Published in final edited form as:

Am J Ind Med. 2012 December ; 55(12): 1122–1128. doi:10.1002/ajim.21023.

Biomass Fuel Use for Cooking in Sri Lanka: Analysis of Data from National Demographic Health Surveys

Sumal Nandasena, MBBS, MSc, MD,

Evaluation and Research Unit, National Institute of Health Sciences, Ministry of Health, Sri Lanka

Ananda Rajitha Wickremasinghe, MBBS, PhD, and

Department of Public Health, Faculty of Medicine, University of Kelaniya, Sri Lanka

Nalini Sathiakumar, MD, DrPH

Department of Epidemiology, School of Public Health, University of Alabama at Birmingham

Sumal Nandasena: NSathiakumar@ms.soph.uab.edu; Ananda Rajitha Wickremasinghe: arwicks@sltnet.lk

Abstract

Background—Biomass cooking fuel is the main source of indoor air pollution in the majority of households in the developing world. Sri Lanka is an island of about 20 million population with urban, rural and estate population of 14.6%, 80.0% and 5.4%, respectively. This study describes biomass fuel use for cooking in Sri Lanka.

Methods—We analyzed data from two national Demographic Health Surveys (2000 and 2007) to identify the use and determinants cooking fuels in Sri Lankan households. The results are based on a sample of 8,169 households in 2000 and 19,862 households in 2007.

Results—Wood was the principal cooking fuel used in 78.3% and 78.5% of households in 2000 and 2007, respectively. In 2007, 96.3% of estate sector households used firewood as compared to 84.2% in the rural and 34.6% in the urban sectors. Similar trends were noted in 2000 as well.

Conclusions—The shift from firewood to cleaner fuels in Sri Lanka is negligible from 2000 to 2007. Improving the quality of life of the population does not necessarily predict a shift towards the use of cleaner cooking fuels in Sri Lanka.

Keywords

biomass; Sri Lanka; cooking; Demographic Health Survey; developing world; firewood

INTRODUCTION

Exposure to indoor air pollution is estimated to account for more than 1.5 million deaths and 2.7% of the global burden of disease in year 2000 based on the deaths and Disability-Adjusted Life Years (DALYs) from acute lower respiratory infections among children under five years of age, and chronic obstructive pulmonary disease and lung cancer among adults (WHO, 2007). Indoor air quality is a result of complex interactions between the structure and building systems, indoor source strength, removal and deposition rate within the structure, indoor mixing and chemical reactions, furnishings, the outdoor environment, and practices and behaviors of inhabitants [Mitchell et al., 2007].

Corresponding author: Sumal Nandasena, Address: Evaluation and Research Unit, National Institute of Health Sciences, PO Box 28, Kalutara, Sri Lanka., Telephone: 0094 777 747142, sumalnandasena@gmail.com.

Conflict of Interest Statement: The authors do not have any conflict of interest.

Biomass fuel is considered to be the main source of indoor air pollution in households around the world; approximately one half of the world's population and up to 90% of rural households in developing countries still rely on unprocessed biomass fuels [Bruce et al., 2000]. These are typically burnt indoors in open fires or poorly functioning stoves. As a result, there are high levels of air pollution, to which women, especially those responsible for cooking, and their young children, are most exposed [MoH Mongolia, 2003–2004]. Biomass fuel can be defined as any material derived from plants or animals which are deliberately burnt by humans. In general, wood is the commonest type of biomass fuel used, although animal dung and crop residues are widely used [de Koning et al., 1985] in countries such as China, South Africa and India [Bruce et al., 2000; Viswanathan and Kumar, 2005].

Biomass smoke contains an enormous number of substances, many of which damage or are injurious to human health. Most important are particulates, carbon monoxide, nitrous oxides, sulphur oxides, formaldehyde, and polycyclic organic matter [de Koning et al., 1985]. Different air pollutants cause different health conditions. Indoor air pollutants from cooking with biomass fuel can cause a spectrum of conditions including respiratory infections, nasopharyngeal and airways irritation, wheezing, chronic bronchitis, chronic obstructive pulmonary disease (COPD), exacerbation of COPD, low birth weight, an increase in prenatal deaths, cancers of the lung, mouth, nasopharynx and larynx, cataracts etc. [Bruce et al., 2000; Bruce et al., 2002; Smith, 2002].

Cooking fuels become cleaner, and more convenient, efficient and costly as people move up the “energy ladder” from animal dung, the lowest in the ladder, towards crop-residues, wood, charcoal, kerosene, gas and electricity at the top of the ladder. People tend to move up the ladder as socioeconomic conditions improve accompanied with modernization. However, the slow pace of development in many countries suggests that biomass fuels will continue to be used by the poor for many decades [Smith et al., 1994]. Knowledge of the trends of biomass fuel use, and its socioeconomic and demographic determinants in a particular setting are essential to plan further research, to implement indoor air pollution mitigating interventions and to raise awareness of the ill effects of indoor air pollution among the public.

Sri Lanka is a tropical island in the Indian Ocean with a population of about 20 million. According to the 2001 Census of Population and Housing of Sri Lanka, the urban, rural and estate population distribution were 14.6%, 80.0% and 5.4%, respectively.

The Demographic and Health Surveys (DHS) provide excellent data that are representative of the country that can be used for baseline analyses and hypotheses generation. The DHS of Sri Lanka is a reliable and valid survey which is conducted by the Department of Census and Statistics (DCS) every six to seven years, generating scientifically robust data related to health conditions and practices of Sri Lankans. The details of the survey are available on the website of the DCS (www.statistics.gov.lk) and the report of the Demographic and Health Survey 2007 [DCS, 2009].

Although the DHS surveys began in 1975 (World Fertility Survey of 1975, Contraceptive prevalence Survey of 1982, Demographic and Health Surveys of 1987, 1993, 2000 and 2007)[DCS, 2002], data on the principal cooking fuel used in households were included only from 2000 onwards. We compared data of DHS 2000 and 2007 to identify the patterns of, and associated factors of, use of different cooking fuels in Sri Lanka with special reference to biomass fuels.

METHODS

Study sample and respondents

The study sample of DHS represents the whole country which is obtained by multistage sampling techniques. The DHS 2000 was confined to 7 out of 9 provinces in Sri Lanka (excluding the Eastern and Northern Provinces). DHS 2007 included the Eastern province but not the Northern Province. The DHS used a stratified two-stage sampling design. In order to provide reliable estimates at different levels, some districts were oversampled. Details of the sampling procedures of DHS are explained elsewhere [DCS, 2002; DCS, 2008]. DHS 2001 had a sample size to provide accurate estimates at national and sector (urban, rural and estate) levels only. DHS 2007 was more extensive than DHS 2000 and was done on a larger sample to provide accurate estimates at three levels: national, sector and district level, and for tsunami affected areas. Districts are geographic administrative units, and Sri Lanka is divided into 25 administrative units. The respondents were ever married women aged 15–49 years in the selected households who are usually residents of the households or visitors present in the household the night before the interview.

Variables

DHS obtains information on fertility, mortality, family planning, child nutrition, health status of children as well as housing characteristics. The survey gathered information on fuel type used for cooking by households via the question “what type of fuel does your household mainly use for cooking?” A list of different responses was available for selection. The responses list differed slightly between DHS 2000 and 2007. Both surveys had “electricity,” “LPG gas,” “kerosene,” and “firewood” as responses. DHS 2000 also included “saw dust/paddy husk” and “other” categories. DHS 2007 included “not cooking in the home” and “other” categories.

We also obtained information about the housing unit and the individual. We correlated the wealth index with the cooking fuel type. The wealth index is a socioeconomic indicator and a proxy for long-term standard of living of the household. It is based on data on the household's ownership of consumer goods, dwelling characteristics, drinking water source, toilet facilities, and characteristics that are related to a household's socioeconomic status. Each asset was assigned a weight (factor score) generated through principal component analysis, and the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and standard deviation of one. Then each household was assigned a score based on the sum of individual scores. The entire sample was then divided into quintiles from one (lowest) to five (highest).

Data Processing and Analysis

Prior to the analysis, the DHS 2000 and the DHS 2007 data sets were weighted according to the weights given for each zone and sector (urban, rural and estate). Each data set was analyzed separately. Initially, we performed descriptive analyses which included examining the frequencies of households using different types of cooking fuel at the national and the sector level, and selected characteristics of households using wood fuel. We also examined frequencies of type of fuel used cross-tabulated with the wealth index. Using the chi square test, we evaluated the association between predictor variables of interest and cooking fuel type. We categorized cooking fuel into two groups: (1) clean fuel (gas, electricity); and (2) biomass (wood/saw dust/paddy husk) and kerosene. Predictor variables of interest included electricity, ethnicity and religion. We used the chi square test of trend to assess the use of cooking fuel category based on respondents' education level. Data analysis was performed using the SPSS version 16.

Ethical approval

The DCS obtained informed consent from each respondent. We obtained a de-identified dataset from the DCS after obtaining approval from the Director General of DCS. Ethical clearance was obtained from the Ethics Committee of the Faculty of Medicine, University of Kelaniya.

RESULTS

In the DHS 2000, 8,756 households were identified during enumeration and interviews were completed in 8,169 households. In the DHS 2007, 20,317 households were identified during enumeration and interviews were completed in 19,862 households (Table I). Household response rates were over 93% and 97% for DHS 2000 and 2007, respectively. The number of eligible respondents identified was 6,601 and 15,068 in DHS 2000 and 2007, respectively, the response rate being 97% in both surveys.

The main source of energy used as the principal cooking fuel in Sri Lanka was wood in both surveys (78.3% and 78.5% in DHS 2000 and DHS 2007, respectively) (Table II). The use of wood as a cooking fuel was different in different sectors but the pattern was similar in both surveys. The majority of estate sector households (96%) used firewood in both surveys. About 34% of households in the urban sector, in both surveys, used wood as the principal type of cooking fuel.

The percentage of houses using electricity for lighting had increased from 68.2% in 2000 to 80.0% in 2007 (data not displayed in a table). However, the use of electricity for cooking was negligible (less than 0.5% in both surveys) with no increase from 2000 to 2007. In 2000, only 25.9% of households with electricity used electricity or gas (Liquid Petroleum Gas (LPG), natural gas, bio gas) as the main cooking fuel, the rest relying on biomass or kerosene ($p<0.001$) (Table III). In 2007, only 21.3% of households with electricity used electricity or gas as the main cooking fuel ($p<0.001$).

Households of 65.3% of the respondents who had an education above grade 10 used biomass fuel; households of 94.9% of the respondents having primary schooling or less used biomass fuel in 2007 (Table IV). A similar pattern was also noted in DHS 2000. Higher the education level of the respondents, it was less likely to use biomass or kerosene in their households (in both surveys) (Chi square for trend $p<0.001$). A significantly higher percentage of households in which the respondent was a Buddhist as compared to being of another religion, and in which the respondent was a Sinhalese as compared to other ethnicities used biomass or kerosene.

Table V provides the distribution of households of the DHS 2007 by the principal cooking fuel used and the wealth index. The majority of households used wood as the principal cooking fuel in all quintiles except in the richest quintile, in which 71.6 % of households used LPG.

Among households using wood as the principal cooking fuel, 65.3% of households cooked in the same building; 9.5% of these households had a separate building for cooking (Table VI). The majority of households in which cooking was done in the same building had a separate room for cooking (94.7%). Only about 72.6% of the households using wood as the principal cooking fuel within the house had a chimney.

DISCUSSION

Although the percentage of global energy derived from biomass fuels fell from 50% in 1900 to around 13% in 2000, evidence shows that their use is now increasing among the poor. Poverty is one of the main barriers to use of clean fuels [Bruce et al., 2000]. It has been reported that households often continue to use simple biomass fuels in most of the developing countries, even where clean and more sophisticated fuels are available [Bruce et al., 2000]. This study shows that the situation in Sri Lanka is not different from other developing countries.

The DHS 2007 of Sri Lanka indicates that the increase in the percentage of households using cleaner fuels since 2000 is negligible. Use of electricity as an energy source for cooking is negligible (0.4% of households in DHS 2007) even though the use of electricity as a means of lighting has increased since 2000. The poverty head count index in 2002 was 22.7 and it was 15.2 in 2007 indicating an improvement in the quality of life of Sri Lankans [DCS, 2008]. Despite this improvement, there has been no change in the use of biomass as the main type of fuel for cooking from 2000 to 2007. Households may use more than one type of fuel for cooking. For example, some households may use LPG and biomass. This information cannot be ascertained from the DHS questionnaire. The Sri Lanka energy balance report of 2007 reports that biomass and petroleum demand in “the households and the commercial sector” in year 2000 were 82.29% and 10.48%, respectively; the same figures for 2007 were 79.82% and 8.89%, respectively [SSEA, 2007]. This corroborates with the findings of the information from the DHS that biomass fuel use has not changed from year 2000 to 2007. The “Households and Commercial” sector consumed about 48% of total energy consumption of the country in year 2007 [SSEA, 2007].

Use of LPG by >70% of the richest households indicates the shift to cleaner fuels with improved economic status. Despite this, one-fourths of the richest households still rely on wood for cooking. The difference in the use of wood by locality, 34% in the urban sector and >84% of households in the rural sector (Table II), may not be explained by poverty alone. The relative availability of a particular energy source may influence the type of cooking fuel used as a marked variation was observed between the sectors. Other considerations such as the availability of wood, as well as attitudes, practices and life styles of the rural population can influence the type of principal cooking fuel used.

Although the adverse effects of indoor air pollution on respiratory health, birth weight, cataract, etc. are well documented [WHO, 2002], the health impacts of indoor air pollution coupled with traditional practices in Sri Lanka has not been adequately addressed and discussed. A few studies of the effects of air pollution on health from Sri Lanka have been documented [Lankathilaka et al., 2000; Pathirane and Mahanama, 2006; Perera and Mahanama, 2004; Ranasinghe and Mahanama, 2004; Karunasekara et al., 2001]. Some determinants of morbidity and mortality have been identified and steps have been taken to mitigate their effects. Nationally, asthma and respiratory disease morbidity has increased during the last few years with respiratory diseases being the number one cause of outpatient visits in government hospitals [MoH Sri Lanka, 2003; MoH Sri Lanka, 2005]. A further reduction of respiratory disease morbidity and premature mortality may need the mitigation of yet unattended factors such as indoor air pollution.

Most of the local stoves used traditionally for wood have incomplete combustion emitting in high emissions; combined with poor ventilation, very high levels of indoor air pollution result [Amerasekera, 2004]. Kitchens in which wood was used with traditional stoves had reported average PM_{2.5} concentrations exceeding 1200 µg/m³ [Amerasekera, 2004]. A reduction in indoor air pollution has been demonstrated by the use of improved wood stoves

in various settings [Amerasekera, 2004]. Although these improved stoves have been introduced to the community from time to time [Amarasekara and Sepalage, 1988] in Sri Lanka, the community level use of these improved stoves together with other kitchen improvements such as having an appropriate chimney and hood is far from satisfactory.

Considering the possibility of the continued use of wood as the main source of cooking fuel for many more years in Sri Lanka, measures should be taken to mitigate the health hazards due to indoor air pollution. Most importantly, improved stoves could be introduced as a national priority among wood users. Proposed stoves should be culturally acceptable, user friendly and of low cost for sustained use by the needy communities.

Possible structural changes would be another option to improve ventilation in the kitchens of households by having chimneys, exhaust fans and open windows. Awareness programmes will be helpful in improving the knowledge about the health effects due to indoor air pollution and in changing attitudes that lead to improper cooking practices. Conducting further studies to monitor actual indoor air quality, ventilation levels in Sri Lankan households should be prioritised. Epidemiological studies pertaining to biomass smoke exposures are needed to explore and quantify the threat and extent of the public health impact and health cost.

CONCLUSIONS

Irrespective of the improvement in some of the quality of life indicators, use of biomass for cooking in Sri Lanka has not changed from year 2000 to 2007. However, higher the education and the wealth, the use of biomass is lower. Further studies are necessary to explore indoor air quality levels, exposure to biomass fuel and related health effects, behaviours and practices which are important to provide background information to plan exposure reduction interventions.

Acknowledgments

The authors thank the Director General and the staff of the Department of Census and Statistics, Sri Lanka, for providing data of DHS 2000 and 2007. The present work was supported by the University of Alabama at Birmingham International Training and Research in Environmental and Occupational Health program, Grant Number 5 D43 TW05750, from the National Institutes of Health-Fogarty International Center (NIH-FIC). The content is solely the responsibility of the authors and do not necessarily represent the official views of the NIH-FIC.

Grant sponsor: the National Institutes of Health-Fogarty International Center (NIH-FIC) Grant number: 5 D43 TW05750

References

- Amarasekara, RM.; Sepalage, BP. Boiling Point No15. 1988. Sri Lankan Stoves Past and Present.
- Amerasekera, RM. Proven interventions to reduce indoor air pollution due to cooking with biomass "Air That We Breathe". First National Symposium on Air Resource Management in Sri Lanka Colombo; Air Resource Management Center, Ministry of Environment and Natural Resources; 2004.
- Bruce N, Perez-Padilla R, Albalak R. Indoor air pollution in developing countries: a major environmental and public health challenge. Bulletin of the World Health Organization. 2000; 78:1078–1092. [PubMed: 11019457]
- Bruce, N.; Perez-Padilla, R.; Albalak, R. The health effects of indoor air pollution exposure in developing countries. Geneva: World Health Organization; 2002. p. 11
- DCS. Sri Lanka Demographic and Health Survey 2000. Colombo: Department of Census and Statistics (DCS); 2002. p. 9
- DCS. Demographic and Health Survey 2006/2007, Preliminary Report. Department of Census and Statistics; Sri Lanka: 2008.

- DCS. Poverty Indicators: Household Income and Expenditure Survey -2006/07. In: SL, editor. Department of Census and Statistics and Ministry of Finance and Planning. 2008a.
- DCS. Demographic and Health Survey 2006/2007. Colombo: Department of Census and Statistics (DCS), Sri Lanka; 2009.
- de Koning HW, Smith KR, Last JM. Biomass fuel combustion and health. *Bull World Health Organ.* 1985; 63:11–26. [PubMed: 3872729]
- Karunasekara KAW, Jayasinha JA, Alwis LW. Risk factors of childhood asthma: a Sri Lankan study. *Journal of Tropical Pediatrics.* 2001; 47:142–145.
- Lankathilaka, KN.; Seneviratne, SRDA.; Fernando, DN. Indoor air quality and respiratory symptoms among children and women. Sri Lanka Association for the Advancement of Science - 56th Annual Session; Colombo. 2000.
- Mitchell CS, Zhang J, Sigsgaard T, Jantunen M, Lioy PJ, Samson R, Karol MH. Current State of the Science: Health Effects and Indoor Environmental Quality. *Environmental Health Perspectives.* 2007; 115:958–964. [PubMed: 17589607]
- MoH Mongolia. Health Risk Assessment of Indoor Air Quality. Ulaanbaatar: Ministry of Health, Mongolia; 2003–2004. MoH/HSE/4.3/001, AC.01.03.01.AW
- MoH SriLanka. Annual Health Bulletin - 2003. Department of Health Services; 2003. p. 26
- MoH SriLanka. Annual Health Bulletin-2005. Department of Health Services; 2005. p. 31
- Pathirane, SM.; Mahanama, KRR. Low Birth Weights of Infants and Exposure to Smoke from Biomass Fuel during Pregnancy. “Air That We Breath”, Second National Symposium on Air Resource Management in Sri Lanka 2006; Colombo. 2006.
- Perera, MAKKP.; Mahanama, KRR. Investigation of Lung Cancer to Human Activities in Sri Lanka. “Air That We Breath”, First National Symposium on Air Resource Management in Sri Lanka; Colombo. 2004.
- Ranasinghe, MH.; Mahanama, KRR. Risk of Cataract Formation with Exposure to Biomass Smoke. “Air That We Breath”, First National Symposium on Air Resource Management in Sri Lanka; Colombo. 2004.
- Smith KR. Indoor air pollution in developing countries: recommendations for research. *Indoor Air.* 2002; 12:198–207. [PubMed: 12244750]
- Smith KR, Apte MG, Yuqing M, Wongsekiattirat W, Kulkarni A. Air pollution and the energy ladder in Asian cities. *Energy.* 1994; 19:587–600.
- Authority, SLSE., editor. SSEA. Sri Lanka Energy Balance 2007: An analysis of energy sector performance. Colombo: Sri Lanka Sustainable Energy Authority; 2007.
- Viswanathan B, Kumar KSK. Cooking fuel use patterns in India: 1983–2000. *Energy Policy.* 2005; 33:1021–1036.
- WHO. The health effects of indoor air pollution exposure in developing countries. Geneva: World Health Organization; 2002. p. 11
- WHO. Indoor Air Pollution: National Burden of Disease Estimates. Geneva: World Health Organization; 2007. p. 1

Table I

Study population and response rates

	DHS 2000	DHS 2007
Households identified (N)	8,756	20,317
Households interviewed (N)	8,169	19,862
Households response rate (%)	93.5%	97.8%
Number of eligible women identified (N)	6,601	15,068
Number of eligible women interviewed (N)	6,385	14,692
Eligible women response rate (%)	96.6%	97.5%

Table II

Principal type of cooking fuels used in Sri Lanka

Type of cooking fuel	Households										
	Sri Lanka			Urban			Rural			Estate	
	2000 N (%)	2007 N (%)		2000 N (%)	2007 N (%)		2000 N (%)	2007 N (%)		2000 N (%)	2007 N (%)
Total	8,169 (100.0)	19,862 * (100.0)		1,498 (100.0)	2,483 * (100.0)		6,087 (100.0)	16,449 * (100.0)		584 (100.0)	930 (100.0)
Wood	6,397 (78.3)	15,597 (78.5)		509 (34.0)	858 (34.6)		5,324 (87.5)	13,842 (84.2)		564 (96.6)	897 (96.3)
Saw dust/paddy husk	6 (0.1)	-		3 (0.2)	-		1 (0.0)	-		2 (0.3)	-
Kerosene	295 (3.6)	560 (2.8)		210 (14.0)	317 (12.8)		78 (1.3)	237 (1.4)		7 (1.2)	7 (0.7)
LPG	1,389 (17.0)	3,318 (16.7)		753 (50.3)	1,215 (48.9)		630 (10.4)	2,086 (12.7)		6 (1.0)	17 (1.9)
Electricity	33 (0.4)	44 (0.2)		3 (0.2)	16 (0.6)		27 (0.4)	28 (0.2)		3 (0.5)	1 (0.1)
Other	47 (0.5)	22 (0.1)		20 (1.3)	8 (0.3)		27 (0.4)	14 (0.1)		2 (0.4)	0 (0.0)
No food is cooked	-	313 (1.6)		-	68 (2.8)		-	237 (1.4)		-	8 (0.9)

* Includes missing values.

Table III

Households' availability of electricity by type of energy for cooking

Cooking energy type	Electricity at home		
	Yes	No	Total
DHS 2000	N (%)	N (%)	N (%)
Biomass and kerosene	4,129 (74.1)	2,563 (98.6)	6,692 (81.9)
Clean fuels (gas, electricity)	1,442 (25.9)	35 (1.4)	1477 (18.1)
	5,571 (100.0)	2,598 (100.0)	8,169 (100.0)
	$\chi^2=720.3$; $p < 0.001$		
DHS 2007			
Biomass and kerosene	12,348 (78.7)	3,821 (99.3)	16,169 (82.8)
Clean fuels (gas, electricity)	3,335 (21.3)	25 (0.7)	3,360 (17.2)
	15,683 (100.0)	3,846 (100.0)	19,529 (100.0)
	$\chi^2=921.4$; $p < 0.001$		

Table IV
Main source of energy for cooking according to respondents' education, religion and ethnicity

	Main types of cooking fuels					
	Biomass* and kerosene		Clean fuels [†] (gas, electricity)		Total	
	DHS 2000 N (%)	DHS 2007 N (%)	DHS 2000 N (%)	DHS 2007 N (%)	DHS 2000 N (%)	DHS 2007 N (%)
Total	5326	11708	1059	2583	6385	14291
Education						
Primary schooling or less	1642 (95.7)	2467 (94.9)	73 (4.3)	133 (5.1)	1715 (100.0)	2600 (100.0)
Grades 6–10	2546 (89.3)	6162 (88.3)	305 (10.7)	817 (11.7)	2851 (100.0)	6979 (100.0)
Grade 10	1138 (62.6)	3079 (65.3)	681 (37.4)	1633 (34.7)	1819 (100.0)	4712 (100.0)
	DHS 2000: $\chi^2=831.6$; $p < 0.001$		DHS 2007: $\chi^2=1360.9$; $p < 0.001$			
Religion						
Buddhist	4078 (85.8)	8975 (84.9)	672 (14.2)	1591 (15.1)	4750 (100.0)	10566 (100.0)
Other religions	1248 (76.3)	2733 (73.4)	387 (23.6)	992 (26.4)	1635 (100.0)	3725 (100.0)
	DHS 2000: $\chi^2=79.7$; $p < 0.001$		DHS 2007: $\chi^2=249.1$; $p < 0.001$			
Ethnicity						
Sinhalese	4394 (84.3)	9487 (83.4)	819 (15.7)	1883 (16.6)	5213 (100.0)	11370 (100.0)
Other ethnicities	932 (79.5)	2221 (76.0)	240 (20.5)	701 (24.0)	1172 (100.0)	2922 (100.0)
	DHS 2000: $\chi^2=15.7$; $p < 0.001$		DHS 2007: $\chi^2=86.6$; $p < 0.001$			

* Biomass - wood/saw dust/paddy husk.

[†] Clean fuels - gas, electricity.

Table V
Distribution of households by wealth index and principal cooking fuel, DHS 2007

	Poorest N (%)	Poorer N (%)	Middle N (%)	Richer N (%)	Richest N (%)	Total N (%)
Total	4256 (100.0)	4046 (100.0)	3936 (100.0)	3815 (100.0)	3802 (100.0)	19855 (100.0)
Principal cooking fuel						
Electricity	2 (0.1)	4 (0.1)	12 (0.3)	9 (0.2)	17 (0.5)	44 (0.2)
LPG	6 (0.1)	45 (1.1)	98 (2.5)	444 (11.7)	2724 (71.6)	3318 (16.7)
Kerosene	78 (1.8)	91 (2.2)	112 (2.8)	187 (4.9)	93 (2.5)	560 (2.8)
Wood	4061 (95.4)	3827 (94.6)	3652 (92.8)	3127 (82.0)	930 (24.5)	15598 (78.6)
No food cooked	106 (2.5)	76 (1.9)	58 (1.5)	41 (1.1)	33 (0.9)	313 (1.6)
Other	3 (0.1)	3 (0.1)	4 (0.1)	7 (0.2)	4 (0.1)	22 (0.1)

Table VI

Characteristics of households using wood for cooking, DHS 2007

Characteristic	N	%
Place of cooking		
Total	15,597	100.0
In the house	10181	65.3
Separate building	1,476	9.5
Outdoor	173	1.1
Temporary hut	3,745	24.0
Other	2	0.0
Missing data	21	0.1
Availability of separate room for kitchen *		
Total	10181	100.0
Yes	9640	94.7
No	483	4.7
Missing data	58	0.6
Availability of a chimney *		
Total	10181	100.0
Chimney	7,392	72.6
No chimney	2,789	27.4

* Includes only houses where indoor cooking was done in the main household building.