Poverty and Indoor Air Pollution: A Case Study of Women in Rural Bihar

ABSTRACT

OF

THESIS

SUBMITTED TO

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY

(A CENTRAL UNIVERSITY)

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BABASAHEB
BHIMRAO
AMBEDKAR
UNIVERSITY

LUCKNOW

प्रज्ञा शील करुणा

ESTABLISHED 1996

FOR THE AWARD OF DEGREE OF

Doctor of Philosophy

IN

ECONOMICS

Under the Supervision of

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Enrollment No. 347/14

Year 2020

Abstract

Certain human activities are degrading our environment- life-support system, which disrupts the eco-system and endangering human health. Among all these the greatest risk for serious illness due to environmental pollution are women, children and elderly and those living in poverty. Environmental pollution remains a concern globally, however there are two types of pollution that are found in the environment, first one is outdoor and second one is indoor, both consists serious problems for human health.. All types of pollutions, such as water pollution, noise pollution and air pollution are the major cause of diseases. But among these, indoor air pollution is significantly affecting the health of the people. Increasing population, excessive use of vehicles, construction activities, etc. are the main reasons for air pollution. However, the use of unclean fuels for cooking, the use of air condition in the houses, etc. are the main reasons for indoor air pollution (Emily. S. 2009: pp.1-2). According to World Health Organization, 7 million people died as a result of air pollution exposure in 2012 (WHO 2014: p1). This figure indicates that air pollution is now the world's largest single environmental health risk, killing more people than malaria and AIDS. Air quality is not only one country's concern; the case invokes universal cooperation, as air is a natural resource that does not follow to geopolitical borders (WHO 2014: p.1).Air pollution is one of the major causes of premature deaths in both developed and developing countries. In 2015, 9 million premature deaths had happened due to air pollution, which accounts 16 percent of all deaths in the world and three times higher than death due to AIDS, tuberculosis, and malaria. It is also more than 15 percent higher than deaths from wars and violence. In pollution-affected countries, one in four deaths occurs due to pollution. Air pollution is the fifth

most prominent factor in mortality worldwide. It is responsible for more deaths than the risks of malnutrition, alcohol use, and physical inactivity. Each year, more people die from diseases caused by air pollution than the number of deaths due to road accidents, malaria. In 2017, around 4.9 million people died due to air pollution worldwide and 147 million people lost years of healthy life (Health Effects Institute. 2019: pp.1-2).

Indoor air pollution (IAP) is a significant reason for both morbidity and mortality throughout the world. It has been severely impacting developing countries as compared to developed countries. Due to burning of traditional biomass fuels such as wood, animal dung and crops residues from daily domestic cooking in rural households (World Bank 1992; Smith and Mehta 2000). In 2017, 3.6 billion people (47 percent of the global population) were exposed to for indoor air pollution by using dirty fuel for cooking, in which East Asia, South Asia and sub-Saharan Africa regions were the most common. 13 countries in which more than 50 million population resides, having 10 percent of the population which were affected by domestic air pollution. Around 846 million people (60 percent of the population) in India and 452 million people (32 percent of the population) in China were affected by indoor air pollution in 2017. Burning dirty fuel around and indoors contributes significantly to air pollution. The contribution of indoor air pollution to air pollution varies across regions and is not calculated in most countries. Currently a global estimate has suggested that domestic energy use, as defined, contributes about 21 percent of the global ambient $PM_{2.5}$ concentration. Another study estimated that domestic energy consumption accounted around 31 percent of deaths from global outdoor air pollution. According to the Global Burden of Disease from Major Air Pollution Sources (GBD MAPS) project found that in India, the burning of biomass at indoor level was

responsible for 24 percent of the total population-weighted of PM2.5 concentrations in 2015. In China the burning of biomass and coal in 2013 of PM2.5 was responsible for 19 percent (Health Effects Institute. 2019: pp.8-9). Therefore, indoor air pollution is one of the most significant worldwide risk factors for initial deaths and diseases. In 2017, indoor air pollution accounted for 1.6 million deaths (2.9 percent of all deaths) and 59 million DALYs (2.4 percent of all DALYs) (Health Effects Institute. 2019: p.14) Therefore, the present study examines examine the relationships between indoor air pollution and rural poverty. The study also examines the impact of indoor air pollution on health of rural people and the reason for not using clean fuel and willingness to pay for it.

Objectives of the Study

1. To examine the relationships between indoor air pollution and rural poverty.
2. To study the impact of indoor air pollution on health of rural people.
3. To study the reason for not using clean fuel and willingness to pay for it.

Research Questions

1. What is the relationship between indoor air pollution and rural poverty?
2. What are the effects of indoor air pollution on health of rural people?
3. Whether people are WTP from use of better energy?

Hypotheses of the Study

1. In rural areas, indoor air pollution causes poverty and vice-versa.
2. Indoor air pollution causes substantial ill-health in rural areas.
3. People are using biomass fuel instead of clean fuel and also they are WTP from better energy.

Methodology and Research Design

(a) Criteria for Selection of the Study Area

The study is based on unclean fuel used for cooking and its impact on health of women. We have taken NSS 68th round data to define the unclean fuels[1]. To select the state for primary survey, we have taken the state wise data of energy consumption from NSS 68th round. The consumption pattern of cooking energy has been taken from 17 states. With this data the average percentage of energy consumption of all the cooking sources is calculated among the states. Chhattisgarh (97.9 percent) has first rank in using unclean fuel among 17 major states followed by Odisha (95.5 percent), Jharkhand (95.4 percent), and Bihar (94 percent). These four major states are using more unclean fuel than other states. Among these states, most of the states are using firewood and chips more than other sources of unclean energy. However Bihar is the only state who uses all sources of unclean fuels. In the case of dung cake Bihar is using 20.8 percent which is highest among these four state. Same case in using other sources such as coke and coal and kerosene Bihar has highest percent among the states (NSS 2011-12 (68th rounds): pp.14). Further, comparing the per capita income of these four states, Bihar has lowest per-capita income that is Rs.22582 after Chhattisgarh Rs.48366, Odisha Rs.43463 and Jharkhand Rs.36554. (Planning Commission 2011-12). Hence, based on above two indicators, viz., unclean fuels consumption and per capita income, Bihar is one of the poorest state. Therefore, Bihar is selected among the states for the study. Further using unclean fuels for cooking and per capita income selection of district is done. It is observed that Paschim Champaran is one of the districts, where substantial percentage of households depends on unclean

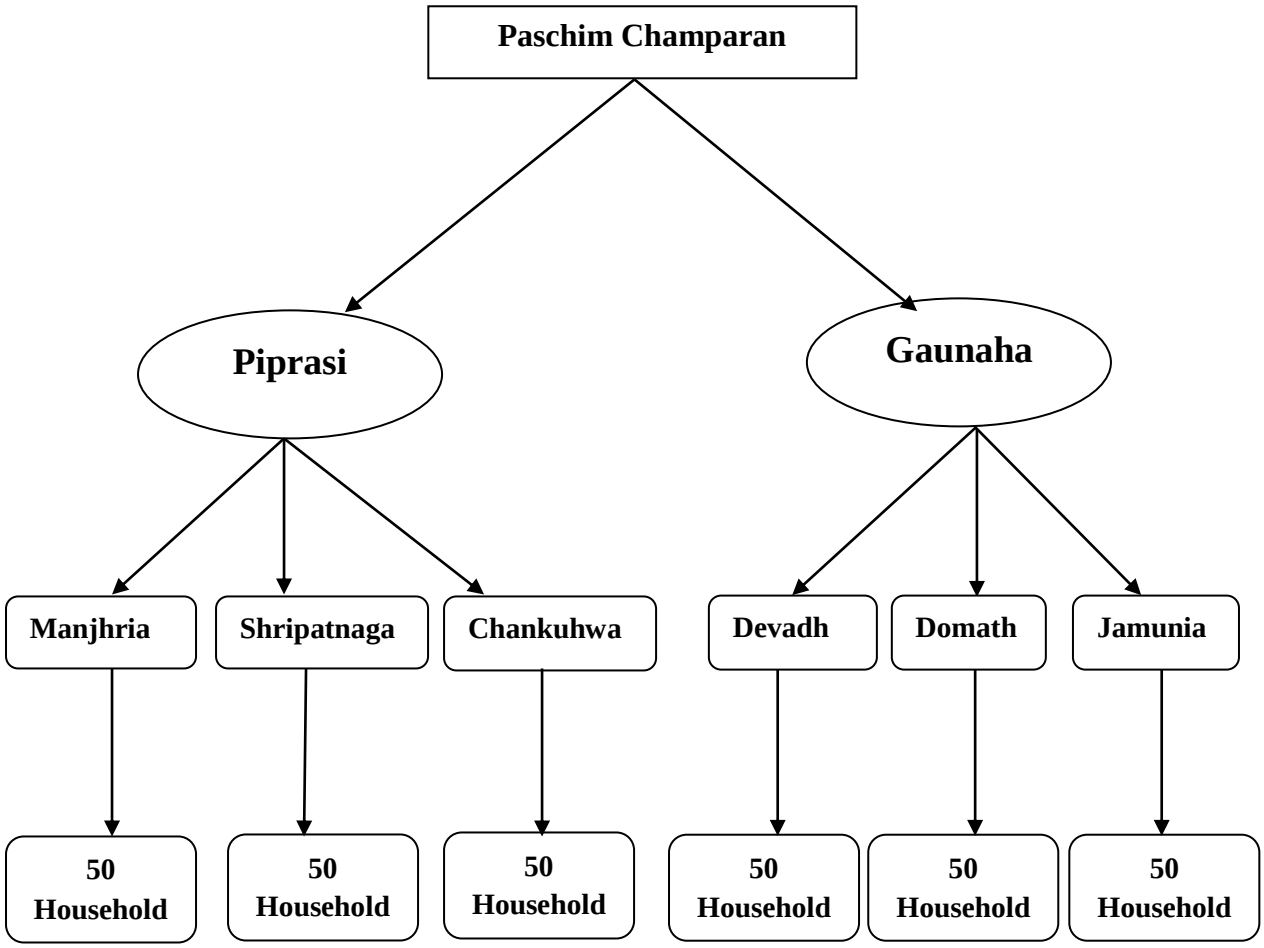
[1]Firewood and chips, cow dung, coke coal and kerosene etc. have categorized as unclean fuel for source of cooking.

energy for cooking purpose. Unclean fuels data viz., firewood & chips, dung cake, crop residue, coal lignite charcoal, biogas, are among these 38 districts Kishanganj has 1st rank (99.3 percent) after Kishanganj in sequence second Purnia (98.8 percent), third Araria (98.6 percent), fourth Madhepura (98.5 percent) and fifth Paschim Champaran (97.7 percent). To know the poverty status of these five districts we use the data of Ministry of Rural Development, Government of Bihar. We have taken the percentage of BPL card family data of these five districts. We found that Purnia has highest number of BPL card holder i.e. 4.251, Paschim Champaran has 4.236, Araria has 2.68, Kishanganj has 2.31 and Madhepura has lowest number of BPL card holder 2.07. On this basis Paschim Champaran was selected for primary survey, as it is one of the poverty ridden districts

(b) Sample Design and Size

Based on the records of Department of Rural Development, Government of Bihar, Paschim Champaran District is divided into 18 sub districts. Among them, two sub-districts, viz., Piprasi (99.7 percent) and Gaunaha (99.4 percent) are selected subsequently, there villages from each sub-district are identified based on the criteria as maximum number of households use unclean energy for cooking and other purposes. In total, six villages are selected from two sub-district (chart 1). Further, household's selection was done with the help of complete enumeration of households within each village and systemic random sampling method was applied for selecting households.

Chart 1: Selection Process of Households



(C) Approaches for data analysis

The present study tried to examine indoor air pollution and its impact on human health. Many diseases are involved in the environment due to indoor air pollution, which affects human health viz., bronchitis, cancer, allergy, skin infection, eye infection, etc. The household uses a different type of preventive measure to minimize the effect of disease through expenditure a considerable proportion of their income. So, due to indoor air pollution, the standard of life and economic conditions are adversely affected, and households are trapped within vicious cycle of poverty.

Chapter one entitled "Indoor air Pollution Issues and Methods" deals with extent of indoor air pollution and its impact on human health. It further comprises of research questions, objectives and hypothesis, research methodology and Chapterisation.

Chapter two entitled "Energy Consumption and Economic Development: Conceptual and Theoretical Background" includes various theories related to importance of energy consumption in economic development. The classical economists highlighted the pivotal role played by natural resources in economic development and so did the neo-classical economists. Chapter three entitled "Pattern of Energy Consumption in Rural and Urban Areas in India". In this chapter, primary source of energy used for cooking and lighting are based on various rounds of NSS data. Majority of the households are using unsustainable fuel for cooking in the rural areas, while clean fuel is used in the urban areas for cooking. It is also observed that the huge variation in rural energy after globalization in India. However, state level variation is high in rural as compared to urban areas. The use of LPG in urban India is around 68 percent in recent years where as reverse situation is found in rural India. Nearly 67 percent use of firewood and chips is for cooking in rural India. The weightage of use of unsuitable fuels for cooking and lighting is significantly higher among ST and SC social groups as compared to OBC and General category. There is high level of inequality persist in Rural and Urban India, while kerosene is superior fuel compare to bio-fuels. Secondary data analysis depicts that clean fuel are not easily available so people are ultimately relying on unsustainable energy sources. People are shifting towards clean fuel but the percentage is very low in order to obtain the sustainable economy with sustained environment where as after globalization there is a shift in usage of qualitative fuel.

Chapter Four "Demographic, Socio- Economic Profile of Households in Study Area of Paschim Champaran, Bihar" shows that income, education, occupation and health are main indicators of the development of any country and society. In this chapter, discussion on the socio-economic status of the study area are done on the

basis of 300 sample households has been done. The discussion based on demographic structure, family structure, occupation, income, education, and sanitation etc. Primary data analysis reveals that poverty condition of schedule tribe (ST) is very high on the basis on below poverty line (BPL) and Antodaya cardholders. Considering education pattern in the area, data reflects that in terms of literacy rate, the number of both males and females is found to be declining in higher education levels. The female participation is lower than that of males in higher education. The educational situation is truly depressing. Certain schools lack basic educational as well as infrastructural services, particularly for girls, which are reflected in an alarmingly low literacy rate between girls and the gender disparity in education attainment. Overall, literacy rate of district is below the state average. Taking into account the occupational pattern, the population of this area is completely dependent on agriculture. There are very limited numbers of industries in the area and those which exist are micro or small. Work force participation rate is low in the sampled district as the population of young people is more. However, due to lack of work/job opportunities, the people of this area migrate to work in other states if they do not work on agricultural fields. Agriculture, wage labour, private job, self-employment in non-agriculture are some of the main sources of income of the people in the sampled area.

Chapter Five is entitled as "Health Cost Measurement of the Households in the Study Area of Paschim Champaran District" This chapter measures health-cost through cost of illness method (COI). Cost-of-illness method measures the economic burden of diseases and evaluates the monetary value of health expenditure. The data shows that educated people are less affected by diseases as compared to uneducated people. During the 15 day reference period, in-patient average direct cost is Rs.11027.5 and for outpatient is Rs.2142.21. For 365 day reference period, the mean

value of direct cost for in-inpatient is Rs.29268.1 and for out-patient the mean value is Rs.5070.29 rupees. The inpatient health cost expenditure is higher as compared to out-patient. The socio economic variables affect health expenditure. The gender wise study shows that women suffer more from indoor air pollution borne illness than male. The biggest reason for this is that women spend more time at home due to which they have to face more smoke. Focusing on gender-wise health cost, it is found that due to prevalence of higher incidence of illness, the health cost of women is higher than that of men. It is clear that the situation of women of rural India has not improved even today. The majority of the people in the study area suffer from chronic diseases (91.57 percent), while a lower percentage (8.43 percent) suffers from acute diseases. Within our sampled population, 17.84 percent of people are not getting treatment due to lack of money and for other reasons. Women are the main victims of indoor air pollution and bear high health cost.

Chapter Six is entitled as "Willingness to Pay for Clean Energy in the Survey Area" which shows the block-wise willingness to pay of households. Out of the total population, 69.18 percent opt for bid 2 (above 300 rupees) and 30.82 percent preferred bid 1 (Below 300 rupees). In the 5th income quintile (i.e. high income group) a higher percentage of households agreed to pay as per bid 2 and 20 percent according to bid 1. Overall, 69.18 percent of respondents are in favor of giving payment as per bid 2 and 30.82 percent according to bid 1. Education plays an important role in the willingness to pay. There is no significant difference between men and women on the basis of willingness to pay (WTP) because women have more saving behavior than men. The caste plays a key role in the consumption of goods and services. Further, data reflects that the people spend according to their economic status, if they are poor then they are willing to pay less. Likewise, if they are rich then

their willingness to pay is more. As per social caste categorization, the willingness to pay (WTP) is high in case of general category 91.62 percent followed by OBC (75 percent), SC (69.23 percent) and ST (63.36 percent). Out of 300 households, 279 respondents revealed their willingness to pay (WTP) for the given alternative choice sets of monetary values in multiples of Rs. 150. The average willingness to pay is Rs.381.54 rupees with a standard deviation of Rs. 82.94. For the consumption of clean energy, households have to bear the financial burden, so they are not able to access clean energy. The average wood consumption is 387 kg per month and the standard deviation is Rs.145.62. The monetary value of this fuel is Rs 1935 per month, which is double the price of 14.2 kg LPG. However, if people are given about Rs. 382 for LPG gas, then the dirty fuel can be replaced. People of the study area are consuming smoke of Rs 1935 per month. The logistic regression model is used to find the determinants of willingness to pay (WTP) and the results show that education and income are significantly related to WTP. The low income and illiterate households are more willing to pay for clean energy than high income and educated households. The reason may be that they are more suffered from air pollution due to use of unclean energy.

Conclusions

Energy plays an important role in economic development. However, the energy consumption is highly depended on the income of the households. The higher income households are using clean fuel whereas the lower income groups are using unclean fuels for cooking and lightening. According to NSSO (68^{th} round), there is considerable variations in using energy fuels between urban and rural areas. 67.3 percent of the rural households are using firewood and chips for cooking, while about 68 percent of the urban households are using LPG for cooking. The study concludes

that there is a wide gap across social and religious groups on the basis of occupation, education, income and land distribution in the Paschim Champaran district of Bihar. The incidence of poverty among the SC and ST households are higher as compared to OBCs and other households. Moreover, majority of the ST and SC households are working as a daily wage workers and they have marginal land holding. Therefore, the households are using unclean fuels for cooking and other purposes due to poverty. The unclean energy leads to indoor air pollution, due to which the households are facing the health problems, particularly which is more vulnerable for female as compared to male. The health problem puts burden of health costs on the households, which further endures them into the vicious circle of poverty. Therefore, due to health problems from the unclean fuels the sampled households are willing to pay some amount to avoid the health cost. The average willingness to pay of sampled households for clean energy is 381 rupees.

Policy Implications

1. Housing quality is one of the major essential elements for the health of the rural people. Hence the condition of the houses to prevent the disease caused by indoor air pollution Healthy housing conditions can be the first step to avoid indoor air pollution.
2. The average willingness to pay of the study area is Rs 381.54 if the government provides 14.2 kg of gas cylinders at the price of Rs.400, then people can afford it and replace dirty fuel with clean fuel in the kitchens.
3. To provide relief to poor families from smoke, the government will have to take an electricity bill of up to Rs 400 for cooking, heating, and lighting.