will be helpful.
- Establishment of a rural fuel market by fixing a price or economic value for the fuel wood collected could be another helpful initiative.
- To ensure economic empowerment, access to energy should be linked as a promotional incentive for running small-scale energy business units so that security or livelihood is ensured and employment opportunities for women are generated. The options such as improves stoves, solar cookers, biogas and more LPG and kerosene need to be also considered.
- Health centres should be sensitised to the issues associated with indoor air pollution as well as diseases from hardships found in fuel transporting and collection; training workers to spot and address respiratory diseases as well as problems linked to transporting fuels can ensure better health for women.
- Health impacts of hardships endured need more studies with larger sample size and in various situations.

In the long term, a successful and sustainable energy system is needed to provide end-use services for livelihood, lighting, transport, agriculture, etc. in an integrated manner.

7. Concluding remarks

The two questionnaire surveys carried out in the mountainous state of Himachal Pradesh in India and the consequent data analysis clearly conclude the following:

- (1) There is a substantial physical burden in collecting, transporting and processing biomass leading to health impacts and

accidents, ranging from neck ache, backache, knee aches, falls, bruises, snakebites etc.

- (2) The health impact of these activities has not yet been adequately focussed upon by researchers.

Cooking with biofuels exposes women to harmful indoor air pollution having negative health effects as indicated by other earlier studies (WHO, 2007a, 2007b; Parikh et al., 1999). However, other health impacts and discomforts such as backache, bruising, headaches and neck ache resulting from collecting, transporting and processing of fuels are also important but have not received similar attention. There is also a significant economic burden on the poor in terms of the equivalent number of work days spent, ranging from 3 to 7 days per month, due to fuel collection while suffering from ill health.

These issues have remained on the periphery of policy making and a paradigm shift is required to address them. Women, who provide 30% of national energy (Planning Commission, 2006) need to be supported through management, investment and technology so as to manage their household cooking systems in a sustainable manner and with minimum hardship.

Acknowledgement

I thank ENERGIA—an International Network on Gender and Sustainable Energy and Global Development Network (GDN) for supporting this work, in particular S. Oparocha, Elizabeth Ceulski, Soma Datta and Ana Rojas. I am grateful to Dr. Sangeeta for her help in preparatory work. I thank all the surveyors and research assistants who have made it possible for us to do this work. I thank Professor Saudamini Das, Dr. Aparna and Saudamini Sharma for their valuable contributions in completing this manuscript. I thank the anonymous reviewer for improving the presentation of arguments. I am grateful to guest editors Shonali Pachauri and Wes Foell for their comments and improvements in the final manuscript.

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