

HOUSEHOLD COOKING FUEL USE PATTERNS AND DETERMINANTS IN MYANMAR*

Mar Mar Aye¹

Abstract

Choosing an appropriate types of cooking fuel is essential for safeguarding good health and enhancing the well-being of people in developing countries. In Myanmar, the majority of rural and urban households rely on solid fuels for cooking, and there are adverse effects of such solid fuels on human health and environmental sustainability. This study investigates the determinants of household cooking fuel choice using the data from the Myanmar Inter-Censal Survey MICS (2019). The principal component analysis, Pearson chi-square association test, and a binary logistic regression model are applied. It is found that 65% of households use unclean cooking fuels, but 35% of households use clean cooking fuels. According to the results of the chi-square test of association, age, gender, marital status, education, and occupation of household head, household size, wealth quintiles, location based on urban and rural, and location based on states and regions are related to household cooking fuel choice. Regarding the results of the binary logistic regression model, female-headed households, married, widowed and divorced household heads, employed household heads, household heads with higher education, and rich households have a greater chance of using clean fuels. However, younger household heads, larger families and those residing in rural areas have less chance to use clean fuels.

Keywords: Cooking fuel choice, Clean fuel, Determinants, Binary logistic regression

Introduction

Energy is an essential ingredient for social, economic and industrial development of every nation (Oyedepo, 2012). It is also a basic necessity of life as it is required by every household for cooking, lighting and heating. At the world level, 40% of the population lack access to clean cooking fuel and technologies rely on polluting fuel like wood, charcoal, other solid biomass, kerosene, and coal (Puzzolo et al., 2017). In spite of increased awareness of the adverse consequences of the use of unclean fuel and innovations on clean energy technology, around 2.8 billion people do not have access to clean cooking fuel (Karimu, 2015).

Globally, about 2.5 billion still depend on traditional biomass fuels to meet their primary cooking energy requirements while over one billion people do not have access to electricity, International Energy Agency (IEA), 2018. Low-income households primarily rely on fuel wood, dung, and residue as their main source of energy, whereas wealthier families tend to utilize electricity and liquefied petroleum gas (LPG) (Behera et al., 2015).

Households in developing countries consumed about 90% of the energy and cooking fuel choices have become a major concern for both households and policymakers (Foell et al., 2011). There are other numerous consequences with the use of inappropriate cooking fuels in developing countries. Fuel wood and other solid fuel-based energy sources for cooking remain significantly dependent by households in developing countries. The demand for electricity and liquefied petroleum gas (LPG) have increased while that for kerosene and gasoline declined as reported by International Energy Agency (IEA, 2007).

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¹Department of Applied Statistics, Yangon University of Economics

According to the 2019 Myanmar Inter-Censal Survey, less than 40% of households have access to electricity. The choice of clean fuels or other liquid fuels used for cooking was less than 1.5%. The use of charcoal is far less than the use of firewood. Firewood is the main for cooking in almost all rural areas of Myanmar. Therefore, this study investigates how socioeconomic and demographic factors relate to household choice for cooking fuel. Specifically, it aims to identify the major determinants of the choice of cooking fuel and to analyze how these determinants have significant impact on cooking fuel choice.

Literature Review

Several studies on cooking fuels at the household level in developing countries have shed light on the determinants that influence a household's decision to choose a particular cooking fuel. Paudel et al. (2018) studied that understanding the determinants of the choice of cooking fuel in Afghanistan. The survey collected information data on ownership, access to public services and housing characteristics. The multinomial logistic regression model was used in which cooking fuel choice (LPG, Wood and Straw/Shrubs) as the dependent variable and socioeconomic and demographic variables as the explanatory variables. This study found that place of residence in urban areas, availability to electricity, wealth quintile, high education, marital status and separate cooking place plays an important role of household fuel choice in this country.

Ali et al. (2019) also identified the determinants of cooking fuel choice among rural household in Pakistan. Based on the data of cooking fuel choices such as (Gas, Fuelwood, and Dung/residue) which were considered as the dependent variable and a set of socioeconomic and demographic variables as the explanatory variables, Multinomial logistic regression was used. The results of this study showed that education is the most important determinant of adoption of clean fuel for cooking in rural Pakistan, and then household size, and employment sector.

Mperekumana et al. (2021) studied the effect of socioeconomic factors on household fuel choice in Northern Sudan. Multinomial logistic regression model was used to predict the occurrence of socioeconomic and demographic impact. In this paper, primary cooking fuel choice (liquefied petroleum gas (LPG), firewood and charcoal) was used as dependent variable, and gender, location, household size, education level, migration, cooking time, place of cooking, monthly income, cooking experience, size of apartment and distance to fuel market were used as independent variables. Results of the Multinomial logistic regression analysis revealed that cooking fuel choice is significantly influenced by location, household size, size of apartment and educational level.

Meng et al. (2021) observed the determinants of cooking fuel usage in Sub-Saharan urban households. The order probit model was used. The findings indicated that higher income and better education were linked to a higher probability of using clean cooking fuel more and using unclean fuel less, which had positive effects on the health of those preparing meals and the environment.

Dongzagla and Adams (2022) also examined the factors influencing household cooking fuel choice in Ghana. In this study, the data were analyzed using binary logistic regression model. The results of this study indicated that age, marital status, education level of household head, household size and household wealth are determinants of the household cooking fuel choice in Ghana.

Data and Methods

Data and Variables of the Study

In this study, the data were obtained from the 2019 Myanmar Inter-Censal Survey (MICS) conducted by the Ministry of Labor, Immigration and Population. Although there were 548,553 people participated in MICS (2019), this study focused on 132,092 household heads. The household cooking fuel types are grouped into two categories: “clean fuel” and “unclean fuels”. Clean fuels included electricity, liquid petroleum gas (LPG), natural gas, and biogas. Unclean fuels included coal, lignite, charcoal, wood, straw, shrubs, grass, agricultural crops, animal dung, and others. The dependent variable of the study is whether household used clean cooking fuel or not (i.e, 1 for households which used clean fuels, and 0 for households used unclean fuels). The independent variables are gender, age, marital status, education and occupation of household heads, household size, wealth quintile, location based on residence and location based on states and regions. The description and classification of dependent and independent variables are shown in Appendix Table (1).

Methods

In this study, descriptive statistics, principal component analysis, Pearson's chi-square association test, and the binary logistic regression model were applied. Firstly, the descriptive statistics was used to investigate the household cooking fuel patterns and socioeconomic and demographic factors of household heads. After that principal component analysis was conducted to construct household wealth index. Then, the relationship between socioeconomic and demographic characteristics and the household cooking fuel choice were analyzed through chi-square test of association. Binary logistic regression model was used to explore the determinants of the household cooking fuel choice.

Binary Logistic Regression Model

Binary logistic regression is a prognostic model that is fitted where there is dichotomous/binary dependent variable. Since logistic regression calculates the probability of an event occurring over the probability of an event not occurring, the impact of independent variable is usually explained in terms of odds. In logistic regression, the mean of the response variable Y in terms of an explanatory variable X is modeled relating Y and X through the equation

$$Y = E(Y / X) + \varepsilon_i \quad (1)$$

For a binary dependent or response variable ‘Y’ and an independent or predictor variable ‘X’, the probability for the distribution of ‘Y’ can be written as:

$$P(Y = 1) = \pi$$

$$P(Y = 0) = 1 - \pi$$

The logistic regression model is therefore given as

$$\pi_i = \frac{\exp(\sum_{j=1}^p \beta_j X_{ij})}{1 + \exp(\sum_{j=1}^p \beta_j X_{ij})} \quad (2)$$

Findings

Construction of Wealth Index

An indicator of relative poverty is the wealth index. Instead of using financial income as a basis, the wealth index uses asset ownership and household characteristics. To develop a meaningful wealth index using principal component analysis (PCA), a variety of asset ownership and household characteristics are needed. According to the meaningful wealth index, relative wealth is supposed to be represented by the first principal component of the PCA. The set of variables used in PCA methodology for determining wealth quintiles of Myanmar are presented in Appendix Table (2).

This study used a series of nineteen assets, including three household characteristics, access to three public services, and thirteen asset ownerships. The housing characteristics are the type of housing unit, roof, and floor. The public services are lighting, access to clean water, and toilets. The assets owned are motorcycle, mobile phone, canoe/boat, internet at home, television, motor boat, cart, radio, four-wheel tractor, car, line phone and computer. The type of housing unit is divided by (condominium, apartment/flat, bungalow/brick house, semi-pucca) and others (wooden house, bamboo, hut 2-3 years, hut 1 year). The roof is divided by (dhani/palm/ in leaf, bamboo, earth) and (wood, corrugated sheet, tile, brick, concrete, and others). The floor is divided into bamboo, earth, wood, tile, brick/concrete, and others. Types of ownership are divided by owned and rented (government, private, provided free, and others). Motorcycle, mobile phone, canoe or boat, internet at home, television, motor boat, cart, radio, four-wheel tractor, car, computer, line phone, and bicycle are considered into yes or no. Lighting is divided by grid electricity (government grid, border country grid, community-based grid electricity, off-grid electricity (generator (private), solar system energy, wind and water mill), and others. Drinking water is divided by pipe water (pipe into dwelling, pipe into compound, yards or plot, pipe to neighbor, public tap/standpipe) and others. Toilet systems are divided by flush to piped sewer system, flush to septic tank, flush to pit latrine, and others. The factor weight, mean, and standard deviation are described in Appendix Table (3).

Each variable is given a factor weight based on the first principal component. The factor weight represents the relative importance of each variable to the constitution of the first principal component. Through PCA, each asset and household characteristics is given a factor weight and each respondent can be given a wealth index score from minimum to maximum. The range of wealth index scores and percentage corresponding to each wealth quintile for Myanmar are described in Table (1). It can be seen that 20% of households are poorest, poorer and middle wealth quintiles, 20.1% of households are richer wealth quintiles and 19.9% of households are richest wealth quintiles.

Table (1) Wealth Index Score of Myanmar

Quintile	Minimum Wealth Index Score	Maximum Wealth Index Score	Percent (%)
Poorest	-3.2168	-0.8656	20.00
Poorer	-0.8656	-0.1613	20.00
Middle	-0.1612	0.3644	20.00
Richer	0.3645	0.9001	20.10
Richest	0.9002	2.5614	19.90

Source: SPSS output

Descriptive Analysis

The types of cooking fuel choice and socioeconomic and demographic characteristics of the sample households are described in Appendix Table (4). According to the types of cooking fuel choice, 65% of households use the unclean cooking fuels whereas 35% households use the clean cooking fuels. Regarding socioeconomic and demographic characteristics, 31.60% of household heads are aged 60 years or older. As regards the gender of household heads, 76.30% are male and 23.70% are female, with 5.20% being single and 94.80% being marriage, widowed and divorced.

Furthermore, regarding the educational attainment of household heads, 48.50% have completed primary education, while 19.00% have reached the middle education level, 18.50% hold a higher education degree, and 14.00% have no formal education. In terms of household size, 49.20% of households have 4-6 members, while 10.80% have 7 or more members. In relation to wealth quintiles, 20% of households fall into the poorest, poorer, and middle wealth quintiles, while 20.10% and 19.90% are in the richer and richest wealth quintiles, respectively. The majority of household heads live in the Yangon, Mandalay and Ayeyarwady Regions. The most household heads 72.30% live in rural areas but 27.70% live in urban areas.

With regard to the primary use of cooking fuels in households, 39.0% of clean cooking fuels are used by female household heads, 43.9% by single household heads, and 58.7% by household heads with higher education levels. Additionally, 65.0% of households in the wealthiest quintile and 69.7% of those living in urban areas utilize clean fuels and the usage rates are 71.3% in the Yangon Region, 59.6% in the Mandalay Region, and 58.7% in Naypyidaw.

Bivariate Analysis

The relationship between socioeconomic and demographic characteristics and household cooking fuel choice was analyzed using the chi-square association test. The results are shown in Appendix Table (5). It is found that gender, age, marital status, education and occupation of household head, household size, wealth quintiles, location based on residence and location based on states and regions are significantly related to the household cooking fuel choice at the 1% significance level.

Multivariate Analysis

A binary logistic regression analysis is performed to analyze the influencing factors of the household cooking fuel choice. According to the model evaluation criteria (Pseudo $R^2 = 0.477$), 47.70% of the variation in household cooking fuel choice can be explained by socioeconomic and demographic characteristics. Likelihood ratio LR chi-square test of model coefficients shows that the addition of the independent variables improved the predictive power of the model. Regarding LR chi-square test of model, it has been found that the model is significant (chi-square = 45958.514, $df = 30$, $p\text{-value} = 0.000 < 0.01$). Hosmer and Lemeshow goodness of fit test states how closely the observed and predicted probabilities match. The results of Hosmer and Lemeshow statistics (chi-square = 33.857, $df = 8$, $p\text{-value} = 0.473 > 0.01$) show that the data fit the model well.

The results of the binary logistic regression model are shown in Appendix Table (6). It can be seen that gender, marital status, education, wealth quintiles and occupation of household heads are the influencing factors of household cooking fuel choices in Myanmar.

According to demographic characteristics, gender is statistically significant at 1% level.

Concerning the sex of household heads, female household heads are about 1.170 times more likely to use clean fuel compared to male headed household.

Regarding household heads' age groups 30 - 39 years, 40 - 49 years, 50 - 59 years, 60 years and above are significant at 1% level. Conversely the household heads' age groups of 30 - 39 years, 40 - 49 years, 50 - 59 years, 60 years and above are about 0.096, 0.046, 0.066 and 0.067 times less likely to use clean fuels compared to those age group below 30 years. The marital status of household heads is statistically significant at 1% level. Married, widowed and divorced household heads are about 1.096 times more likely to use clean fuel compared to single household heads.

Household size is significant at 1% level. The size of household with 4-6 members, 7 and more members are about 0.16 and 0.39 times less likely to use clean cooking fuel compared with 1-3 members. The location based on place of residence is statistically significant at 1% level. Household heads who live in rural areas are about 0.761 time less likely to use clean cooking fuel compared with urban areas. The location based on states and regions is statistically significant at 1% level. Household heads who live in Mandalay Region, Naypyidaw, Shan State, Mon State, Ayeyawady Region, Thnintharyi Region, Kayin State, Kayah State, Chin State, Sagaing Region, Bago Region, Magway Region, Rakine State and Kachin State are about 0.718, 0.896, 0.457, 0.38, 0.746, 0.754, 0.673, 0.650, 0.884, 0.869, 0.978, 0.772, 0.653 and 0.668 times less likely to use clean fuel compared with household heads who live in Yangon Region.

Regarding the socioeconomic characteristics, the educational level of household heads is statistically significant at 1% level. Household heads who achieved primary, middle and high level and above are about 1.609, 2.119 and 2.511 times more likely to use clean cooking fuel compared with though no education.

The occupation of household heads is statistically significant at 1% level. Employed household heads are about 1.241 times more likely to use clean cooking fuel than unemployed household heads. The wealth quintiles are statistically significant at 1% level. Household heads from poorer, middle, richer and richest households are about 4.315, 9.243, 14.284 and 20.739 times more likely to use clean cooking fuel compared with the poorest households.

Discussion

The study aims to observe the relationship between socioeconomic and demographic characteristics and the household cooking fuel uses in Myanmar. The results of this study show that age of the household head is significantly related to household cooking fuel used. The younger age of a household head is more likely to use clean fuel than the other age group. Therefore, the younger than the older household head is, the cook has a greater willingness to accept modern technologies. The results of the study are consistent with the findings of Dongzagla and Adams (2022).

Place of residence is a significant factor in the amount of household cooking fuel used. It can be seen that rural people are less likely to use clean fuels (electricity and LPG) compared to urban people. The findings of the study are consistent with the results of Paudel et al. (2018).

The household's wealth quintile is the most important predictor of household cooking fuel used. Rich households are more likely to use clean fuels (electricity and LPG) than poor households. Therefore, the results of this study are consistent with the findings of Meng et al. (2021).

Education is essential way to address the growing problems of the human environment. Having a better education will become understanding of the benefits of clean fuels and the drawbacks of biomass fuels. Awareness campaign and public education can play an important role in reducing the amount of polluted cooking fuel used.

Conclusion

This study focuses on household cooking fuel choices and its socioeconomic and demographic determinants in Myanmar. This study observes that most households in the states and regions use firewood as cooking fuel. The majority of households in Myanmar, both urban and rural areas, continue to rely on unclean fuels (such as solid fuels, firewood, kerosene, etc.). In rural areas, firewood is mostly used because there is no alternative fuel or electricity. It is found that the gender, age of household head, marital status, education, occupation, household size, wealth quintiles, residence and states and regions are significant effect on household cooking fuel choices in Myanmar.

In this study, the gender of household head, age, education level of household heads, wealth quintiles, and occupation of household heads are the major determinants of household cooking fuel choice. It was found that female household head, achieving higher education, and rich households are more likely to use clean cooking fuels. However, older household head, people residing in rural areas and larger family sizes are less likely to use clean cooking fuel.

This study suggests that all these variables should be taken into consideration by policymakers while addressing issues regarding household cooking fuel choice. Furthermore, one solution to the environmental implications of unsustainable wood exploitation is to make modern cooking fuels more available and affordable, as well as to make the use of firewood and charcoal more sustainable. In addition, proper policies should be designed to educate and train a large number of people in order to enhance the likelihood of households expanding their usage of alternative fuels. Finally, since the majority of people prefer firewood and charcoal as fuels, and because the transition to new and renewable energy could be sluggish and indirect, the reforestation strategy should be improved to resolve energy demand issues as well as other relevant problems such as soil erosion and desertification.

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Appendix

Table (1) Description and Classification of Dependent and Independent Variables

Dependent Variable	Classification
Types of cooking fuel	Y = 1 if the household uses clean fuels = 0 if the household uses unclean fuels
Independent Variables	Classification
Gender	X ₁ = 1 if the household head is male = 2 if the household head is female
Age (years)	X ₂ = 1 if the age of household head is below 30 years = 2 if the age of household head is 30-39 years = 3 if the age of household head is 40-49 years = 4 if the age of household head is 50-59 years = 5 if the age of household head is 60 years and above
Marital status	X ₃ = 1 if the household head is single = 2 if the household head is married, widowed and divorced
Education	X ₄ = 1 if the household head has no education = 2 if the household head completed primary = 3 if the household head completed middle = 4 if the household head completed high and above
Occupation	X ₅ = 1 if the household head is unemployed = 2 if the household head is employed
Household size	X ₆ = 1 if the household size is between 1 to 3 = 2 if the household size is between 4 to 6 = 3 if the household size is between 7 and above
Wealth quintiles	X ₇ = 1 if it is a poorest household = 2 if it is a poorer household = 3 if it is a middle household = 4 if it is a richer household = 5 if it is a richest household
Location based on residence	X ₈ = 1 if the household live in urban = 2 if the household live in rural
Location based on states and regions	X ₉ = 1 if the household live in Yangon region = 2 if the household live in Kachin state = 3 if the household live in Kayah state = 4 if the household live in Kayin state = 5 if the household live in Chin state = 6 if the household live in Sagaing region = 7 if the household live in Tanintharyi region = 8 if the household live in Bago region = 9 if the household live in Mgaway region = 10 if the household live in Mandalay region = 11 if the household live in Mon state = 12 if the household live in Rakine state = 13 if the household live in Shan state = 14 if the household live in Ayeyarwady region = 15 if the household live in Naypyitaw region

Source: 2019 Inter-Censal Survey, Department of Population, Ministry of Labor, Immigration and Population

Table (2) Selected Variables for Constructing Wealth Index

Housing Material Indicators	Code
Type of housing unit	0 = Wooden house, bamboo, hut 2-3 years, hut 1 year, other 1 = Condominium, apartment/ flat, bungalow/brick house, semi-pucca house
Roof	0 = Dhani/theke/palm/in leaf, bamboo, earth corrugated sheet 1 = Wood, tile/ brick/ concrete/ other
Floor	0= Dhani/theke/palm/in leaf, bamboo, earth, corrugated sheet 1 = Wood, tile/ brick/ concrete/ other
Electricity, Water Source and Sanitation	Code
Lighting	0= Polluted electricity 1= Non-polluted electricity
Drinking water	0= Improved water 1= Imported water
Toilet	0= Improved toilet 1= Imported toilet
Ownership of Household Assets	Code
Motorcycle	0=No 1=Yes
Mobile phone	0=No 1=Yes
Canoe/Boat	0=No 1=Yes
Internet	0=No 1=Yes
Television	0=No 1=Yes
Motor boat	0=No 1=Yes
Cart	0=No 1=Yes
Radio	0=No 1=Yes
Four-wheel tractor	0=No 1=Yes
Car	0=No 1=Yes
Computer	0=No 1=Yes
Line phone	0=No 1=Yes
Bicycle	0=No 1=Yes 1 = Yes 1 = Yes 1 = Yes

Source: 2019 Inter-Censal Survey, Department of Population, Ministry of Labor, Immigration and Population

Table (3) Factor Weight and Standard Deviation

Variables	Component 1	Mean	Std. Dev
Type of housing unit	0.6480	0.2937	0.4555
Roof	0.6660	0.8682	0.3394
Floor	0.5240	0.7810	0.4136
Lighting	0.5030	0.8710	0.3352
Drinking water	0.2850	0.8397	0.3670
Toilet	0.3680	0.9262	0.2614
Motorcycle	0.4500	0.6291	0.4831
Mobile Phone	0.559	0.8534	0.3537
Canoe/boat	-0.0870	0.0352	0.1843
Internet at home	0.5560	0.5500	0.4975
Television	0.6520	0.5917	0.4915
Motor boat	-0.0800	0.0306	0.1721
Cart	0.4200	0.1791	0.3834
Radio	0.0400	0.1960	0.3970
Four-wheel tractor	0.1560	0.0372	0.1891
Car	0.4200	0.6519	0.2780
Computer	0.3520	0.0539	0.2258
Line phone	0.2030	0.0502	0.2184
Bicycle	0.2290	0.3529	0.4831

Source: SPSS output

Table (4) Percent Distribution of Household Cooking Fuel Choices and Socioeconomic and Demographic Characteristics in Myanmar

Variables	Classification	Household cooking fuel used (%)		Number	Percent
		Unclean	Clean		
Gender	Male	65.7	34.3	100847	76.30
	Female	61.0	39.0	31245	23.70
Household size	1-3	64.4	35.6	52872	40.00
	4-6	64.3	35.7	64964	49.20
	7 and above	66.4	32.6	14256	10.80
Age (years)	Less than 30	67.4	33.4	8672	6.60
	30-39	66.6	34.9	19674	14.90
	40-49	65.1	36.3	30043	22.70
	50-59	63.7	36.7	32027	24.20
	60 and above	63.3	35.4	41676	31.60

Variables	Classification	Household cooking fuel used (%)		Number	Percent
		Unclean	Clean		
Marital status					
	Single	56.1	43.9	6876	5.20
	Married, widowed, divorced	65.0	35.0	125216	94.80
Education	No education	80.4	19.6	18532	14.00
	Primary	72.3	27.7	64086	48.50
	Middle	55.9	44.1	25072	19.00
	High and above	41.3	58.7	24402	18.50
Wealth quintiles	Poorest	95.1	4.9	26443	20.00
	Poorer	80.7	19.3	26429	20.00
	Middle	63.5	36.5	26381	20.00
	Richer	48.5	51.5	26487	20.10
	Richest	35.0	65.0	26347	19.90
Location based on residence	Urban	30.3	69.7	36539	27.70
	Rural	77.7	22.3	95553	72.30
Occupation	Unemployed	61.9	65.8	42161	31.90
	Employed	38.1	34.2	89931	68.10
Location based on states and regions	Yangon	28.7	71.3	13751	10.40
	Kayah	53.6	46.6	16769	12.70
	Kayin	73.7	26.3	5531	4.20
	Chin	75.5	24.5	2654	2.00
	Sagaing	73.1	26.9	16780	12.70
	Tanintharyi	92.3	7.7	4671	3.50
	Bago	68.5	31.5	11275	8.50
	Magway	72.4	27.6	11394	8.60
	Mandalay	40.4	59.6	2161	1.60
	Mon	53.6	46.4	4867	3.70
	Rakine	60.7	39.3	2425	1.80
	Kachin	65.7	34.3	5426	4.10
	Shan	65.9	34.1	14844	11.20
	Ayeyarwady	87.8	12.2	15852	12.00
	Naypyitaw	41.3	58.7	3692	2.80
Total				132092	

Source: 2019 Inter-Censal Survey, Department of Population, Ministry of Labor, Immigration and Population

Table (5) Results of the Relationship between Household Fuel Choices and Socioeconomic and Demographic Characteristics in Myanmar

Variables	Classification	Chi -square	P- value
Gender	Male	229.032***	0.000
	Female		
Household size	1-3	24.558***	0.000
	4-6		
	7 and above		
Age (years)	Below 30	113.965***	0.000
	30-39		
	50-59		
	60-69		
	70 and above		
Marital status	Single	229.994***	0.000
	Married, widowed, divorced		
Education	No education	10276.141***	0.000
	Primary		
	Middle		
	High and above		
Wealth quantiles	Poorest	268881.209***	0.000
	Poorer		
	Middle		
	Richer		
	Richest		
Location based on Residence	Urban	25897.775***	0.000
	Rural		
Occupation	Unemployed	193.462***	0.000
	Employed		
Location based on Stages and Regions	Yangon	16880.579***	0.000
	Kayah		
	Kayin		
	Chin		
	Sagaing		
	Tanintharyi		
	Bago		
	Magway		
	Mandalay		
	Mon		
	Rakine		
	Kachin		
	Shan		
	Ayeyawaday		
	Naypyidaw		

Note: ***, **, * statistically significant at 1% level, 5% and 10% level.

Source: 2019 Inter-Censal Survey, Department of Population, Ministry of Labor, Immigration and Population

Table (6) Parameter Estimation of Binary Logistic Regression Model for Cooking Fuel Choices in Myanmar

	Classification	Coefficients	Odds Ratio	Standard Errors	P-value	95% CI	
						Lower	Upper
Constant		-2.493***	0.083	0.079	0.000		
Gender	Male (ref.)						
	Female	0.157***	1.170	0.024	0.000	1.115	1.227
Household size	1-3 (ref.)						
	4-6	-0.174***	0.840	0.016	0.000	0.815	0.867
	7and above	-0.495***	0.610	0.025	0.000	0.581	0.640
Age (years)	Less than 30 (ref.)						
	30-39	-0.101***	0.904	0.035	0.000	0.844	0.967
	40-49	-0.047***	0.954	0.025	0.000	0.909	1.002
	50-59	-0.068***	0.934	0.021	0.000	0.896	0.973
	60 and above	-0.07***	0.933	0.020	0.000	0.897	0.970
Marital status	Single (ref.)						
	Married widowed, divorced	0.091***	1.096	0.035	0.009	1.014	1.163
Education	No education (ref.)						
	Primary	0.475***	1.609	0.029	0.000	1.535	1.685
	Middle	0.751***	2.119	0.021	0.000	2.012	2.235
	High and above	0.921***	2.511	0.023	0.000	2.513	2.382
Wealth quintile	Poorest (ref.)						
	Poorer	1.462***	4.315	0.033	0.000	4.043	4.608
	Middle	2.224***	9.244	0.032	0.000	8.675	9.850
	Richer	2.659***	14.282	0.033	0.000	13.402	15.225
	Richest	3.032***	20.739	0.033	0.000	19.427	22.139
Location based on residence	Urban(ref.)						
	Rural	-1.430***	0.239	0.016	0.000	0.232	0.247
Occupation	Unemployed (ref.)						
	Employed	0.216***	1.241	0.016	0.000	1.203	1.280
	Yangon(ref.)						
	Kayah	-1.051***	0.350	0.052	0.000	0.312	0.378

Explanatory variables	Classification	Coefficients	Odds Ratio	Standard Errors	P-value	95% CI	
						Lower	Upper
	Kayin	-0.061***	0.941	0.065	0.000	0.935	1.208
	Chin	-2.153***	0.116	0.054	0.000	0.104	0.129
	Sagaing	-2.034***	0.131	0.066	0.000	0.115	0.149
	Tanintharyi	-1.40***	0.246	0.045	0.000	0.226	0.269
	Bago	-3.804***	0.022	0.072	0.000	0.019	0.026
	Magway	-1.48***	0.228	0.047	0.000	0.208	0.25
	Mandalay	-1.266***	0.282	0.053	0.000	0.254	0.313
	Mon	-0.476***	0.621	0.045	0.000	0.569	0.678
	Rakine	-1.059***	0.347	0.053	0.000	0.313	0.385
	Kachin	-1.102***	0.332	0.064	0.000	0.313	0.385
	Shan	-0.611***	0.543	0.047	0.000	0.293	0.377
	Ayeyawady	-1.371***	0.254	0.047	0.000	0.495	0.596
	Naypyidaw	-2.261***	0.104	0.049	0.000	0.095	0.278

Note: ***, **, * statistically significant at 1% level, 5% and 10% level.

Source: 2019 Inter-Censal Survey, Department of Population, Ministry of Labor, Immigration and Population