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Salma Kousar
Anwar Hussain

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Salma Kousar
Pakistan Institute of Development Economics, Islamabad

and

Anwar Hussain
Pakistan Institute of Development Economics, Islamabad

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Pakistan Institute of Development Economics
Islamabad, Pakistan

E-mail: publications@pide.org.pk
Website: http://www.pide.org.pk
Fax: +92-51-9248065

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ABSTRACT

This study evaluates the impact of various socio economic and environmental variables on the incidence of diseases in district Bhimber of Azad Jammu and Kashmir (AJK). The selected diseases were diarrhoea, dysentery, cholera, typhoid, bronchitis, pneumonia, asthma, and malaria. In this study, we used primary data, collected through questionnaire from 267 randomly selected households. Analysis has been made through applying logistic regression. The results revealed that incidence of water borne diseases decreases with the increase in income, education, use of piped or motor pump water, satisfaction from water quality, drinking water treatment practices, hand wash facility near the toilets, availability of toilets in the houses, and frequency of toilet cleaning. Whereas water source outside the homes, sewerage water drainage in open drains, food storage in open jars/utensils show significant positive relationship with water borne diseases. Similarly, cooking in multipurpose rooms, use of wood, animal dung as cooking fuel, and smoking have significant positive impact on incidence of air borne diseases. Whereas cooking practices in open air, room space, presence of chimney at cooking place, and ventilator also have negative relationship with air borne diseases. Fly door, fly window and preventive measures from mosquitoes other than mosquito net show negative link with the incidence of malaria. While sewerage water drainage in open drains, presence of garbage heaps and stagnant water near a house and water storage in open container have significant positive effect on the incidence of malaria disease. This study suggests that the emphasis be placed upon awareness regarding health, improvement of sanitation conditions, introduction of hygienic practices, modern fuels like Liquefied Petroleum Gas (LPG) and bio-gas for better health.

Keywords: Heath Status, Communicable Diseases, Socio Economic, Water and Sanitation Condition, Fuel Consumption, Hygiene Practices, Preventive Measures Logistic Egression

1. INTRODUCTION

There is a well understood correlation between health and economic growth of a country. As the economy of a country improves, health of its citizens also improves; on the other hand, improving the health of a nation can supplement a country s economic growth due to its healthy labour force as a factor of production. Different growth theories suggest that the role of human capital plays a significant role in growth processes. According to Fogel (1994), approximately one third of ross Domestic Product DP of Britain between 1790 and 1980 is the outcome of improvements in health, especially improvement in nutrition, public health, and medical care facilities.

he wealthier is healthier hypothesis declares both that income is the key factor of health and the correlation among income and health is adequately close-fitting for income rankings to specify well-being more broad [Case and Deaton (2005)]. Therefore, income plays an important role in determining disease prevention and existing living conditions of households. If once environmental conditions improve, it is highly expected that incidence of diseases reduces, and therefore good quality of life can be attained.

Indoor air pollution is accountable for 2.7 percent of the global load of disease. More than three billion people globally continue to depend on solid fuels, including biomass fuels (wood, dung, agricultural residues), and coal for their energy needs [World Health Organisation (2002a)]. Likewise diarrhoeal disease counting cholera, typhoid, and dysentery are frequently spread by contaminated water in the developing countries or by contaminated food in the developed countries, 3.1 million people die due to these diseases every year, most of them are children. Similarly after every minute, five children in the developing countries die due to malaria or diarrhoea [World Health Organisation (2004); World Health Organisation and HELI (2004)].

It is projected that four billion cases of diarrhoea each year—generally in developing countries—cause at least 1.8 million deaths, of which 90 percent are children under the age of five [UNICEF (2009)]. About 88 percent of these deaths are attributable to hazardous water supply, inadequate sanitation, and poor hygiene [World Health Organisation (2005)].

In spite of these complexities, number of studies have been conducted which concluded that differences in economic status, nutritional habits, accessibility to particular kinds of food, topographical location, occupation, occasions for employment, and other dynamics would be reflected in differential rates of illnesses and deaths [(Singh, Fazal, Azam, and Rahman (1996); Rahman (2006); Karn, Shikura, and Harada (2003) and Boadi (2004)].

An access to safe water and sanitation is essential for better health. In Pakistan, only 8 percent of households use a suitable water treatment method. Fifty-nine percent of households have a better-quality toilet facility. Sixty-two percent of households used solid fuel. Pakistan is placed sixth amongst 22 high disease burdened countries of the world. Forty percent of the load of disease in Pakistan is in the form of infectious diseases such as diarrhoea, Acute Respiratory Infections (ARI), pneumonia, cholera malaria and Tuberculosis (TB). Each year, roughly 91,000 and 53,300 children in Pakistan die from diarrhoea, and pneumonia respectively. Diarrhoea, malaria, and pneumonia together contribute to around 50 percent of children deaths [National Institute of Population Studies (NIPS) and Government of Pakistan (2012-2013)].

There are many communicable diseases prevailing in district Bhimber of AJK. In the year 2012, there was 18,680 and 13,442 child less than the age of five years affected by diarrhoea or dysentery and pneumonia respectively in the district Bhimber. Moreover, there is no Communicable Disease Control Officer in the district. In AJK, the status of water and sanitation is unsatisfactory, and about 20 percent population have public water supply and only 21 percent have toilet facilities [TRF (2012)]. In district Bhimber, number of health care facilities are limited as there is only one Tehsil Headquarter hospital and Two Rural Health Centers [PAIMAN (2009)]. With this motivation, this study thus carried out in order to analyses household environmental conditions (i.e. housing conditions, water supply conditions, bath- room and sanitation conditions, household garbage and solid waste, indoor air pollution etc.), and their conse uence on the health of the resident s population of city Bhimber.

The objective of this study is to estimate the impact of various socio-economic and environmental factors on health in district Bhimber of AJK. It will be helpful to put in place a policy and action plan to make sure the prevention of diseases on continuous basis. Better understanding of these associations will contribute towards better health and that in turn will also help the residents to enhance their living standards.

This study is organised into five sections. Section 1 sets the introduction of this study. In Section 2, related literature is given. In Section 3, nature of data, sampling design, theoretical background, and econometric modelling are presented. Section 4, comprised on result and discussion. Section 5 consists of conclusion and recommendations based on findings of this study.

2. LITERATURE REVIEW

Various researchers have had been acknowledging that there are a number of factors influencing the health status. The most important of these studies are briefly presented in the subsequent section.

Singh, *et al*. (1996), Rahman (2006) and Karn, *et al*. (2003) assessed relationship among income, health, and environmental condition at the household level in India. They concluded that there is a strong association among the infectious diseases and poor household environmental condition because of low income, and thus poverty is considered as the main polluter for poor health.

Burr, Miskelly, Butland, Merrett, and Vaughan-Williams (1989) tried to identify environmental determinants of six symptoms; eczema, nasal discharge, wheeze, prolonged colds, diarrhoea, and vomiting in infancy. They used multiple logistic regression analysis. None of the factors studied showed a convincing relationship with eczema. Overcrowding, open coal fire, house dust and maternal smoking were significantly positively associated with colds, wheeze, asthma, and nasal discharge while they did not affect the risk of vomiting and diarrhoea. Similarly low social class and male sex are positively associated, while breast feeding is negatively associated with wheeze, vomiting, diarrhoea, colds, and Nasal discharge.

Pant (2007) explored the effects of pollution reducing interventions on chronic bronchitis, asthma, and ARI by using simple probit, as well as by using instrumental variable probit. The visible symptoms of these diseases were surveyed. The explanatory variables included were cooking, technology, fuel, personal characteristics like age, and gender. The results show that the biogas significantly reduces all of three diseases. While improved stoves reduce chronic bronchitis but they have no significant effect on asthma and ARI. The problem of ARI decreases with increase in age, while asthma and bronchitis increase with the increase in age. Similarly asthma and chronic bronchitis are more problematic amongst the females as compared to the males.

Boadi (2004) has examined the household environmental problems and their impact on health of identifiable different social classes. To conclude his findings, he applied Kruskal- aliis test, pearman s rank correlation, and multivariate analysis of variance. The results shows that due to inadequate access to safe drinking water, absence of flush toilets coupled with insufficient toilet facilities to the households, sewerage water drainage, poor refuse disposal practices, pest infestation, presence of stagnant water, rely on solid fuels like wood and coal , and vended kitchens etc. Put together, all these factors put a lot of burden on the urban poor in the form of infectious diseases like diarrhoea, dysentery, malaria, bronchitis, and pneumonia etc.

Goren and Goldsmith (1986) analysed the effect of environmental factors, rowding Index and fathers lower education as proxies of low socio-economic status. Smoking habits of the family members, house heating, previous pneumonia morbidity, and history of pulmonary diseases in the family, on the distribution of respiratory symptoms and diseases like asthma, bronchitis, pneumonia, sinusitis and allergy among second and fifth grade schoolchildren by means of one way analysis of variance called the chi-square test. Their result discovered that all above factors are positively linked with respiratory symptoms and association of pulmonary disease except house heating.

Nie, Li, Yang, Zhong, and Zhang (2014) studied the socio-economic factors of dysentery disease. They used spatial correlation analysis to explore the association between the selected factors and incidence of dysentery disease at country level. They concluded that age, per capita GDP, per capita government revenue, provision of tap water, access to sanitation, toilet facilities, and number of beds available in hospitals show statistically significant negative correlation with dysentery disease. While sex ratio of male to female along with a percentage of illiterate population in the total population have positive significant impact.

Cifuentes, Suárez, Solano, and Santos (2002) studied the risk of enteric diseases among children living in a water reclamation area in Mexico City. To this end, they used Multiple Logistic Regression (MLR). The result indicated the presence of fecal coliform bacteria (FC/100 mL). Results showed that the prevalence rates of diarrhoea were approximately the same in both seasons. The whole picture simply confirmed that overcrowding, hygiene related practices including food and water storage in open containers, absence of piped water, unpleasant taste of drinking water, less water for flushing the toilets as well as on hand washing habits are at play. Consumption of food sold by the street vendors was positively associated, but it turned statistically insignificant.

Gebru, Taha, and Kassahun (2014) assessed the risk factor of diarrhoeal disease among under-five children in 2012 at Sheko district. They concluded that maternal education, income, personal hygiene refuse disposal system and health extension programs were associated with the occurrence of diarrhoea and negatively linked, while sanitary facility (latrine and hand washing) and water supply (source, distance and home based treatment) were not associated with the occurrence of diarrhoea.

Arif and Ibrahim (1998) investigated the impact of socio-economic, demographic, and environmental condition on both prevalence and duration of diarrhoea among children under five in Pakistan in 1995-1996. Results revealed that all the variables i.e. are statistically significant and negatively associated with diarrhoea morbidity. And prevalence rates were higher in the rural areas than in the urban areas, similarly higher for males than for females.

Ali, ul-Haq, and Akhtar (2003) examined the relationship of WES interventions with that of the incidence of diarrhoea among children under age 10. They applied LRM. The result demonstrated that hygiene practices, latrine facility, covered drain or soak pits, and supply of potable water can significantly reduce the incidence of diarrhoea among children. While the incidence of diarrhoea is much lower even among houses, where latrine facility is not available. Moreover, the incidence of diarrhoea is significantly higher among males than females children. However, somehow the effects of education and income are not significant.

Olago, *et al*. (2007) investigated the climatic, socio-economic, and health factors affecting human vulnerability to cholera. They performed trend analysis (both linear regression and LOWESS [locally weighted scatter-plot smooth]). They argued that the communities living around the Lake Victoria basin are vulnerable to climate-induced cholera that is aggravated by the low socio-economic status, and lack of an adequate health care system. The sanitation facilities available to the communities indicate that most of the households do not have access to proper toilets and rely predominantly on pit latrines and the bush.

DuBois, Sinkala, Kalluri, Makasa-Chikoya, and Quick (2006) documented the potential transmission routes and prevention strategies for cholera disease. To conclude their results they performed multivariate analysis using a conditional logistic regression. Their finding shows that consumption of raw vegetables and local staple maize porridge was significantly associated with cholera. While consumption of a local sardine-like fish, presence of hand soap at homes, and boiling of drinking water were strongly protective factors. However, water source was not significantly associated with cholera.

Jinadu, Olusi, Agun, and Fabiyi (1991) conducted a study to determine the prevalence, mortality, and socio-environmental determinants of diarrhoeal diseases in children less than five years of age at household level. To appraise their results, they used percentages and Chi square statistics. They concluded that social and environmental factors including dirty feeding bottles and utensils, inadequate disposal of feces and household refuse, poor storage of drinking water, open field defecation, parents having no formal education, no hand washing before preparing children's food, and after toilet use were found to be significantly related to the high incidence of the diseases. Moreover, the death rate was the highest among less than one year old and slightly higher among the boys than girls.

Woldemicael (2001) examined the effects of environmental and socioeconomic factors that were associated with childhood diarrhoea. He used logistic regression for analysing the data. The results of his study showed that the environmental and socioeconomic conditions of the population were significant predictors of diarrhoeal morbidity. The study also found an association of diarrhoeal morbidity at the age of weaning or at 6-11 month of age and in households with a large number of children. And there was significant negative relationship among availability of toilet, education of the mothers, breast feeding and in urban areas.

Rahman, *et al*. (2009) studied the heritable component of susceptibility of cholera disease. They used chi-square test in particular they focused the Generalised Estimating Equations (GEEs) and LRM. Their result exposed that the strongest predictor of hospitalisation with cholera was, use of open toilets or defecation in open places, lower socio-economic status, and contamination of household drinking-water. Moreover males were more affected than females.

Ellegård (1996) assessed the cooking fuel smoke and respiratory symptoms among women in low income areas in Maputgao. The fuels most commonly used were wood, charcoal, electricity, and LPG. His study revealed that wood users were exposed to significantly higher levels of particulate pollution during cooking time (1200 pg/m3) than charcoal users (540 pg/m3), and users of modern fuels (LPG and electricity) (200-380 pg/m3). This association remained significant when controlling for a large number of environmental variables.

Rehfuess, Tzala, Best, Briggs, and Joffe (2009) estimated the impact of fuel type and cooking practices on ALRI mortality among children in different African countries. Determinants of ALRIs assessed were socio-economic circumstances (i.e. wealth, maternal education, and urban/rural location), cooking practices (i.e. main cooking fuel, stove type, presence of chimney or wood, cooking location), and heating practices. They concluded that the outdoor cooking is less harmful than the indoor cooking.

Semple, *et al*. (2010) assessed indoor air pollution and health in Malawi and Nepal. The result discovered that there existed statistically significant relationship between airborne endotoxin and respiratory illness in the first two years of life.

Goren and Goldsmith (1986) compared the health status of children growing up in three Haifa Bay areas with different levels of air pollution. They found that mostly respiratory illness symptoms was found for school children growing up in the medium and high pollution areas as compared with the low pollution area.

Ezzati and Kammen (2001) estimated exposure to indoor air pollution from biomass combustion for particulates < 10 pm diameter (PM10) on ARIs in developing countries. They used OLS regression and logistic regression estimate through maximum likelihood method. They concluded that ARIs and acute lower respiratory infections are concave, increasing functions of average daily exposure to PM10, with the rate of increase declining for exposures above approximately 1,000-2,000 pg/m3. Moreover, females suffer much than males due to a greater exposure. Similarly tobacco smokers were found to be suffering more.

Balakrishnan, *et al*. (2002) assessed exposures to respirable particulate matter from combustion of biomass fuel along with socio-economic and health information in the Southern India. To conclude their study findings, they performed One-way Analysis of Variance (ANOVA). Variable of interest included were fuel type, type and location of the kitchen, smoke from neighbourhood cooking, stove type, cooking duration, number of meals cooked, time spent in or near the kitchen while cooking, and presence or absence of chimneys. Their results revealed that fuel types, kitchen types, and proximity to the stove during cooking times were the only parameters that showed significant association. Smoke generation from combustion of biomass fuels was the single most important source of respirable particulates.

Grassi, Bugiani, and de Marco (2006) aimed to assess multiple indicators and multiple determinants of asthma in young adults by applying Latent Variable Mixture Models (LVMMs). They divided the determinants of asthma into host variables (sex, Body Mass Index, and family history), environmental variables (active smoking, passive smoking, occupational exposure, and mold in the house), and childhood exposures. Their findings revealed that the family history, active and passive smoking, were the more relevant predictor of the two-class of asthma syndrome. Moreover, the prevalence rate of asthma is more in adult women as compared to men. While, it was found that asthma is far more common in boys than girls during their early childhood.

Singh and Rahman (2001) examined the occurrence of malaria and related environmental issues in a small town of India, Aligarh city. The study was carried out at household levels belonging to different income groups. The differences in the occurrence of malaria in the different income households suggested that most of these differences were related to the environmental conditions existing inside and outside their homes, such as poor drainage system, poor refuse disposal, open blocked drains, water logging, and indoor water storage in the open containers.

Alemu, Tsegaye, Golassa, and Abebe (2011) studied malaria prevalence and associated risk factors in the Jimma town during the months of April and May. They used logistic regression to determine the outcome of variable of interest. The result revealed that the prevalence rate was higher among females than males and same under the age of five years. In multivariate analysis, after controlling for Keble and monthly income, the only significant predictors of *Plasmodium* infection was existence of stagnant water. Moreover, distant from stagnant water and use of Insecticide-Treated Bed Nets (ITN) were negatively associated.

The aforementioned studies mainly focused on environmental condition of the households. Few studies also evaluated the demographic and socio-economic determinant of disease occurrence. The results of the studies reviewed in the literature revealed that lower socio-economic condition, inadequate water and sanitation facilities, unhygienic practices and indoor pollution result in higher prevalence rate of communicable diseases.

As far as Pakistan is concerned a little research work has been done, and only few studies analyses the socio-economic and environmental determinants of disease incidence. However, these studies did not cover all the diseases under consideration such as diarrhoea, dysentery, cholera, typhoid, asthma, bronchitis, pneumonia, and malaria. Therefore, this study estimates the impact of socio-economic and environmental factors on health status in district Bhimber of AJK. For this purpose, it uses eight diseases as indicator of health status (i.e. air, water, food born). Moreover, nobody has conducted such type of research in the study area. Thus, this study will be a valuable contribution in the existing literature.

3 DATA AND METHODOLOGY

This chapter provides details about theoretical background, sampling design, nature of data, sample size and its allocation, and econometric modelling. These are given in subsequent section.

3.1. Theoretical Background

To examine the impact of environmental condition on health status, the health production function approach provides relevant theoretical background. This approach shows on relationship among combination of health inputs, both medical and non-medical, and subsequent health output. It shows how health inputs interrelate to produce a certain level of health, and how health status changes if health inputs used and their combination changes [Grossman (1972)].

After Grossman (1972) contribution, several models have been proposed by researchers to discover different features of the health production function. Like, at macro level Rosenzweig and Schultz (1983) took the study of production functions with missing inputs at initial level. In their study, all inputs were selected optimally as a part of a household utility maximisation problem subject to a budget constraint. They showed a generally used approach to deal with the unmeasured inputs and settled it as the hybrid production function. Liu, Mroz, and Adair (2009) used a more prescribed derivation of hybrid production function to discover possible biases in the assessment of marginal effects due to optimally chosen unobserved inputs. Later on Mityakov and Mroz (2013) employed a model of utility maximisation with health production to originate specific form of expected effects of observable inputs on health outcomes, when some other inputs were not observed.

At micro level Dasgupta (2004) assessed the health damages incurred by urban households by implementing a health production function approach based on the theory of utility-maximising consumer behaviour to estimate the probability of illness for a household.

This study followed the Dasgupta (2004) utility maximisation problem. An economic assessment of health effect caused by change in an environmental resource would emphasis consideration on the changes in individual preference due to adverse effects on the individual s utility.

The utility function can be written as:

$$U = U(X, L, S) \quad (3.1)$$

Where:

X household s aggregate consumption
L=leisure time per period and,
S= time spent ill

The household get utility from X and L, while S causes disutility. So, the first and second order conditions are of the following types:

U_X, $U_L > 0$; $U_S < 0$
U_{XX}, $U_{LL} > 0$; $U_{SS} < 0$

Time spent ill (S) is demonstrated as a function of the exposure to contaminants (P) and prevention or self-protective behaviour (D) to reduce the probability of illness that can enhance the household s wellbeing. hus, the health production function can be specified as:

$$S = S(D, P) \quad (3.2)$$

and

$$S_D < 0; S_P > 0; S_{DD}, S_{PP} > 0$$

The time spent ill (S) is also modelled as a function of the time spent in defensive activities (T_d) and the exposure to contamination (P) and can be written as:

$$S = S(T_d, P) \quad (3.3)$$

he household s budget constraint can be specified as:

$$I + w(T - L - T_d - S(T_d, P)) = X + p_d T_d \quad (3.4)$$

Or

$$I + wT - wL - wT_d - wS(T_d, P)) = X + p_d T_d \quad (3.5)$$

Or

$$I + wT = wL + wT_d + wS(T_d, P)) + X + p_d T_d \quad (3.6)$$

Where, I = total non-labour income:

w = wage rate
T = total time available
p_d = household expenditures per unit of time

Supposing that all individuals work for a positive amount of time, infers that:

$$[T - L - T_d - S(T_d, P)] > 0$$

Thus, the Lagrange multiplier in the first order conditions also takes a value of ero. he household s decision-making problem can be written as follows:

$$\max\Delta = U(X, L, S(T_d, P))+\lambda[I + wT \quad wL - wT_d - wS(T_d, P)) \quad X \quad p_dT_d] \quad (3.7)$$

Where:

λ= Lagrange multiplier for income constraint

Taking partial derivatives:

$$\Delta X = U_X - \lambda = 0 \quad (3.8)$$

$$\Delta L = U_L - w\lambda = 0 \quad (3.9)$$

$$\Delta T_d = U_S ST_d - \lambda w - \lambda wST_d - \lambda p_d = 0 \quad (3.10)$$

$$\Delta\lambda = I + wT - wL - wS(T_d, P) - X - wT_d - p_d T_d = 0 \quad (3.11)$$

Equations (3.8) and (3.9) represent the tradeoff between labour and leisure time while Equation (3.10) yields:

$$\lambda w = U_S ST_d - \lambda wST_d - \lambda p_d$$

Or:

$$w = U_S ST_d / \lambda - \lambda wST_d - \lambda p_d \quad (3.12)$$

From Equation (3.8):

$$\lambda = U_X$$

By putting value of (λ) into Equation (3.12); the equation can be re-written as:

$$w = U_S ST_d / U_X - wST_d - p_d \quad (3.13)$$

The equation (3.13) represents the optimality condition. Where $U_S ST_d/U_X$ is the marginal rate of substitution between T_d and X which implied the gain in utility in term of X from a unit increase in T_d. The wST_d is positive as wage rate is >0 while ST_d is negative which indicate that time spent on defensive activities increase the ill time will decrease, thus wST_d gives gains due to reduction in ill time valued at the wage rate. So ($U_S ST_d/U_X - wST_d$) shows the gross gain from an increase in T_d. And p_d refers to the expenditure incurred for defensive activities. Therefore, the right hand side of Equation (3.13) represents the net gains from a unit increase in T_d. This study aimed to analyse the damages from adverse environmental conditions by using health production function based on the theory of utility maximising consumer behaviour. For this purpose, Logistic models were established for assessing the probability of diseases for a household.

3.2. Study Area Profile

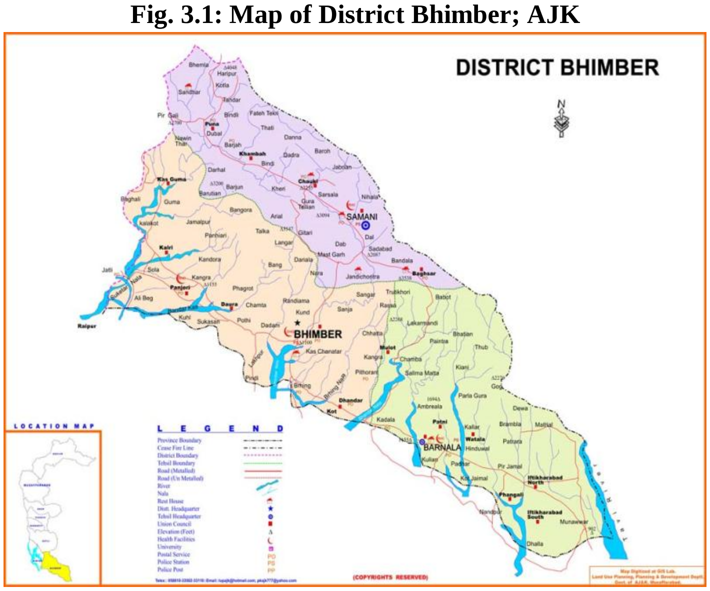
District Bhimber is the southernmost part of Azad Jammu and Kashmir. There are total 19 union councils in district Bhimber; out of which, one is urban union council and all the other union councils are in rural areas.

Total area of district Bhimber is 1516 Sq.km. According to 1998 census, the total population of the district stands at 297,000, while in 2014, its projected population with an annual increase of 2.6 percent will be approximately 452368. And there are 67518 households in the district. The urban area has 3297 households and the rest is in rural units. The average household size is 6.7. In the whole district, health care facilities are very limited.

3.3. Sampling Design

This study used primary data. Here respondents were the knowledgeable female members of the household, because they spent most of their time at homes and have greater exposure to indoor pollution, and sanitation conditions. Information were obtained through questionnaire (See in Appendix-A) from the randomly selected households taken from both rural and urban areas of district Bhimber, AJK. The questionnaire for data collection was arranged in such a way, to get information on socio-economic, water and sanitation condition, waste management, housing characteristics, fuel consumption, preventive measures from mosquitoes, and smoking habits of households. The term household in this study refers to the family members living in a house and sharing the same kitchen.

Fig. 3.1: Map of District Bhimber; AJK



3.4. Sample Size and Its Allocation

Keeping confidence level[1] and confidence interval or margin of error[2] as 95 percent and 6 percent respectively, the sample size calculated is 267 household. The sample size and total estimated population of the study area are presented in Table 1.

Table 1

Projected Population, Sample Size and Its Allocation

S. No.	Union Councils	Projected Population for the year (2014)	Projected Households for the year (2014)	Sample size
1	Bhimber	22088	3297	13
2	Bhimber Rajani	28413	4241	17
3	DhanderKot	27158	4053	16
4	Dhoura	26695	3984	16
5	Panjeri	25096	3746	15
6	Kalri	23902	3567	14
7	Kasgumma	11612	1733	7
8	Barnal	32710	4882	19
9	Malote	24239	3618	14
10	Patni	24029	3586	14
11	Watala	25197	3762	15
12	Pangali	11368	1697	7
13	Ifitkhara Abad Shamali	13755	2053	8
14	ifitkhara Abad junubi	15270	2279	9
15	Samani	34620	5167	20
16	Choki	29342	4380	17
17	Poona	34916	5212	21
18	Khumbah	20575	3072	12
19	Baghsar	21367	3189	13

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[1]**Confidence level** tells us how sure we can be. It is expressed as a percentage and represents how often the true percentage of the population, who would pick an answer lies within the confidence interval. For example, 95 percent confidence level means that if we had conducted the same survey 100 times, 95 times out of 100, the survey would have yielded the same results.

[2]**Confidence interval** or margin of error is the plus-or-minus figure usually reported in newspaper or television opinion poll results. For example, if we use a confidence interval of 4 and 47 percent of our sample picks an answer (confidence level), we can be sure that if we had asked the question of the entire relevant population between 43 percent (47-4) and 51 percent (47+4) would have picked that answer. When we put the **confidence level** and the **confidence interval** together, we can say that we are 95 percent sure that the true percentage of the population is between 43 percent and 51 percent.

Sample size formula is given below as:

$$s=\frac{(p)*(1-p)^{z^{2*}}}{c^{2}}$$

where:

ss= sample size
Z=Z value (e.g. 1.96 for 95 percent confidence level)
p=percentage picking a choice, expressed as decimal (.5 used for sample size needed)
c= confidence interval, expressed as decimal (e.g., .06 = ±6).

After sampling frame preparation, the calculated sample sizes were allocated proportionally to each selected union council of the study area.

3.5. Econometric Modelling

Logistic regression has been especially popular with medical research in which the dependent variable is whether or not a patient has a disease. Because of data constraints, it is difficult to examine all possible theoretical relationships between different factors and association of communicable disease. An attempt has been made to examine key factors that can affect prevalence of communicable diseases in the study area.

This study employs descriptive statistic and LRM for assessing the impact of socio-economic and environmental characteristics on the incidence of communicable diseases of the household.

When the dependent variable is binary, and when one assessed it through OLS by ignoring the binary nature of the variable, the procedure is known as Linear Probability Model (LPM)in literature. LPM was used broadly, when the computer packages were not available.

However, LPM is not used frequently by the researchers. Greene (2003) alternately used Logit and Probit models to overcome the problem associated with LPM, because both Logit and Probit models are based on cumulative distributive functions. Literature confirms Ezzati and Kammen (2001) that neither of the two models has advantages over the other [Bationo, Ayuk, Ballo, and Kone (1997)].

In addition, Logit and Probit models have used widespread due to the availability of the appropriate computer schedules [Albert and Anderson (1984)]. Probit and Logit models are estimated by Maximum Likelihood Estimation (MLE) in contrast to OLS used in ordinary regressions that are based on the Gauss-Markov assumptions. Since logistic regression is relatively easy to interpret, we will use LRM. This model has been used in the study of Cifuentes, *et al*. (2002), Arif and Ibrahim (1998), Alemu, *et al*. (2011), Ezzati and Kammen (2001), and Ali, *et al*. (2003) for assessing the relationship between disease happening and their predictor variables.

The general form of logistic distribution function can be written as:

$$P(Y=1) = 1/1 + \exp[\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_K X_K \qquad (3.14)$$

Another name for the logit is log-odds so we can also write logistic function as

$$Logit\ [p(Y=1) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_K X_k \qquad (3.15)$$

This fit the model as

$$Ln[(p)/(1-P)] = \alpha + \sum b_i x_i \ \ldots \qquad (3.16)$$

Where,
p = probability of a dependent variable that is binary and codded in the form of 0 and 1
α= intercept coefficient
β_i= are the estimated regression coefficient and
x_i= indicate the independent variables.

As stated earlier the main objective of this study is to estimate the impact of various socio-economic and environmental variables on health in district Bhimber (AJK), eight diseases will be used as indicator of health status in this study. So eight linear logistic regressions have been estimated separately for each disease, because different diseases have different influencing factors. To this end, the following models have been estimated:

$$\begin{aligned} Logit[p(D1=1) &= \alpha+\beta_1 HHI+\beta_2 EDU+\beta_3 W\_src+\beta_4 W\_qua+\beta_5 W\_dis \\ &+\beta_6 W\_tre+\beta_7 F\_qua+\beta_8 SWD+\beta_9 R\_dis+\beta_{10} T\_typ+\beta_{11} G\_heap+ \\ &\beta_{12} HWF+\beta_{13} T\_cle+\beta_{14} F\_sto+\beta_{15} T\_use \end{aligned} \tag{3.17}$$

Equation (3.17) estimating the influencing factors of diarrhoea disease. The description of the dependent variable is detailed in Table 3.2, while independent variables are described in Table 3.3.

$$\begin{aligned} Logit[p(D2=1) &= \alpha+\beta_1 HHI+\beta_2 EDU+\beta_3 W\_src+\beta_4 W\_qua+\beta_5 W\_dis \\ &+\beta_6 W\_tre+\beta_7 F\_qua+\beta_8 SWD+\beta_9 R\_dis+\beta_{10} T\_typ+\beta_{11} G\_heap+ \\ &\beta_{12} HWF+\beta_{13} T\_cle+\beta_{14} F\_sto+\beta_{15} T\_use \end{aligned} \tag{3.18}$$

Equation (3.18) estimating the influencing factors of dysentery disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$\begin{aligned} Logit[p(D3=1) &= \alpha+\beta_1 HHI+\beta_2 EDU+\beta_3 W\_src+\beta_4 W\_qua+\beta_5 W\_dis \\ &+\beta_6 W\_tre+\beta_7 F\_qua+\beta_8 SWD+\beta_9 R\_dis+\beta_{10} T\_typ+\beta_{11} G\_heap+ \\ &\beta_{12} HWF+\beta_{13} T\_cle+\beta_{14} F\_sto+\beta_{15} T\_use \end{aligned} \tag{3.19}$$

Equation (3.19) estimating the influencing factors of cholera disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$\begin{aligned} Logit[p(D4=1) &= \alpha+\beta_1 HHI+\beta_2 EDU+\beta_3 W\_src+\beta_4 W\_qua+\beta_5 W\_dis \\ &+\beta_6 W\_tre+\beta_7 F\_qua+\beta_8 SWD+\beta_9 R\_dis+\beta_{10} T\_typ+\beta_{11} G\_heap+ \\ &\beta_{12} HWF+\beta_{13} T\_cle+\beta_{14} F\_sto+\beta_{15} T\_use \end{aligned} \tag{3.20}$$

Equation (3.20) estimating the influencing factors of typhoid disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$Logit[p(D5=1) = \alpha + \beta_1 HHI + \beta_2 EDU + \beta_3 P\_kic + \beta_4 OAK + \beta_5 MPR + \beta_6 Wod + \beta_7 LPG + \beta_8 Chim + \beta_9 A\_dun + \beta_{10} B\_gas + \beta_{11} smok + \beta_{12} T - spa + \beta_{13} Ven \quad (3.21)$$

Equation (3.21) estimating the influencing factors of bronchitis disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$Logit[p(D6=1) = \alpha + \beta_1 HHI + \beta_2 EDU + \beta_3 P\_kic + \beta_4 OAK + \beta_5 MPR + \beta_6 Wod + \beta_7 LPG + \beta_8 Chim + \beta_9 A\_dun + \beta_{10} B\_gas + \beta_{11} smok + \beta_{12} T - spa + \beta_{13} Ven \quad (3.22)$$

Equation (3.22) estimating the influencing factors of pneumonia disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$Logit[p(D7=1) = \alpha + \beta_1 HHI + \beta_2 EDU + \beta_3 P\_kic + \beta_4 OAK + \beta_5 MPR + \beta_6 Wod + \beta_7 LPG + \beta_8 Chim + \beta_9 A\_dun + \beta_{10} B\_gas + \beta_{11} smok + \beta_{12} T - spa + \beta_{13} Ven \quad (3.23)$$

Equation (3.23) estimating the influencing factors of asthma disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

$$Logit[p(D8=1) = \alpha + \beta_1 HHI + \beta_2 EDU + \beta_3 F\_win + \beta_4 F\_dor + \beta_5 W\_stag + \beta_6 SWD + \beta_7 G\_heap + \beta_8 G\_col + \beta_9 M - net + \beta_{10} W\_sto + \beta_{11} P\_mea \quad (3.24)$$

Equation (3.24) estimating the influencing factors of malaria disease. The description of the dependent variable is detailed in Table 3.2, while independent variables in Table 3.3.

Table 2

Description of Dependent Variables

Variable	Notation	Description
Diarrhoea	D1	Diarrhoea(1=if any member of household suffered by diarrhoea disease in last 12 month, 0= otherwise)
Dysentery	D2	Dysentery(1=if any member of household suffered by dysentery disease in last 12 month, 0= otherwise)
Cholera	D3	Cholera(1=if any member of household suffered by cholera disease in last 12 month, 0= otherwise)
Typhoid	D4	Typhoid(1=if any member of household suffered by typhoid disease in last 12 month, 0= otherwise)
Bronchitis	D5	bronchitis(1=if any member of household suffered by bronchitis disease in last 12 month, 0= otherwise)
Pneumonia	D6	Pneumonia(1=if any member of household suffered by pneumonia disease in last 12 month, 0= otherwise)
Malaria	D7	Malaria(1=if any member of household suffered by malaria disease in last 12 month, 0= otherwise)
Asthma	D8	Asthma(1=if any member of household suffered by asthma disease in last 12 month, 0= otherwise)

Table 3

Description of Independent Variables

Variable	Notation	Description	Expected Sign
Household monthly income	HHI	Household monthly income from all sources	-
Education	EDU	education of the earning members of the household(total schooling year)	-
Water source	W_src	water source (1= if source of drinking-water is Piped/Motor-pump, 0=Otherwise)	-
Distance of water source from house	W_dis	water source outside the household (1= if sources of drinking-water outside the house, 0=otherwise)	+
Water quality	W_qua	water quality (1= if water quality is satisfactory, =0 otherwise)	-
Drinking water treatment practice	W_tre	drinking water treatment practice (1= if drinking water treatment practice done,0=otherwise)	-
Quality of food	F_qua	quality of food(1= if consuming low quality cheap food from & eating habits street vendors,0=otherwise)	+
Sewerage water drain	SWD	sewerage water drain(1= if sewerage water drain in open drains ,0=otherwise)	+
Refuse disposal	R_dis	refuse disposal(1=if Refuse properly disposed,0=otherwise)	-
toilet type	T_typ	toilet type(1= if Flush system, 0=Otherwise)	-
Garbage Heaps	G_heap	Garbage Heaps(1= if Poor garbage Heaps lying uncollected outside house, 0=otherwise)	+
Hand wash facility	HWF	hand wash facility (1= if Hand washing facility near to toilet, 0=otherwise)	-
Toilet cleanliness	T_cle	tiolet cleanliness (1= if toilet clean dialy, 0= otherwise)	-
Food storage	F_sto	food storage(1= if food storage in open air,0=otherwise)	+
Use of toilet	T_use	Use of toilet(1= if household member Use toilet,0=otherwise)	-
Garbage collection	G_col	garbage collection(1= if garbage collected by municipality, 0=otherwise)	-
Fly window	F_win	fly window(1= if use fly window in every room,0=otherwise)	-
Fly door	F_dor	fly door (1=if use fly door in every room,0=otherwise)	-
Stagnant water around the house	W_stag	Stagnant water around the house(1=if there is Stagnant water around the house,0=otherwise	+
Mosquito net	M_net	mosquito net(1=if use mosquito net,0=otherwise)	-
Water storage	W_sto	Water storage (1=if water store in open containers, 0=otherwise)	+
Preventive measures	P_mea	Preventive measures(1=if any preventive measure is used for mosquito other than mosquito net , 0=otherwise)	_
Proper kitchen	P_kic	Proper kitchen (1=if Proper kitchen for cooking,0=otherwise)	-
Open air kitchen	OAK	open air kitchen(1= if open air kitchen for cooking,0=otherwise)	-/+
Multipurpose room	MPR	multipurpose room (1=if cooking take place in multipurpose room,0=otherwise)	+
LPG fuel	LPG	LPG fuel (1=if used LPG for cooking ,0=otherwise)	-
Wood	Wod	wood(1= if used wood for cooking ,0=otherwise)	+
Animal dung	A_dun	animal dung (1=if used animal dung for cooking ,0=otherwise)	+
Bio gas	B-gas	bio gas(1= if used bio gas for cooking ,0=otherwise)	_
Smoking	Smok	smoking(1= if smoke any member of household ,0=otherwise)	+
Room space	R_spa	room space(1= if space per person in sleeping rooms >20 sq. foot,0=otherwise)	_
Chimneyat cooking place	Chim	chimney at cooking place(1= if there is chimney at cooking place, 0=otherwise)	_
Ventilator	Ven	ventilator(1=if ventilator in every room,0=otherwise)	_

4. RESULTS AND DISCUSSIONS

To achieve the objective of this study, it estimated descriptive statistics along with econometric models. The analysis of these empirical results is given in subsequent section.

In the study area on average monthly household income is Rs 30089.89 and on average the education of earning member of household is eight years. Moreover, minimum monthly household income is Rs. 2000, while maximum is Rs 240000. Similarly minimum education is 0 year, while the highest education is 18 years of schooling in the study area.

Table 4 shows that 143 person having diarrhoea, similarly 129 persons affected by dysentery, 73 person having cholera disease, 118 persons having typhoid disease, 180 persons having bronchitis disease, 128 persons having pneumonia disease, 70 people having asthma disease and 101 people having malaria disease. This indicate that more than half of sampled household affected by diseases matched more or less with the findings of RAF (2012).

Table 4

Description of Disease Profile of Household

Name of Disease	Freq.	Percentage
Diarrhoea	143	53.56
Dysentery	129	48.31
Cholera	73	27.34
Typhoid	118	44.19
Bronchitis	180	67.42
Pneumonia	128	47.94
Asthma	70	26.22
Malaria	101	37.83

Source: own survey.

Table 5 shows that there are total 942 people affected by different diseases in this study. Out of them there were 44.55 percent were male affected and 55.31 percent females affected. On average only 38.58 households have save assess to source of drinking water and only 47.94 household have the toilet facility in the study area. While in AJK approximately 20 percent had public water supply and only 21 percent with toilet facilities (RAF, 2012). And 62.92 household had water source inside their homes, only 35.21 households were satisfied with water quality regarding its taste, colour, odour, and dust particles in the water. Table 5 shows that 49.81 percent water stored in open containers, only 34.83 percent households do practice for purification of water, only 29.21percent household daily cleaned their toilet, only 38.58 percent households had hand wash facility near the toilet, and only 34.08 percent household had toilets with flush system.

Table 5

Sanitation Conditions, Hygiene Practices and Preventive Measures of Households

Characteristics	Freq.	Percentage
Males affected by diseases	421	44.55
Female affected by diseases	521	55.45
Water source	103	38.58
Distance of water source from house	168	62.92
Water quality	94	35.21
Drinking water treatment practice	93	34.83
Water storage	133	49.81
Use of toilet	128	47.94
Toilet cleanliness	78	29.21
Hand wash facility	103	38.58
toilet type	91	34.08
Garbage collection	45	16.85
Garbage Heaps	179	67.04
Refuse disposal	43	16.10
Sewerage water drain	194	72.66
Stagnant water around the house	182	68.16
Quality of food	83	31.09
Food storage	73	27.34
Room space	101	37.83
Proper kitchen	68	25.47
Open air kitchen	229	85.77
Multipurpose room	132	49.44
Ventilator	94	35.21
Chimney at cooking place	75	28.09
Fly window	99	37.08
Fly door	76	28.46
Wood	194	72.66
Animal dung	159	59.55
LPG fuel	32	11.99
Bio gas	29	10.86
Mosquito net	52	19.48
Preventive measures	107	40.07
Smoking	186	69.66

Only eight percent of households use an appropriate water treatment method and 59 percent of households had an improved toilet facility.

Table 5 shows that only 16.85 percent households avail the facility of proper garbage collection that is by municipality, 67.04 percent households have garbage heaps around their houses, and only 16.10 percent households avail the facility of proper refuse disposal method. The 72.66 percent houses drain their sewerage water in open drains, and 68.16 percent households have stagnant water around their houses. Only 31.09 percent households have eating habits from street vendor that sell cheap and low quality foods, and 27.34 percent households store their food items and meal in open utensils. Only 37.83 percent households have adequate room space for sleeping purposes. Only 25.47 percent households prepare their meals in separate kitchens, 85.77 percent households cooked their food in open air kitchen, 35.21 percent households have ventilator in their homes, only 28.09 percent households have chimney at cooking place, only 37.08 percent households have fly window and 28.46 percent have fly door. Only 19.48 percent households used mosquito nets, while 40.07 percent households used other preventive measures from mosquitoes.

The 72.66 percent households used wood as major fuel for cooking, 59.55 percent households use animal dung as a major fuel for cooking, only 11.99 percent households used LPG fuel for cooking, and only 10.86 percent households use bio gas fuel for cooking. There are 69.66 percent households founds that households members have habits of smoking. According to the National Institute of Population Studies (NIPS) and Government of Pakistan (2012-2013) 62 percent of households used solid fuel for cooking, and 39 percent are exposed daily to second-hand smoke.

The results given in table 6 shows that HHI had a significant negative impact on the incidence of having diarrhoea. The household income probably helps to reduce diarrhoea disease through improving their nutritional status, and providing better sanitary conditions. This is quite in line with the finding of Gebru, *et al*. (2014) and Ellegård (1996). Similarly the coefficient of education (EDU) also has negative significant impact on incidence of diarrhoea disease. he household s educations like income can also cause behavioural differences regarding hygiene practices that affect the transmission of enteric pathogens. Same results found in the studies of Jinadu, *et al*. (1991).

The coefficient of source of drinking water (W_src), has significant negative impact on the diarrhoea disease; i.e. piped or motorised. This findings match with the findings of Jinadu, *et al*. (1991). The result shows that satisfaction from water quality (W_qua) has negative significant impact with the incidence of diarrhoea findings quite in line with the findings of Cifuentes, *et al*. (2002). On the other hand, distance from water source (W_dis) has a positive association with diarrhoea disease, as the distance from the source of water increases it exert less water consumption, as a result there is a strong and significant reduction in hygiene practices which increase the incidence of disease. Findings are quite in line with Ravallion and Jalan (2001).

Sewerage Water Drainage (SWD) in open drains has positive and significant effect on the association of diarrhoea disease. As open drains are often blocked, thus providing environmental pollution and a breeding place for germs leading to increased risk of diseases including diarrhoea. Similar positive and significant impact was shown by Ali, *et al*. (2003). The coefficient of drinking water treatment practices (W_tre) has significant negative impact on the chance of being sick by diarrhoea. As pathogens are mostly transferred through drinking water into the human body, so after taking purification practices, it will reduce the incidence of disease happening. This result was quite in line with the findings of Ali, *et al*. (2003).

The coefficient of toilet cleanliness (T_cle) is significant predictor of diarrhoeal disease that associated negatively with the disease occurrence. Results to matched with the findings of Rahman (2006).

Table 6

Logistic Regression Results of Incidence of Diarrhoea Disease

Dependent Variable is Diarrhoea Disease					
Independent Variable	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.0002	0.00003	5.77	0.00	0.99
Edu	0.32	0.11	3.10	0.002	0.72
W_src	1.64	0.59	2.78	0.01	0.19
W_qua	1.06	0.57	1.86	0.06	0.35
W_dis	2.21	0.52	4.27	0.00	9.07
SWD	1.36	0.58	2.34	0.02	3.88
W_tre	1.46	0.64	2.28	0.02	0.23
T_typ	.53	0.56	0.95	0.34	0.59
HWF	1.69	0.79	2.12	0.03	.18
T_use	1.56	0.66	2.38	0.02	.21
T_cle	1.27	0.66	1.92	0.054	0.28
F_sto	0.89	0.53	1.67	0.09	2.44
G_heap	0.17	0.63	0.27	0.79	1.18
R_dis	0.26	0.652	0.40	0.69	0.77
F_qua	0.33	0.49	0.67	0.51	1.39
Cons	9.67	1.66	5.82	0.000	15885.78
Goodness of fit statistics					
Wald chi2(15) = 66.41			Log likelihood = 64.77		
Prob> chi2 = 0.0000			seudo R2 = 0.65		

Hand Wash Facility (HWF) near the toilets is significant predictor of diarrhoeal disease that associated negatively with the disease occurrence. Similar result found by Rahman (2006).

Surprisingly household having toilet with flush system (T_typ) did not show significant association with diarrhoea disease, although, this category had the expected negative sign. It probably may be the usage pattern of toilet at homes, rather than the type of toilets that transmits pathogens causing diarrhoea. These findings were quite in line with findings of Asma and Naheed (2012).

Results showed that the presence of toilet facility (T_use) in the house had negative expected sign that significantly reduced the incidence of diarrhoea. This finding quit matched with the finding of Ali, *et al*. (2003) and Woldemicael (2001).Whereas, food storage in open utensils (F_sto) showed a significant positive relationship with the prevalence of diarrhoea disease. Similar results found in the study of Cifuentes, *et al*. (2002).

However, proper disposal of refuse (R_dis) did not turn out to be statistically significant; probably very few house hold had the facility of proper refuse disposal. Although, the expected negative sign found. The negative sign was also found in the study of Jinadu, *et al*. (1991). The coefficient of presence of garbage heaps near or around the house (G_heap) positively linked with incidence of diarrhoea disease. Similar findings suggested by Rahman (2006) the relationship did not turn out to be significant. The eating habit from street wonders (F_qua) positively linked with diarrhoea sickness, but it turned statistically insignificant. This phenomenon might be associated with eating habits outside the home or with living for long periods under unfavourable sanitary conditions. This result were consistent with the study of Cifuentes, *et al*. (2002). The overall fit of the model indicated by the value of chi-square that is highly significant.

The results given in table 4.5 shows that HHI had a significant negative impact on the incidence of having dysentery disease. This is so, because the more is the income, the more a household is concerned about its health, and hence acquire greater awareness about health related threats to avoid it. This is quit in line with the findings of Ellencweigi and Slater (1986). Similarly the coefficient of education (EDU) also has negative significant impact on the incidence of dysentery disease. The household education like income can also cause behavioural differences regarding hygiene practices, and awareness about causes and preventive measures of the increased diseases, that can affect the transmission of enteric pathogens. Same results found in the studies of Ellencweigi and Slater (1986).

The coefficient of source of drinking water (W_src), have significant negative impact on the dysentery disease; i.e. piped or motorised. This findings match with the findings of Singh et al. (1996). The result given in Table 4.5 shows that satisfaction from water quality (W_qua) has negative significant impact with the incidence of dysentery findings that is quite in line with the findings of Boadi (2004) and Singh, *et al*. (1996). On the other hand, distance from water source (W_dis) has a positive association with dysentery disease, as the distance from the source of water increases, it exerts less water consumption. As a result there is a strong and significant reduction in hygiene practices which increase the incidence of disease. Findings are quite in line with the findings of Rahman (2006).

SWD in the open drains has positive and significant effect on the association of dysentery disease. As open drains are often blocked, thus providing environmental pollution and a breeding place for germs leading to increased risk of diseases including dysentery.

Table 7

Logistic Regression Results of Incidence of Dysentery Disease

Dependent Variable is Dysentery					
Independent Variable	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	.0008	.00005	1.70	0.09	0.99
EDU	0.13	0.07	1.87	0.06	0.88
W_src	1.22	0.58	2.12	0.03	0.29
W_qua	0.97	0.53	1.83	0.07	0.38
W_dis	1.01	0.46	2.19	0.03	2.76
SWD	1.49	0.71	2.10	0.04	4.45
W_tre	0.79	0.46	1.71	0.09	0.45
T_cle	0.16	0.49	0.32	0.75	0.85
HWF	0.74	0.41	1.79	0.07	0.48
T_use	0.77	0.39	1.93	0.05	0.46
T_typ	0.81	0.46	1.77	0.08	0.44
F_sto	1.05	0.51	2.08	0.04	2.85
G_heap	0.36	0.78	0.47	0.64	1.44
R_dis	0.09	0.83	0.11	0.91	0.91
F_qua	1.24	0.76	1.63	0.104	3.44
Cons	3.41	1.25	2.72		30.12
Goodness of Fit Statistic					
Wald chi2(15) = 79.16			Log likelihood = 84.16		
Prob> chi2 = 0.00				Pseudo R2 = 0.54	

Similar positive and significant impact shown by Boadi (2004) and Ellencweigi and Slater (1986). The coefficient of drinking water treatment practices (W_tre) has significant negative impact on the chance of being sick by dysentery. As pathogens are mostly transferred through drinking water into the human body, so after taking purification practices, it will reduce the incidence of disease happening. This result is quite in line with findings of Rahman (2006). The coefficient of toilet cleanliness (T_cle) are significant predictor of dysentery disease that are associated negatively with the disease occurrence. Result matches with the findings of Rahman (2006). HWF are significant predictor of dysentery disease that associated negatively with the disease occurrence. Similar result found by Rahman (2006).

The coefficient of toilet facility (T_use) in the house has negative expected sign that significantly reduces the incidence of dysentery. This finding quite matches with the finding of Boadi (2004) and Singh, *et al*. (1996). Household having toilet with flush system (t_typ) has negative impact on the incidence of dysentery disease. These findings are also in line with findings of Boadi (2004). But surprisingly it does not turn as significant. It is probably due to the usage pattern of toilet at homes, rather than the type of toilet that transmits pathogens causing dysentery. Whereas Table 7 reveals that food storage in the open utensils (F_sto) shows a significant positive relationship with the prevalence of dysentery disease. Similar results were found in the study of Ellencweigi and Slater (1986).

The coefficient of presence of garbage heaps near or around the house (G_heap) were positively linked with incidence of dysentery disease, similar findings were suggested by Singh, *et al*. (1996) and Rahman (2006). But the relationship did not turn out to be significant. Refuse disposal has also negative but insignificant effect on disease association. However, proper disposal of refuse (R_dis) did not turn out to be statistically significant—probably very few households had the facility of proper refuse disposal. Although, the expected negative sign was found. The negative sign was also found in the study of Boadi (2004). The eating habits from the street wonders (F_qua) had positive link with dysentery sickness, but it turned statistically insignificant. This phenomenon might be associated with eating habits outside the home or with living for long periods under unfavourable sanitary conditions. This result was consistent with the study of Ellencweigi and Slater (1986). The overall fit of the model indicated by the value of chi-square that is highly significant.

The results given in Table 8 showed that coefficient of HHI had a significant negative impact on the incidence of having cholera. The household income probably helps to reduce cholera disease through improving their nutritional status and providing better sanitary conditions. This is quite in line with the findings of Olago, *et al*. (2007) and Jinadu, *et al*. (1991). Similarly the Coefficient of Education (EDU) also has negative significant impact on incidence of cholera disease. The household education, like income, can also cause behavioural differences concerning hygiene practices that affect the transmission of enteric pathogens. Same results were found in the studies of Olago, *et al*. (2007). The coefficient of source of drinking water (W_src) has significant negative impact on the cholera disease; i.e. piped or motorised. This findings matched with the findings of Olago, *et al*. (2007) and Jinadu, *et al*. (1991).

The satisfaction from water quality (W_qua) has negative significant impact with the incidence of cholera findings which is quite in line with the findings of K. M. Rahman, *et al*. (2009) and Rahman (2006).

On the other hand, distance from water source (W_dis) has a positive association with cholera disease, as the distance from the source of water increases, it exerts less water consumption, as a result there is a strong and significant reduction in hygiene practices, which increase the incidence of disease. Findings are quite in line with Rahman (2006). SWD in open drains has positive and significant effect on the association of cholera disease. As open drains are often blocked, thus providing environmental pollution and a breeding place for germs leading to increased risk of diseases including cholera. Similar positive and significant impact were shown by Ellencweigi and Slater (1986).

Table 8

Logistic Regression Results of Incidence Cholera Disease

Dependent Variable is Cholera Disease					
Independent Variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.00003	9.07e-06	3.27	0.001	0.99
EDU	0.11	0.06	1.78	0.07	0.89
W_src	0.95	0.48	1.99	0.05	0.38
W_sat	1.11	0.44	2.55	0.01	0.33
W_dis	1.48	0.51	2.89	0.004	4.40
SWD	0.95	0.49	1.93	0.05	2.59
W_tre	0.89	0.42	2.15	0.03	0.41
T_typ	0.38	0.44	0.86	0.39	0.68
HWF	0.85	0.41	2.08	0.04	0.43
T_use	1.55	0.47	3.25	0.001	0.21
T_cle	0.82	0.47	1.75	0.08	0.44
F_sto	0.97	0.48	2.02	0.04	2.64
G_heap	0.25	0.53	0.48	0.63	1.29
R_dis	0.42	0.43	0.97	0.33	0.66
F_qua	0.55	0.46	1.21	0.23	1.74
Cons	2.71	0.94	2.89	0.004	14.98
Goodness of fit statistic					
Wald chi2(15) = 69.03			Log likelihood = 102.45		
Prob> chi2 = 0.00			Pseudo R2 = 0.34		

The coefficient of drinking water treatment practices (W_tre) has significant negative impact on the chances of being sick by cholera. As pathogens are mostly transferred through drinking water into human body; so after taking purification practices, it will reduce the incidence of disease happening. This result is quite in line with findings by Olago et al. (2007) and DuBois, *et al*. (2006). The coefficient of toilet cleanliness (T_cle) is significant predictor of cholera disease that is associated negatively with the disease occurrence. Result is quite in line with the findings of Rahman (2006).

HWF is significant predictor of cholera disease that is associated negatively with the disease occurrence. Similar result were found by K. M. Rahman, *et al*. (2009) and DuBois, *et al*. (2006). Results show that the presence of toilet facility (T_use) in the house has negative expected sign that significantly reduces the incidence of cholera. This finding matches with the finding of Olago, *et al*. (2007) and Singh, *et al*. (1996).

Surprisingly, households having toilet with flush system (T_typ) did not show significant association with cholera disease, although, this category had the expected negative sign. It is probably due to the usage pattern of toilet at homes, rather than the type of toilet that transmits pathogens causing cholera. These findings were quite in line with the findings of Olago, *et al*. (2007) and K. M. Rahman, *et al*. (2009). Whereas it was also found out that food storage in open utensils (F_sto) showed a significant positive relationship with the prevalence of cholera disease. Similar results were found in the study of Ellencweigi and Slater (1986) and Cifuentes, *et al*. (2002) .

The coefficient of presence of garbage heaps near or around the house (G_heap) was positively linked with incidence of cholera disease. Similar findings were suggested by Rahman (2006) and Singh, *et al*. (1996), but the relationship did not turn out to be significant. However, proper disposal of refuse (R_dis) did not turn out to be statistically significant—probably very few households have the facility of proper refuse disposal. Although, the expected negative sign found. The negative sign was also found in the study of Jinadu, *et al*. (1991). The eating habit from street wonders (F_qua) were positively linked with cholera sickness, but it turned statistically insignificant. This phenomenon might be associated with eating habits outside the home or with living for long periods under unfavourable sanitary conditions. This result was consistent with the study of DuBois, *et al*. (2006) and Ellencweigi and Slater (1986).

The results given in Table 9 shows that HHI has a significant negative impact on the incidence of having typhoid. The household income probably helps to reduce typhoid disease, through improving their nutritional status, and providing better sanitary conditions. This is quite in line with the findings of Ellencweigi and Slater (1986) and Rasaily, *et al*. (1994). Similarly the coefficient of education (EDU) also has negative significant impact on incidence of typhoid disease. he household s education, like income, can also cause behavioural differences regarding hygiene practices that affect the transmission of enteric pathogens. Same results are found in the studies of Jinadu, *et al*. (1991).

The coefficient of source of water (W_src) has significant negative impact on the typhoid disease; i.e. piped or motorised. This findings match with the findings Rasaily, *et al*. (1994) and Cifuentes, *et al*. (2002). The result given in Table 9 shows that satisfaction from water quality (W_qua) has negative significant impact with the incidence of typhoid. Findings are quite in line with the findings of Cifuentes, *et al*. (2002). On the other hand, distance from water source (w_dis) has a positive association with typhoid disease, as the distance from the source of water increases, it exerts less water consumption, as a result there is a strong and significant reduction in hygiene practices, which increase the incidence of diseases. Findings are quite in line with Singh, *et al*. (1996).

SWD in open drains has positive and significant effect on the association of typhoid disease. As open drains are often blocked, thus providing environmental pollution and a breeding place for germs leading to increased risk of diseases including typhoid. Similar positive and significant impact is shown by Ellencweigi and Slater (1986). The coefficient of drinking water treatment practices (W_tre) has significant negative impact on the chance of being sick by typhoid. As pathogens are mostly transferred through drinking water into the human body, so after taking purification practices, it will reduce the incidence of disease happening. This result is quite in line with the findings of Singh, *et al*. (1996). The coefficient of toilet type (T_typ) is insignificant predictor of typhoid disease that is associated negatively with the disease occurrence.

It probably may be due to the usage pattern of toilet at homes, rather than type of toilet that transmits pathogens causing typhoid. Result quite match with the findings of Rahman (2006) and Cifuentes, *et al*. (2002). HWF are significant predictor of typhoid disease that associated negatively with the disease occurrence.

Table 9

Logistic Regression Results of Incidence of Typhoid Disease

Dependent Variable is Typhoid Disease					
Independent Variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.00004	0.000015	2.64	0.01	0.99
EDU	0.12	0.05	2.61	0.01	0.88
W_src	1.17	0.52	2.26	0.02	0.31
W_qua	0.89	0.43	2.08	0.04	0.41
W_dis	1.86	0.56	3.34	0.001	6.45
SWD	0.78	0.45	1.75	0.08	2.18
W_tre	0.78	0.43	1.81	0.07	0.46
T_typ	0.05	0.38	0.12	0.90	0.96
HWF	0.97	0.47	2.09	0.04	0.38
T_use	1.12	0.52	2.18	0.03	0.32
T_cle	0.64	0.36	1.76	0.08	0.53
F_sto	2.13	0.77	2.76	0.01	8.42
G_heap	0.12	0.38	0.31	0.76	1.12
R_dis	0.02	0.41	0.04	0.97	0.98
F_qua	0.09	0.41	0.22	0.83	1.09
Cons	0.79	0.95	0.83	0.41	2.19
Goodness of fit statistic					
Wald chi2(15) = 73.69			Log likelihood = 124.01		
Prob> chi2 = 0.00			Pseudo R2 = 0.31		

Similar result found by Rasaily, *et al*. (1994), by Jinadu, *et al*. (1991) and Rahman (2006). Results show that the presence of toilet facility (T_use) in the houses has negative expected sign that significantly reduces the incidence of typhoid. This finding quite matches with the finding of Rasaily, *et al*. (1994), by Jinadu, *et al*. (1991) and Singh, *et al*. (1996).

Households having toilet clean daily (T_cle) showed significant association with typhoid disease, and also this category had the expected negative sign. These findings were quite in line with findings of Rasaily, *et al*. (1994). Whereas it was also found out that food storage in open utensils (F_sto) showed a significant positive relationship with the prevalence of typhoid disease. Similar results were found in the study of Cifuentes, *et al*. (2002).The coefficient of presence of garbage heaps near or around the house (G_heap) were positively linked with incidence of typhoid disease, similar findings were suggested by Rahman (2006). But the relationship did not turn out to be significant.

However, proper disposal of refuse (R_dis) did not turn out to be statistically significant. Probably very few households had the facility of proper refuse disposal. Although, the expected negative sign was found. The negative sign was also found in the study by Jinadu, *et al*. (1991). The eating habits from street wonders (F_qua) were positive linked with typhoid sickness, but it turned statistically insignificant. This phenomenon might be associated with eating habits, outside the homes or with living for longer periods under unfavourable sanitary conditions. This result was consistent with the study of Ellencweigi and Slater (1986) and Cifuentes, *et al*. (2002). The overall fit of the model indicated by the value of chi-square that is highly significant.

The results given in Table 10 show that coefficient of HHI had a significant negative impact on the incidence of having bronchitis. The household income probably helps to reduce bronchitis disease, through not only better economic conditions and behavioural changes but also by providing modern fuels and improved surroundings. This is quite in line with the findings Rehfuess, *et al*. (2009) and Karn, *et al*. (2003). Similarly, the EDU also has negative significant impact on incidence of bronchitis disease. he household s education, like income, can also cause behavioural differences and awareness regarding indoor and outdoor pollution. Same results is found in the studies of Goren and Goldsmith (1986) and Karn, *et al*. (2003).

Surprisingly, cooking in proper kitchens (P_kic) did not turn out significant predictor of bronchitis disease. The insignificance may occur in the study area because open air cooking practices were common in the study area. However, the expected negative sign was found. Similar result found by Balakrishnan, *et al*. (2002). The result given in table 10 shows that cooking practice in open air (OAK) has negative significant impact with the incidence of bronchitis. Findings are quite in line with the findings of Rehfuess, *et al*. (2009) and Balakrishnan, *et al*. (2002).

Cooking practices in Multi-Purpose Room (MPR) has positive and significant effect on the association of bronchitis disease. The overcrowding surroundings favour the spread of pathogens. Similar positive and significant impact is shown by Balakrishnan, *et al*. (2002), Rahman (2006) and Singh, *et al*. (1996). The coefficient of use of wood as cooking fuel (Wod) shows positively association with the bronchitis disease. Moreover it turned statistically significant. Because wood release greater number of particulate matter in the air that lead to air pollution, as compared to modern fuels like LPG, as proposed by Ellegård (1996), Semple, *et al*. (2010), Boadi (2004) and Rehfuess, *et al*. (2009).

Table 10

Logistic Regression Results of Incidence of Bronchitis Disease

Dependent Variable is Bronchitis					
Independent variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.00007	0.00002	3.95	0.00	0.99
EDU	0.22	0.13	1.70	0.09	0.80
P_kic	0.17	0.58	0.30	0.77	0.84
OAK	1.99	0.86	2.31	0.02	0.14
MPR	1.05	0.59	1.78	0.08	2.85
Wod	1.23	0.56	2.21	0.03	3.41
LPG	0.61	1.38	0.45	0.66	0.54
B_gas	0.22	0.64	0.34	0.73	0.80
A_dun	1.62	0.71	2.28	0.02	5.04
R_spa	0.87	0.47	1.87	0.06	0.42
Chim	1.03	0.60	1.71	0.09	0.36
Ven	1.01	0.60	1.68	0.09	0.36
Smok	0.88	0.48	1.85	0.06	2.41
Cons	7.56	1.47	5.14	0.00	1918.20
Goodness of fit statistic					
Wald chi2(13) = 97.39			Log likelihood = 62.12		
Prob> chi2 = 0.0000			Pseudo R2 = 0.63		

The coefficient of LPG as cooking fuel (LPG) has a negative impact on the chance of being sick by bronchitis. As LPG fuel produce less particulate matter in the surroundings, so less chances of disease happening. This result is quite in line with findings of Ellegård (1996). But the result in this study did not turn as significant. This may happen as a very small proportion of households relies on LPG fuel for cooking purposes. The coefficient of bio gas as cooking fuel (B_gas) has a negative impact on the chance of being sick by bronchitis. As bio gas fuel produces less particulate matter in the surroundings, so less chances of disease happening. This result is quite in line with the findings of Pant (2007). But the result in this study did not turn as significant. This may happen as a very small proportion of household relies on bio gas fuel for cooking purposes.

Animal dung as cooking fuel (A_dun) shows a significant positive relationship with the prevalence of bronchitis disease. Similar results are found in the study of Rehfuess, *et al*. (2009) and Semple, *et al*. (2010). The coefficient of Room space (R_spa) shows a significant predictor of bronchitis disease that is associated negatively with the disease occurrence. It is evident that the overcrowding increases the risk of transfer of pathogens. Therefore, if there is more space the chances of being affected are less likely. Results quite matches with the findings of Goren and Goldsmith (1986) and Karn, *et al*. (2003).

On the other hand, presence of chimney at cooking place (Chim) has a negative significant association with bronchitis disease. Findings are quit in line with Rehfuess, *et al*. (2009). Whereas smoking (Smoke) shows a significant positive relationship with the prevalence of bronchitis disease. This is consistent with the study of Goren, Hellman, Brenner, Egoz, and Rishpon (1990), and Ezzati and Kammen (2001). The coefficient of ventilator (Ven) has a significant negative impact on the bronchitis disease. This findings matches with the findings of Singh, *et al*. (1996) and Rahman (2006). The overall fit of the model indicated by the value of chi-square that is highly significant.

The results given in Table 11 shows that the coefficient of HHI had a significant negative impact on the incidence of having pneumonia. The household income probably helps to reduce pneumonia disease, through not only better economic conditions and behavioural changes, but also by providing modern fuels and improved surroundings. This is quite in line with the findings of Rehfuess, *et al*. (2009) and Karn, *et al*. (2003). Similarly the EDU also has a negative significant impact on incidence of pneumonia disease. The education, like income, can also cause behavioural differences and awareness regarding indoor and outdoor pollution. Same results were found in the studies of Goren and Goldsmith (1986) and Karn, *et al*. (2003).

Table 11

Logistic Regression Results of Incidence of Pneumonia Disease

Dependent Variable is Pneumonia					
Independent Variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.000025	0.000015	1.71	0.09	0.99
EDU	0.24	0.12	1.98	0.05	0.78
P_kic	1.43	0.93	1.53	0.13	0.24
OAK	2.68	0.73	3.66	0.00	0.07
MPR	1.18	0.47	2.53	0.01	3.26
Wod	2.28	0.94	2.43	0.02	9.78
LPG	0.43	0.45	0.97	0.33	0.65
B_gas	0.62	0.85	0.73	0.47	0.54
A_dun	1.16	0.48	2.44	0.02	3.19
R_spa	0.72	0.39	1.82	0.07	0.49
Chim	1.65	0.64	2.57	0.01	0.19
Ven	0.99	0.39	2.50	0.01	0.37
Smok	0.78	0.41	1.90	0.06	2.18
Cons	6.44	1.78	3.62	0.00	
Goodness of fit statistic					
Wald chi2(13) = 59.10			Log likelihood = 90.3		
Prob> chi2 = 0.0000			Pseudo R2 = 0.51		

Surprisingly, cooking in proper kitchens (P_kic) did not turn out significant predictor of pneumonia disease. The insignificance may occur in the study area because open air cooking practices are common in the study area. However, the expected negative sign was found. Similar result were found by Balakrishnan, *et al*. (2002). The result given in Table 11 shows that cooking practice in open air (OAK) has a negative significant impact with the incidence of pneumonia. Findings are quite in line with the findings of Rehfuess, *et al*. (2009) and Balakrishnan, *et al*. (2002). Cooking practices in MPR has a positive and significant effect on the association of pneumonia disease. As, the overcrowding surroundings favour the spread of pathogens. Similar positive and significant impact were shown by Balakrishnan, *et al*. (2002) and Rahman (2006).The coefficient of use of wood as a cooking fuel (Wod) shows positively association with the pneumonia disease—moreover it turned statistically significant.

Because wood releases greater number of particulate matter in the air, that leads to air pollution as compared to modern fuels like LPG as proposed by Ellegård (1996), Semple, *et al*. (2010), Boadi (2004), Rehfuess, *et al*. (2009) and Ezzati and Kammen (2001). The coefficient of LPG as a cooking fuel (LPG) has a negative impact on the chance of being sick by pneumonia. As LPG fuel produces less particulate matter in the surroundings; so less chances of disease happening. This result is quite in line with findings of Ellegård (1996). But the result in this study did not turn as significant. This may happen as a very small proportion of households relies on LPG fuel for cooking purposes. The coefficient of bio gas as cooking fuel (B_gas) has a negative impact on the chance of being sick by pneumonia. As bio gas fuel produces less particulate matter in the surroundings, so less chances of disease happening. This result is quite in line with findings of Pant (2007). But the result in this study did not turn as significant. This may happen as a very small proportion of household relies on bio gas fuel for cooking purposes.

Whereas Animal dung as a cooking fuel (A_dun) shows a significant positive relationship with the prevalence of pneumonia disease. Similar results were found in the study of Rehfuess, *et al*. (2009) and Semple, *et al*. (2010). The coefficient of Room space (R_spa) shows a significant predictor of pneumonia disease that associated negatively with the disease occurrence. As the overcrowding increase the risk of transfer of pathogens. So if there is more space less the chances of being affected. Result quite matches with the findings of Goren, *et al*. (1990), Goren and Goldsmith (1986) and Karn, *et al*. (2003)

On the other hand, presence of chimney at cooking place (Chim) has a negative significant association with pneumonia disease. Findings are quit in line with Rehfuess, *et al*. (2009), Rahman (2006) and Singh, *et al*. (1996). The coefficient of ventilator (Ven) has a significant negative impact on the pneumonia disease. This findings match with the findings of Singh, *et al*. (1996) and Rahman (2006). Whereas smoking (Smok) shows a significant positive relationship with the prevalence of pneumonia disease. That is consistent with the study of Goren, *et al*. (1990), Goren and Goldsmith (1986) and Ezzati and Kammen (2001). The overall fit of the model indicated by the value of chi-square is highly significant.

The results given in Table 12 shows that coefficient of HHI had a significant negative impact on the incidence of having asthma. The household income probably helps to reduce asthma disease through not only better economic conditions, and behavioural changes, but also by providing modern fuels and improved surroundings. This is quite in line with the findings of Rahman (2006). Similarly EDU also has a negative significant impact on incidence of asthma disease. The education, like income, can also cause behavioural differences and awareness regarding indoor and outdoor pollution. Same results were found in the studies of Goren and Goldsmith (1986).

Surprisingly cooking in proper kitchens (P_kic) did not turn out significant predictor of asthma disease. The insignificance may occur in the study area, because open air cooking practices are common in the study area. However, the expected negative sign found. Similar result was found by Balakrishnan, *et al*. (2002). The cooking practice in the open air (OAK) has a negative significant impact with the incidence of asthma. Findings are quite in line with the findings of Balakrishnan, *et al*. (2002). Cooking practices in MPR has a positive and significant effect on the association of asthma disease. As the overcrowding surroundings favour the spread of pathogens. Similar positive and significant impact was shown by Balakrishnan, *et al*. (2002) and Rahman (2006).

Table 12

Logistic Regression Results of Incidence of Asthma Disease

Dependent Variable is Asthma					
Independent Variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	0.00013	0.000024	5.53	0.000	0.99
EDU	0.16	0.08	1.90	0.06	0.86
P_kic	0.07	0.56	0.13	0.89	0.93
OAK	1.99	0.58	3.44	0.001	0.14
MPR	2.35	0.91	2.58	0.01	10.53
Wod	1.64	0.62	2.64	0.008	5.13
LPG	0.92	0.69	1.32	0.19	0.40
B_gas	0.91	0.66	1.39	0.17	0.39
A_dun	3.37	0.71	4.78	0.000	29.21
R_spa	0.97	0.57	1.69	0.09	0.38
Chim	1.27	0.55	2.32	0.02	0.28
Ven	0.93	0.56	1.66	0.09	0.39
Smok	1.73	0.55	3.12	0.002	5.62
Cons	2.04	1.32	1.55	0.12	7.68
Goodness of fit statistic					
Wald chi2(13) = 72.87			Log likelihood = 55.85		
Prob> chi2 = 0.0000			Pseudo R2 = 0.64		

The coefficient of use of wood as cooking fuel (Wod) shows positively association with the asthma disease, moreover it turned statistically significant. Because wood releases greater number of particulate matter in the air that lead to air pollution, as compared to modern fuels like LPG as proposed by Ellegård (1996). The coefficient of LPG as cooking fuel (LPG) has a negative impact on the chance of being sick by asthma. As LPG fuel produces less particulate matter in the surroundings, so there are less chances of disease to happen. This result is quite in line with the findings of Ellegård (1996). But the result in this study did not turn as significant. This may happen as a very small proportion of household relies on LPG fuel for cooking purposes.

The coefficient of bio gas as cooking fuel (B_gas) has a negative impact on the chance of being sick by asthma. As bio gas fuel produces less particulate matter in the surroundings, so less chances of disease happening. This result is quite in line with the findings of Pant (2007). But the result in this study did not turn as significant. This may happen as a very small proportion of household relies on bio gas fuel for cooking purposes. Whereas Animal dung as a cooking fuel (A_dun) shows a significant positive relationship with the prevalence of asthma disease. Similar results were found in the study of Semple, *et al*. (2010). The coefficient of Room space (R_spa) shows a significant predictor of asthma disease that associated negatively with the disease occurrence. Because the overcrowding increases the risk of transfer of pathogens. So, if there are more spaces then the chances of being affected would be less likely. Result was found quite similar with the findings of Goren, *et al*. (1990), Goren and Goldsmith (1986) and Burr, *et al*. (1989).

On the other hand, presence of chimney at cooking place (Chim) has a negative significant association with asthma disease. Findings are quite in line with Rahman (2006). The coefficient of ventilator (Ven) has significant negative impact on the asthma disease. This findings were almost similar with the findings of Rahman (2006). Whereas smoking (Smok) shows a significant positive relationship with the prevalence of asthma disease. It is consistent with the study of Grassi, *et al*. (2006) and Ezzati and Kammen (2001). The overall fit of the model indicated by the value of chi-square is highly significant.

The results given in Table 13 shows that HHI had a significant negative impact on the incidence of having malaria. The household income probably helps to reduce malaria disease through improving their surroundings, and providing better sanitary conditions. This is almost in line with the findings of Singh and Rahman (2001) and Karn, *et al*. (2003).

Similarly the EDU also has a negative significant impact on incidence of malaria disease. he household s education like income can also cause behavioural differences regarding hygiene practices that affect the transmission of enteric pathogens. Same results were found in the studies of Karn, *et al*. (2003). The coefficient of fly door (F_dor) has a significant negative impact on the malaria disease. This findings match with the findings of Rahman (2006). The coefficient of fly window (F_win) has a significant negative impact on the malaria disease. This findings matched with the findings of Rahman (2006).

SWD in open drains has a positive and significant effect on the association of malaria disease. As open drains are often blocked, thus providing environmental pollution and a breeding place for germs leading to increased risk of diseases including malaria. Similar positive and significant impact was also shown by Boadi (2004), Singh, and Rahman (2001).

Table 13

Logistic Regression Results of Incidence of Malaria Disease

Dependent Variable is Malaria					
Independent Variables	Coef.	Robust Std. Err.	Z values	P>|z|	Odd Ratios
HHI	.0001051	.0000335	3.13	0.002	0.99
EDU	0.28	0.11	2.68	0.007	0.76
F_dor	1.37	0.63	2.18	0.03	0.25
F_win	1.87	0.78	2.39	0.02	0.15
SWD	1.7	0.81	2.10	0.04	5.49
W_stag	1.22	0.69	1.76	0.08	3.39
G_col	0.71	0.99	0.71	0.48	0.49
G_Heap	1.45	0.61	2.39	0.02	4.27
W_sto	1.28	0.71	1.81	0.07	3.6
M_net	0.18	0.64	0.28	0.78	0.83
P_mea	1.06	0.63	1.7	0.09	0.35
Cons	3.77	1.31	2.88	0.004	43.24
Goodness of fit statistic					
Wald chi2(13) = 54.52			Log likelihood = 40.29		
Prob> chi2 = 0.0000			Pseudo R2 = 0.77		

The stagnant water around or near the house (W_stag) has a positive and significant affect on the association of malaria disease. Stagnant provides a breeding ground for germs leading to increased risk of diseases including malaria. Similar positive and significant impact was shown by Boadi (2004), Singh and Rahman (2001), and Alemu, *et al*. (2011).

However, proper garbage collection (G_col) did not turn out to be statistically significant; probably because very few households have the facility of proper garbage collection. Although, the expected negative sign was found. The negative sign was also found in the study of Singh, *et al*. (1996). The coefficient of presence of garbage heaps near or around the house (G_heap) shows significant positive linked with incidence of malaria disease. Similar findings were suggested by Singh, *et al*. (1996).The coefficient of water storage in open container (W_sto) has a positive and significant effect on the association of malaria disease. As water storage in open container provides a breeding place for mosquitoes that leads to an increased risk of malaria. Similar positive and significant impact was shown by Singh and Rahman (2001).

The result given in Table 13 shows that use of mosquito nets (M_net) show negatively associated with the incidence of malaria. Findings are in line with the findings of Alemu, *et al*. (2011). But surprisingly, this did not turn as significant in this study. This may happen due to the reason that there in trend of using mosquito net.The coefficient of preventive measures from mosquitoes (P_mea) has a significant negative impact on the chance of being sick by malaria. This result more or less is in line with findings of Rahman (2006). The overall fit of the model indicated by the value of chi-square is highly significant.

5. CONCLUSION AND RECOMMENDATIONS

This study applied logistic regression to estimate the impact of socio-economic and environmental factors on health status in district Bhimber AJK. This study used eight diseases as indicator of health status. The independent predictor for water borne disease (diarrhoea, dysentery, cholera and typhoid) were HHI, education, water source, satisfaction from water quality, water source outside homes, SWD in open drains, drinking water treatment practices, use of toilets, type of toilets, toilet clean daily, hand wash facility near the toilets, food storages, food quality, garbage heaps around homes, and proper refuse disposals.

The independent predictor for air borne disease (bronchitis, pneumonia and asthma) were HHI, education, cooking in proper kitchens, cooking practices in open air, cooking practices in multipurpose rooms, use of wood as cooking fuels, LPG as cooking fuels, bio gas as cooking fuels, animal dung as cooking fuels, room spaces, presence of chimney at cooking places, smoking, and ventilators. The independent of vector borne disease (malaria) are HHI, education, fly door, fly windows, SWI in open drains, stagnant water around or near the houses, proper garbage collection method, presence of garbage heaps near or around the house, water storages in open containers, use of mosquito net, preventive measures from mosquitoes other than mosquito net. The major findings of this study are given below:

- In case of all eight diseases used in this study as indicator of health status revealed that HHI and education have negative relationship with occurrence of all diseases. However, these relationships also turned out statistically significant.
- Water sources, satisfaction from water quality, drinking water treatment practices, hand wash facility near the toilets, use of toilets, daily toilet cleaning are significant predictor of water borne diseases that are associated negatively with the occurrence of water borne diseases. Whereas water source outside the homes, SWI in open drains, food storage in open jars/utensils shows a significant positive relationship with the prevalence of water borne diseases.
- Type of toilets, proper refuse disposals is negatively linked with water borne diseases.
- Garbage heaps around the home, and food quality are positively linked with incidence of water borne diseases; however, they did not turn out to be statistically significant.
- Cooking practices in MPR, use of wood as cooking fuels, animal dung as cooking fuels, and smoking have positive impact on incidence of air borne diseases.
- Cooking practices in open air, room space, presence of chimney at cooking place and ventilator have negative and significant effect on the air borne diseases.

- However cooking in proper kitchen, LPG and bio gas as cooking fuel did not turn out to be statistically significant. Although, the expected negative sign was found with the incidence of air borne diseases.
- Fly door, fly window and preventive measures from mosquitoes other than mosquito net show significant negative link with incidence of malaria.
- SWI in open drains, stagnant water around or near the house, presence of garbage heaps near or around the house, and water storage in open container have positive and statistically significant effect on malaria disease.
- Proper garbage collection method and use of mosquito net show negative relationship with the incidence of malaria.

The findings suggest that more emphasis should be placed upon improvement of existing poor sanitation conditions, hygienic practices, and education for better health. Better provision of water supply and drinking water treatment should be ensured, which can significantly reduce water borne diseases.

There is a crucial need to address the environmental problems at the household level, so as to improve their health status. These comprises proper collection, dumping of garbage and solid waste, improving the poor state of sewerage drainage system and to overcome stagnant water around the home, provision of sanitation facilities for the poor people. To overcome the health effects connected with cooking fuel like wood and animal dung, the simplest solution may be to encourage modern fuel like LPG and bio-gas.

This study concentrated only on indoor air pollution. This study used only two indicators as socio economic-conditions. So, outdoor pollution may be studied in future with the incidence of air borne diseases. Moreover, this study used only one non-communicable disease that is asthma and only seven communicable diseases. Thus in the future:

- Studies may extend by taking more infectious diseases as well as including the non-communicable diseases.
- Similar studies should be conducted for other areas which will help policy makers to tackle health issues.
- The analysis may further be extended to rural-urban areas separately.
- In future, the impact of other variables like facilities of medical services and seasonal impact can be estimated.

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