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SOCIO-ECONOMIC DETERMINANTS OF DIARRHOEA MORBIDITY IN PAKISTAN

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ABSTRACT

The present study uses the 2004-05 PSLM Survey to determine the socio-economic, demographic, environmental and geographical factors of diarrhoea morbidity among the sampled children. This sample is restricted to children under five years of age (0-4) years and the PSLM has identified 13540 children in this age group. The sample is divided into nine agro-climatic zones of rural areas and it also includes two classifications of urban areas: MUCs and OUCs. Findings of this study have confirmed the positive role of economic factors including land and livestock with respect to Diarhoea morbidity. Both the ownership of land and livestock are means of livelihood for peoples of rural areas. They contribute to better child health by increasing income of household. With respect to prevalence of diarrhoea morbidity, multivariate analysis show that younger children, particularly under the age of two, are relatively at a greater risk to suffer from diarrhoea sickness. The findings of this study suggest that mothers should be given awareness about personal hygiene, and specially of preparing supplementary food for children. This study also revealed that total number of children born and immunization are more helpful to control diarrhoea sickness across rural geographical zones.

Keywords: diarrhoea morbidity, socio-economic, demographic, determinants

1. INTRODUCTION

Diarrhoea is among those diseases which are most prevalent among children in Pakistan (Mahmood and Mahmood, 1995). About two-thirds of total annual deaths in Pakistan are currently among children under the age of five years, and diarrhoea is considered to be one of the major contributors to these deaths. Diarrhoea is usually caused by one of the number of food borne or water borne pathogens. Improvements in environmental factors such as supply of adequate and clean drinking water, improvements in sanitation facilities, and personal hygiene thus can play an important role in reducing the incidence of diarrhoea. Similarly mother's education can cause behavioral changes that can reduce the transmission of enteric pathogens and can be helpful in reducing diarrhoea morbidity rates (Chakrabarti, 2003).

Although the focus of study is on socio-economic variables and diarrhoea morbidity, the impact of other demographic, environmental and geographical factors of diarrhoea morbidity have also been considered. In this study diarrhoea morbidity is used as an indicator of child health, focusing on variations across geographical zones because these zones are different in terms of economic status or the prevalence of poverty. Some zones of rural and urban areas are rich and some are poor, therefore

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this study has tried to examine how diarrhoea morbidity for the sampled children varies across different ecological zones. This study also examines the impact of preventive health care especially measles immunization on diarrhoea morbidity. Immunization may not be directly related with diarrhoea morbidity but measles immunization is likely to protect children against measles – associated diarrhoea (Arif, 1998).

This study makes a useful contribution to the existing evidence on the relationship between diarrhoea morbidity and socio-economic determinants by focusing on variation across geographical zones, as these differ significantly in terms of economic status or prevalence of poverty. The objective of this study is to analyze the relationship between economic status and diarrhoea morbidity. The specific research objectives are: to examine the geographical variation in disease incidence that how the diarrhoea morbidity varies across different ecological zones, which are different in term of economic status or poverty; to examine the relationship between child health and economic factors; to assess the impact of preventive health care especially child immunization on diarrhoea morbidity.

The rest of paper is organized as follows; section 2 presents the review of literature; data source, methodology and estimation technique are discussed in section 3; section 4 presents sample characteristics and poverty among children, while the prevalence of diarrhoea morbidity and its differentials are discussed in sections 5 and 6. Finally section 7 concludes the study.

2. LITERATURE REVIEW

Arif and Ibrahim (1998) using the 1995-96 Pakistan Integrated Household Survey determine the socio-economic, demographic and environmental covariates of both prevalence and duration of diarrhoea among children under five in Pakistan. This study shows that child's age to be a strong determinant of both prevalence and duration of diarrhoea. The diarrhoea morbidity rate peaked at age 1 for both males and females. However the rate in this age group is higher for males than for females. The effect of mother's education, however, was limited to those mothers who at least had 10 years of schooling and were residing in urban areas. Household income also appears to be a strong determinant of diarrhoea morbidity. Children living in household having piped water or motor pump inside the house were less likely to be sick than children in households having other sources of water including hand pump, well or river. Measles immunization and season had independent effects on diarrhoea morbidity in most parts of the country. Prevention and effective treatment of respiratory infection and diarrhoea under the age of five depends on individual, household and community level behavioral factors.

Chakrabarti (2003) has tried to estimate the role played by such factors in determining the utilization of formal health care to cure diarrhoea and certain respiratory illness plaguing young children. He shows that the bivariate probit estimate of cough care and cough and diarrcare and diarrhoea correlation coefficient is positive. Senauer and Kassouf (2000) have tried to analyze the effects of breast feeding on child health. In this study breastfeeding variable is significant and has beneficial effects on reducing illness and improving growth among infants and young children. Exclusive breastfeeding reduced the probability of illness by about 15% among infants age 0-5 months. The probability of illness was some 10% lower among currently breast-fed children age 0-20 months versus those who were not breast fed.

Jalan and Ravallion (2001) has analyzed whether child health gains from access to pipe water. The results indicate that access to piped water significantly reduces diarrhoea incidence and duration. The illness durations were nearly 40% higher where the source of drinking water is public tap rather than a tap within the household premises. Mahmood and Ali (2002) have examined the disease incidence among different sub-groups of population. The pattern of illness varies by age with younger children 0-4 years and older population 60+ exhibiting higher rates of morbidity. Male children under 10 years of age and older adults have shown higher disease incidence than their female counterparts.

Arif (2004) has examined the health status of Pakistani children using two important indicators, morbidity and malnutrition measured by weight for age and height for age. **I**mmunized children were less likely to be sick compared to those who did not have immunization. Children living in Balochistan were more likely to be sick than children living in the Punjab.The effect of birth order is

significant with children from later birth orders being worse nourished. Mother's education has a positive and significant effect on children's nutritional status, but father's education is not significant. The analysis shows that having access to flush toilet has a significant positive effect on the nutritional outcome of children perhaps due to smaller incidence of diseases. Immunized children's have lower odds of receiving medical care during two weeks preceding the survey.

It appears from this brief review of the recent literature that the relationship between diarrhoea morbidity and economic status of households has not been thoroughly measured except in the last study by Arif (2004). This study has two unique features that distinguish it from earlier literature. Firstly, this study has focused on the geographical variations in the occurrence of diarrhoea morbidity. Secondly, this study has introduced ownership of land, livestock and housing as economic variables. Both land and livestock are a means of employment and source of income for peoples of rural regions and housing represents better economic status of a household. Thus this study is a useful addition to the existing literature on child health. The following hypotheses are presented as a basis for examining some important relationships; a) variations in terms of economic status of geographical zones influence the diarrhea morbidity; b) preventive health care leads to improvement in health status of children, and c) better economic status of household helps to improve the health status (diarrhoea) of children.

3. METHODOLOGY AND ESTIMATION TECHNIQUE

3.1. Data Sources

The present study is based on "The Pakistan Social and Living Standard Measurement Survey 2004-05" conducted by Federal Bureau of Statistics. The PSLM Survey is based on Core Welfare Indicators Questionnaire (CWIQ) approach which intends to provide data for formulating the poverty reduction programme initiated under poverty Reduction Strategy Program (PRSP) and Medium Term Development Framework (MTDF) in the overall context of MDGs. For the present analysis, a child file is created and the sample is restricted to 13540 children under five years (0-4 years) covering both rural and urban areas.

3.2. Data Variables

The following variables are included in this analysis

Child's characteristics: age and sex of child; Parent's characteristics: mother's age at the time of birth, education and working status of mother; Household's characteristics: total number of children born and housing construction material; Economic factors: poverty status like poor and non poor, ownership of agriculture land and livestock; Environmental factors: source of drinking water like motorized pump or piped water, toilet facilities and access to electricity; Regional characteristics; Health seeking behavior: child immunization.

3.3. Methodology

For the present study, the 2004-05 PSLM sample is divided into different geographical zones of rural and urban areas. Rural areas are divided into nine agro-climatic zones: rice/wheat Punjab, mixed Punjab, cotton/wheat Punjab, low-intensity Punjab, barani Punjab, cotton/wheat Sindh, rice/other Sindh, NWFP and Balochistan while the urban sample is classified into two categories Major Urban Centers (MUCs) and Other Urban Centers (OUCs) (Appendix Table 1).

Among 4762 urban children 1921 are located in the MUCs and 2841 are located in the OUCs. Out of 8778 rural children 733 are located in rice/wheat Punjab, 697 in mixed Punjab, 1061 in cotton/wheat Punjab, 443 in low-intensity Punjab, 241 in barani Punjab, 1077 in cotton/wheat Sindh, 1046 in rice/other Sindh, 2200 in NWFP and 1280 in Balochistan as shown in Table 1. This division is made in order to see any variation in morbidity across different ecological zones, which differ in climate, environmental setting, and socio economic factors.

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The major caveat of the data set is as follows: this study is based on the self reported morbidity which has several limitations. Women's self reported morbidity generally tends to exaggerate the presence of infection compared to etiological diagnosis (Nayab, forthcoming).

Table 1. Distribution of under –five children identified in the 2004-05 PSLM, by Province and type of rural and urban areas.

Urban/ Rural	Urban Areas			Rural Areas										Total Sample
Province	MUCs	OUCs	All	Rice wheat Punjab	Mixed Punjab	Cotton Wheat Punjab	Low Intensity Punjab	Barani Punjab	Cotton wheat Sindh	Rice - other Sindh	NWFP	Balochistan	All	
Punjab	952	933	1885	733	697	1061	443	241	-	-	-	-	3175	5060
Sindh	594	517	1111	-	-	-	-	-	1077	1046	-	-	2123	3234
NWFP	255	868	1123	-	-	-	-	-	-	-	2200	-	2200	3323
Balochistan	120	523	643	-	-	-	-	-	-	-	-	1280	1280	1923
Pakistan	1921	2841	4762	733	697	1061	443	241	1077	1046	2200	1280	8778	13540

Source: computed from PSLM 2004-05

The Models

Just like in linear regression we assume that some set of X variables is useful for predicting the Y values, but we are claiming that this set predicts the probability that Y=1 (assuming we have coded the dependent variable as [0,1]). The basic formula for estimating Y=1 consists of transforming the regression equation to look like equation 1.

$$P(Y=1) = 1/1+\exp [-(\alpha + \beta 1X1 + \beta 2X2 + \ldots\ldots\ldots + \beta kXk] \quad (1)$$

The whole function is called the logistic distribution function and it is estimated by maximum likelihood (ML) techniques. An advantage of this function is that it guarantees that the probability ranges from 0 to 1 as the regression equation predicts values from negative infinity to positive infinity [Gujrati, (1995), Cameron and Trivedi, (2005)]. Another name for the logit is log-odds so we can also write logistic function as

$$\text{Logit } [p(y=1)] = \alpha + \beta 1X1 + \beta 2X2 + \ldots\ldots\ldots + \beta kXk \quad (2)$$

Where the logit $[p(y=1)] = \log_e | p(y=1)/1-p(y=1)|$ i.e. log-odds (3)

This fits the model

$$\text{Ln } [(p)/ (1-P)] = a + \sum bixi \quad (4)$$

Where p is the probability of a child having the diarrhoea morbidity during the past thirty days preceding the survey, a and bi are estimated regression coefficients, and xi are the background characteristics, consisting of child's age and gender, his/her mother's age and educational attainment, sources of drinking water, toilet facilities, measles immunization, and ecological zones. As stated earlier, the main objectives of the present study is to determine the covariates of prevalence of diarrhoea morbidity. To accomplish this purpose this study has constructed several models for diarrhoea morbidity. Model 1, which is the full model, includes all the children less than five years selected for the present study. Model 2 to 12 has been estimated separately by focusing on

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geographical zones of rural areas and classifications of urban areas. All models are additive and has been summarized through odd ratios.

4. SAMPLE CHARACTERISTICS AND POVERTY AMONG CHILDREN

4.1. Sample characteristics

Information on age and gender of the selected children, their mother's characteristics, the proportion of children being immunized, sanitation facilities, source of drinking water, poverty status, ownership of agricultural land and animals, and geographical zones is reported in Appendix Table 2. An operational definition of these variables is also presented in Appendix Table 3. Selected children were evenly distributed; about 16 percent of them were less than one year old when PSLM was conducted, while 17 percent of the children had completed their first birthday. The share of 2-year old children was about 22 percent, for the 3-year old it was 23 percent and for 4-year old it was 21 percent.

Appendix Table 2 shows that more than 68% of children born to mothers aged between 20 and 35 years, and only16% born to mothers aged between 35 to 39 years. Another 11% of children were born to mothers above 40 years of age. A large proportion of mothers were illiterate (73%) and a considerable proportion of the mothers (45%) of the sampled children gave birth to more than five children. Coverage of immunization was somewhat universal: about 78 percent of children had been immunized while 19% of children did not receive any child immunization.

Only thirteen percent of the selected children lived in a household that had the facility of toilet with flush system. Sixty percent of children lived in households which had different types of toilet facilities such as, flush connected to open drain, pit latrine etc., Forty six percent of the children lived in a household that had the facility of piped water or motorized pump and 53 % of children belonged to households who has other sources for drinking water like hand pump etc. Appendix Table 2 also sets out data on economic characteristics. It shows that 71% of children belong to non poor household and 28% of children belong to poor households while sixty four percent of the children belong to households who owned agriculture land, another sixty two percent of the children belong to households who owned livestock.

Distribution of children by different geographical zones has also been presented in Appendix Table 2. Eight percent of children belong to rice/wheat Punjab zone, 7 percent belong to areas of mixed Punjab, 12 percent belong to areas of cotton/wheat Punjab, 5 percent belong to areas of low-intensity Punjab, 2 percent belong to areas of barani Punjab, 12 percent children belong to areas of cotton/wheat Sindh, 11 percent children belong to areas of rice/other Sindh, 25 percent children belong to areas of NWFP and 14 percent children belong to areas of Balochistan. Urban cities were classified into Major Urban Centres (MUCs) and Other Urban Centres (OUCs). Fourteen percent of children belong to households who were residing in MUCs and 21 % of children belong to household who were residing in OUCS.

4.2. Poverty status of children under five years in 2004-05.

The PSLM identified 13540 children in this age group covering both rural and urban areas. Data on the poverty incidence presented in this study is based on the official poverty line with a threshold of 2350 calories per adult equivalent per day. Based on the official poverty line Appendix Table 4 gives the poverty incidence in 2004-05 for the sampled children. It shows that overall children in rural areas are poorer than children in urban areas and within urban areas the poverty incidence is higher for Other Urban Centers (OUCs) than for Major Urban Centers (MUCs).

Across the rural areas poverty among children is higher in cotton wheat Punjab zone (45.9%), followed by NWFP (37.9%), low-intensity Punjab (34.3%) and mixed Punjab (34.1%). Child poverty is observed to be lowest in barani Punjab (9.1%). In other words, according to Appendix Table 4, Cotton/wheat zone of Punjab, low-intensity zone of Punjab and NWFP as the poorest zones while barani Punjab is the richest zone. Other zones particularly cotton/wheat Sindh, rice/wheat zones of Punjab and Sindh are relatively better off than the poorest zones. Mixed Punjab has the medium level of poverty. Balochistan is also among the poor zones. The estimated poverty figures for the sampled

children are very close to poverty estimates for the whole population, as carried out by earlier studies. [see Malik (1992), Arif and Ahmed (2001) and Irfan (2008)].

This variation in poverty levels across the rural zones has been expained by earlier studies. Arif and Iqbal (2008) attribute the consistently low levels of poverty in barani Punjab to certain socio-economic characteristics of the barani areas including relatively high levels of literacy, particularly among females; the lowest dependency ratio probably because of low fertility; and lowest number of unpaid family workers. Furthermore, rural areas of barani districts are well integrated with the prosperous urban centers with strong linkages to the services sectors and this factor has also attributed for lower level of poverty in these areas. According to Arif and Iqbal rural infrastructure has played a role in poverty differentials across the rural zones. There seems to be negative relationship between poverty and infrastructure investment. Rural regions with low levels of poverty like barani Punjab, rice/wheat Punjab and mixed Punjab have better access to infrastructure e.g. roads, electricity, soling of street, access to piped water, drain underground, access to educational institutions and health facilities. Rural regions with medium poverty have medium level of infrastructure while the regions with high poverty have low access to infrastructure. Amjad, Arif and Mustafa (2008) argue that high incidence of overseas migration and the resulting inflow of remittances contributes a significant proportion of the total household income in barani areas of Punjab.

5. DIARRHOEA MORBIDITY AND ITS DIFFERENTIALS

5.1. Gender differentials across zones

The prevalence rate of diarrhoea morbidity among the sampled children while controlling for gender and zones are shown in Appendix Table 5. The overall diarrhoea morbidity rate for children in 2004-05 is 16 percent. The overall diarrhoea morbidity rate is higher for males than for females in both rural and urban areas, but the overall rate for rural areas is higher than for urban areas. The diarrhoea morbidity rate while controlling for gender in all geographical zones of rural areas is higher for males than for females except in low- intensity Punjab zones. This pattern is also observed in OUCs; the highest prevalence rate of diarrhoea morbidity is found in the zone of cotton/ wheat Punjab, followed by cotton/wheat Sindh zone. These two zones are among the poorest regions of the country.

5.2. Age-Gender Differentials

The age/gender –specific morbidity rates of the sampled children are shown in appendix Table 6. The gender differentials fluctuated considerably between the age groups. Diarrhoea morbidity rates for males peaked at age 1 and for females, diarrhoea morbidity rate peaked at below 1 year. The rate in this age group is higher for males than for females. After age 1 it declined steadily for both sexes. These findings regarding the age pattern of diarrhoea morbidity are consistent with studies conducted in other developing countries, which showed relatively higher diarrhoel disease in the first two years of life (Yohannes, 1992). This outcome could be due to exogenous factors such as reduction of breastfeeding along with increase in food supplementation in the second year of life. The supplementary food can become contaminated in the preparation process under poor hygienic conditions. Therefore continuing breastfeeding of children and maintaining personal hygiene by those who prepare food for children can also play an important role in reducing the incidence of diarrhoea.

The age/gender diarrhoea morbidity rates of the sampled children for rural zones are shown in the appendix Table 8, the gender differentials fluctuated across age groups. Diarrhoea morbidity is higher for children belonging to age group of less than one year. After age 1 diarrhoea morbidity rates declined steadily for both males and females almost in all rural zones. However, total rural sample shows that diarrhoea morbidity rate for both males and females peaked at the age of one year and declined steadily therefore for both sexes. Similar pattern of morbidity decline is also observed in the two classifications of urban areas: MUCs and OUCs (appendix Table 7).

5.3. Environmental Factors and Diarrhoea Morbidity

The relationship between diarrhoea morbidity among children under five and the environment related variables i.e., sources of drinking water and types of toilet facility are shown in appendix Table 9. Children living in households having piped water or motor pump inside the house are less likely to

become sick than children in households having other sources of water including hand pump, well or river. This pattern of diarrhoea morbidity remains same across zones except in three zones, low-intensity Punjab, cotton/wheat Sindh and NWFP. This is the expected pattern since piped water is normally assumed to be less contaminated than other sources. Jalan and Ravallion (2001) indicate that access to piped water significantly reduces diarrhoea incidence and duration.

Appendix table 9 also shows that the prevalence of diarrhoea among children who lived in households with a flush toilet connected to sewerage is substantially lower than among those who lived in household with other types of flush system. This difference persisted even when controlling for urban classifications (MUCs/OUCs). On the other hand, quite surprisingly in rural areas and in different geographical zones of rural areas prevalence rate is higher in the households having toilet with flush connected to sewerage system than households with other sources of toilet facilities. This might be due to poor sanitation facilities or non- use of toilet facilities by the sampled children in these areas.

5.4. Mother's Age, Education and Diarrhoea Morbidity

Appendix Table 10 shows no consistent relationship between the occurrence of diarrhoea and the age of mother. In fact there is a great fluctuation in the morbidity rates across different age groups of mothers. The level of maternal educational attainment, however, did show an association with diarrhoea morbidity. The prevalence of diarrhoea decreased with higher education, particularly for mothers with a matriculate or higher level of education. This pattern of morbidity decline remained unchanged when this relationship is observed for the classification of urban areas MUCs/OUCs and in several rural zones, as discussed latter in this chapter. It has recently been investigated that how mother's education influences the child health. Handa (1999) argues that mother's education helps to understand how to manage nutrition and disease most effectively, and increases the knowledge of appropriate sanitary behavior.

5.5. Economic Factors and Diarrhoea Morbidity

The relationship between diarrhoea morbidity among children under five and economic factors including ownership of agriculture land and ownership of livestock controlling for rural/urban areas and ecological zones is shown in the appendix Table 11. Children living in households which owned agricultural land were less likely to become sick from diarrhoel infection than children in households with no ownership of agricultural land. This relationship holds even after controlling for zones except in the low-intensity Punjab zone, barani Punjab zone and Balochistan.

Appendix Table 11 also shows that prevalence of diarrhoea among children who lived in rural households that own animals was lower than among those who lived in households without animals. But this relationship does not hold for mixed Punjab, barani Punjab, rice /other Sindh and Balochistan.In rural areas ownership of land and livestock is a means of employment. Increased employment due to the ownership of land and livestock directly benefits the poor more than the non-poor as it can reduce poverty by raising income and consumption of the poor households. Thus ownership of land and animals plays an important role to improve the economic position of household; as the economic position of household improves it helps in many ways to protect child from diarrhoea morbidity.

Better economic position of a household can improve the sanitary condition of a household. Increased availability of uncontaminated drinking water and personal hygiene can play a major role to protect child from diarrhoel infection. Similarly better economic status of a household improves nutritional status of child and it can also protect him from diarrhoel disease. To see the independent impact of different economic, environmental, demographic and geographical factors on child health, multivariate technique is applied in the next section.

6. DIARROEA MORBIDITY DIFFERENTIAL: LOGISTIC REGRESSION ANALYSIS

The relative influence of different variables on the probability of a child's having diarrhoea morbidity in the 30 days prior to the 2004-05 PSLM is assessed in this section by the multivariate technique. The logit equation specified in section 3.3.3 of section 3 provides the basis for this assessment.

Diarrhoea morbidity is used as a dichotomous (had or had not diarrhoea during the reference period) dependent variable.

Several explanatory variables (child's age and gender, mother's age, education and working status, total number of children born, sources of drinking water, toilet facilities, measles immunization, ownership of animals, agricultural land, electricity, material used in the roof of house, material used in the walls of house and geographical zones), discussed in section 3, are used in the analyses.

Model 1, which is the full model, includes all the children less than five years age selected for the present study. Several other models are estimated separately by focusing on different geographical zones and classification of rural and urban areas respectively. All models are additive and has been summarized through odd ratios in appendix Table 12-14.

Results of Model 1 show the child's age to be strongly associated with diarrhoea morbidity (appendix Table12). There is a steady decline in the odds of diarrhoea morbidity with child's age (Arif, 2004): a three-year old child is 39 percent less likely than an infant to become sick, and this percentage declined further to 29 percent for a four years old child.

The gender variable has a positive and significant effect (at 5 percent level of confidence) on the probability of getting diarrhoea morbidity, suggesting that males under five are more likely than females to get diarrhoea. It may primarily be attributed to biological differences (Khan, 1994). Appendix Table 12 shows that total number of children born to a mother has a positive association with child morbidity, as the number of children born increases it exerts strong and significant pressure on child sickness but significance has been shown only for high parity women (children 7 and more).

This adverse impact on child health with an increase in number of children reflects relatively less attention of mother on each child's health requirement. Moreover physical resources such as housing space, food, clothing and health care are therefore spread over a larger number of children. The risks of infection are exacerbated when a large number of young children bathe, sleep and eat together (Sathar, 1992). For instance, in urban Pakistan it was found that families where there were one or two children aged under five, 18 percent of them had infectious diseases as compared to 24 percent of children of families where there were two or more children aged under five (Omran,1981).

Age and education of children's mother did show significant and negative effect on the diarrhoea morbidity (Arif and Ibrahim, 1998) as shown in appendix Table 12 whereas mother's working status did not show a significant relationship. Children having measles immunization are less likely to become sick due to diarrhoea, but the relationship does not turn out to be significant. Children who belong to households having relatively safe source of drinking water, piped/motorized-pump inside the house, have shown significant negative association with diarrhoea morbidity. Incidence and duration of diarrhoea among children under five in rural India are significantly lower on average for families with piped water than for observationally identical household without piped water (Jalan and Ravallion, 2001). Surprisingly children living in household having "latrine with flush system" do not show any association with diarrhoea morbidity. It probably may be due to the fact that presence in a household of a latrine does not necessarily mean that a child uses it. In many communities, even where basic sanitation facilities exist and adults use them, young children are often permitted to defecate indiscriminately (Arif and Ibrahim, 1998). So it is not easy to hypothesise whether it is the availability of sanitation facilities or it is the usage pattern of latrine in the home that transmits pathogens causing diarrhoea. Model 1 in appendix Table 12 shows that, children who belong to households who own agricultural land, has a significant and negative relationship with diarrhoea morbidity. Similarly children who belong to household with ownership of animals are less likely to become sick than children who belong to households who have no ownership of animals.

We have taken material used in housing as an indicator of economic factors. Model 1 shows that children who belong to households where material used in the roof of the house is RCC/RBC are less likely to become sick than children who belong to households where other type of material is used in the roof of house e.g., wood /bamboo etc and it has also shown significant association with diarrhoea morbidity. Probably roof material (RCC/RBC) represents better economic position of household. It appears that overall housing has a significant impact on diarrhoea morbidity (Mahmood, 2001).

Access to electricity has a positive but insignificant influence on the probability of being sick as shown in Model 1 (Arif, 2004). Model 1 shows that within rural ecological zones highest odd of diarrhoea morbidity is in the cotton /wheat Sindh zone and the lowest odd of diarrhoea morbidity is in the barani Punjab zone. Model 1 has also shown that pattern of morbidity risk is higher for children living in Other Urban Centres (OUCs) than Major Urban Centers (MUCs). All geographical zones except barani Punjab zone, Balochistan and MUCs have shown positive relationship with diarrhoea morbidity.

The results of Models 2-12, which examined the likelihood of children being sick for residing in rice/wheat Punjab zone, mixed Punjab zone, cotton/wheat Punjab zone, low- intensity Punjab zone, barani Punjab, cotton/wheat Sindh zone, rice/other Sindh zone, NWFP, Balochistan, MUCs and OUCS separately are presented in appendix Tables 12, 13 and 14. Results of these Models reveal some important points. Child gender is positively associated with diarrhoea morbidity in all the geographical zones of rural areas whereas in the urban areas it is positively associated only in the OUCs (Mahmood and Mahmood, 1995; Sathar 1994). Child age is negatively associated with diarrhoea morbidity in all the geographical zones of rural and within classification of urban areas (Boerma and Ginneken (1996).

Total number of children born exerts a negative pressure on child health (Bennett.1999; Preston, 1978) only in rural zones. Mother's age appears to be negatively associated with diarrhoea morbidity (Hobcraft et al, 1985) in geographical zones of rural and urban areas except in barani Punjab, rice/other Sindh, Balochistan and OUCs. Mother's working status appears to be positively associated with probability of children being sick (Arif, 2004) except in rice/wheat Punjab, barani Punjab, cotton/ wheat Sindh, rice/other Sindh, NWFP and MUCs. Mother's education appears to be a very important determinant to control diarrhoea morbidity (Caldwell, 1979). In classification of urban areas mother's education has shown significant negative association.

In rural geographical zones the corresponding impact is in general insignificant; but surprisingly it is significant and positive in two zones such as barani Punjab and cotton/wheat Sindh. It is hard to explain this positive relationship between mother's education and child morbidity in these two zones. This is unexpected since the barani zone is economically better-off than other zones and educational level of adult population is also better in this zone. Krupnick et al (1996) also showed that mother's educations, unlike other studies, were found to have no impact on morbidity.

Measles immunization in the classification of urban areas is not of much importance whereas in the geographical zones of rural areas it seems very helpful to reduce diarrhoea morbidity although it is not significant at many places (Pande, 2000). Relatively safe sources of drinking water, piped/motorized pump appears to be strong determinants of diarrhoea morbidity and it is helpful to reduce diarrhoea morbidity in rural as well as urban areas (Jalan and Ravallion, 2001).

Surprisingly, unlike other studies, toilet facility with flush system connected to sewerage which is used as an indicator of sanitation facilities appears to be positively associated with diarrhoea morbidity except in the rural zones of rice/other Sindh, NWFP and Balochistan. As stated earlier, it could be due to poor sanitation facilities or due to non-use of toilet facilities by the sampled children.

Housing conditions (material use in roof of house and material used in walls of house) has shown importance for the zones of rural areas and within urban classifications to control diarrhoea morbidity. In housing condition, material used in the roof of house seems to be more important than material used in the walls of house across zones and it has also shown significant association for several rural zones. It might be possible that housing represents better economic condition of household which helps to improve child health. Electricity appears to be positively associated with diarrhoea morbidity except in mixed Punjab, barani Punjab, Balochistan, MUCs and OUCs. Again it is an unexpected association.

Ownership of agricultural land is important determinant of diarrhoea morbidity especially at the poor zones of urban and rural areas, for example, OUCs, low-intensity Punjab, cotton/wheat Sindh, rice/other Sindh and NWFP although the corresponding negative impact has shown significant association only for NWFP. Similarly ownership of livestock has shown negative association with

diarrhoea morbidity in rural zones, for example, rice/wheat Punjab, low-intensity Punjab, barani Punjab, cotton/wheat Sindh, rice/other Sindh and NWFP although the corresponding impact has shown negative association only for rice/wheat and barani zone of Punjab.As it has been already mentioned in the section 4 of this study that poverty incidence of each geographical zone differs with each other. Infrastructure investment varies across the rural regions probably this might be the reason that the importance of different variables for diarrhoea morbidity varies across the regions.

7. CONCLUSION

This chapter reveals some important dimensions of diarrhoea morbidity. As each geographical zone has different type of infrastructure and it has also played a profound role for poverty differential in each geographical zone of rural and urban areas, probably this might be the reason that importance of different variables varies across the regions. Although importance of different variables for diarrhoea morbidity varies across the geographical zones but still we are in a position to stress for the importance of some factors which may be helpful to control diarrhoea morbidity.

Child's own characteristics (gender and age), total number of children born, mother's characteristics (age and education), environmental characteristics (sources of drinking water), economic characteristics (ownership of agriculture land and housing) and geographical zones are very important factors to explain diarrhoea morbidity among children. Moreover in the multivariate analysis, except barani Punjab, Balochistan and MUCs, rural zones and classification of urban areas have shown positive association with diarrhoea morbidity. The present study also found a negative association between measles immunization and occurrence of diarrhoea morbidity but its impact was more profound in rural zones.

The focus of the present study is on economic variables and has found a relationship between diarrhoea morbidity and economic factors particularly the ownership of land, livestock and housing conditions. Importance of this relationship, however, varies across the regions. For example, cotton/ wheat Punjab, NWFP, mixed Punjab, low-intensity Punjab and Balochistan, the housing condition is much more important than ownership of land and livestock. In Sindh all economic variables (land, livestock and housing) are important. In rich zones (rice/wheat Punjab and Barani Punjab) land, livestock and material used in roof are important to diarrhoea morbidity.

Policy guidelines

- Government of Pakistan may take measures to increase ownership of land and livestock in rural regions to improve child health, a sort of proxy for preventive health care.
- Government of Pakistan may take measures to decrease poverty incidence of poor rural regions by increasing infrastructure investment. Equal economic status in term of geographical variations may be helpful to focus on important determinants of child health.
- There is a need to add a few more questions in the future surveys concerning breast feeding practices, which will be helpful in further research (Arif, 1998).

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Appendix Table 1
Agricultural zone in Pakistan

Source: For rural agro-climatic zones Pinckney (1989) and for urban classification

Agro-climatic Zones (Rural)	**Districts**
1.Rice/wheatPunjab	Sialkot, Gujrat, Gujranwala, Sheikhupura, Lahore and Kasur
2. Mixed Punjab	Sargodha, Khushab, Jhang, Faisalabad, Okara and Toba Tek Singh
3.Cotton/wheatPunjab	Sahiwal, Bahawalpur, Bahawalnagar, Rahim Yar Khan, Multan, Vehari and Khanewal
4.Low-intensity Punjab	Dera Ghazi Khan, Rajanpur, Muzaffargarh, Leiah, Mianwali, Bhaker and Dera Ismial Khan.
5. Barani Punjab	Attock, Jhelum, Chakwal, Rawalpindi and Islamabad
6. Cotton/wheat Sindh	Sukkur, Khairpur, Nawabshah, Hyderabad, Tharparkar and Sanghar
7. Rice/other Sindh	Jacobabad, Larkana, Dadu, Thatta, Badin, Shikarpur, Nasirabad and Karachi
8. NWFP	Swat, Dir, Peshawar, Kohat, Karak, Mansehra, (Except DI Khan) Abbottabad, Kohistan, Mardan and Bannu
9. Balochistan	Quetta, Sibi, Kalat and Mekran (Except Nasirabad)
Urban Centers	
1. MUCs	Islamabad, Lahore, Gujranwala, Faisalabad, Rawalpindi, Multan, Bahawalpur, Sargodha, Sialkot, Karachi, Hyderabad, Sukkur Peshawar and Quetta, have been considered as large sized cities.
2.OUCS	The remaining urban population in each district in all the provinces has been considered as other urban centers.

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Appendix Table: 2 Percentage (%) Distribution of under-five children by selected characteristics		
Characteristics	**N**	**(%)**
Child's Characteristics		
Child's Gender		
Female	6675	49.3
Male	6865	50.7
Child's Age		
<1	2146	15.8
1	2355	17.4
2	3002	22.2
3	3112	23.0
4	2925	21.6
Mother's Characteristics		
Mother age at the time of birth		
15-19 years	248	1.8
20-24 years	2535	18.7
25-29 Years	3537	26.1
30-34 years	3203	23.7
35-39 years	2195	16.2
> 40 Years	1616	11.9
No Response	205	1.5
Mother Education		
Illiterate	9826	72.6
Primary	1906	14.1
Matric and above	1603	11.8
No Response	205	1.5
Mother's working status		
No	11680	86.3
Yes	1860	13.7
Total No of Children born		
1-2	3165	23.4
3-4	4563	33.7
5-6	3428	25.3
7 and more	2084	15.4
No Response	300	2.2
Immunization		
Child Immunization		
Yes	10595	78.2
No	2624	19.4
No response	321	2.4
Characteristics	N	**continued (%)**
Environmental Characteristics		
Type of Toilet Facility		
No toilet in house	3581	26.4
Flush system(B)	1784	13.2
Others	8175	60.4

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Source of Drinking Water		
Others	7280	53.8
Piped water within the House / Motorized Pump	6241	46.1
Economic Characteristics		
Poverty Status		
Non Poor	9642	71.2
Poor	3898	28.8
Own Agriculture Land		
No	8752	64.6
Yes	4788	35.4
Own Animals		
No	8398	62.0
yes	5142	38.0
Ecological Zones (Rural)		
Rice Wheat Punjab	733	8.4
Mixed Punjab	697	7.9
Cotton-wheat Punjab	1061	12.1
Low Intensity Punjab	443	5.0
Barani Punjab	241	2.7
Cotton Wheat Sindh	1077	12.3
Rice-other Sindh	1046	11.9
NWFP	2200	25.1
Balochistan	1280	14.6
Urban Areas		
Major Urban Centres	1921	14.2
Other urban Centres	2841	21.0

Source: computed from 2004-05 PSLM

(A) Primary category include primary and middle (till 8th class)

(B) The Flush system includes flush system connected to public sewerage

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Appendix Table 3
Definition of Variables

Variables	Definitions
Child's Gender	
Female	Reference category
Male	=1,otherwise
Child's Age	
0	Reference category
1	=1,otherwise 0
2	=1,otherwise 0
3	=1,otherwise 0
4	=1,otherwise 0
Total No of Children born	
1-2	Reference category
3-4	=1,otherwise 0
5-6	=1,otherwise 0
7 and more	=1,otherwise 0
Mother Education	
Illiterate	Reference category
Primary	=1,otherwise 0
Matric and above	=1,otherwise 0
Mother working Status	
No	Reference category
Yes	=1,otherwise 0
Child Immunization	
No	Reference category
Yes	=1,otherwise 0
Measles Immunization	
No	Reference category
Yes	=1,otherwise 0
Type of Toilet Facility	
No toilet in house	Reference category
Flush system(B)	=1,otherwise 0
Others	=1,otherwise 0
Source of Drinking Water	Reference category
Others	=1,otherwise 0
Piped water within the House / Motorized Pump	
Poverty Status	
Non Poor	Reference Category
Poor	

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	=1,otherwise o
Own Agriculture Land No Yes	 Reference category =1,otherwise 0
Own Animals No Yes	 Reference category =1,otherwise 0
Material used in roof of House Others RCC/RCB	 Reference category =1,otherwise 0
Material used in walls of house Others Brick	 Reference category =1,otherwise 0
Source of light Others Electricity	Reference category =1,otherwise 0
Ecological Zones (rural) Rice /wheat Punjab Mixed Punjab Cotton/ wheat Punjab Low- Intensity Punjab Barani Punjab Cotton/ wheat Sindh Rice/ Other Sindh NWFP Balochistan MUCs OUCs	 Reference category =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0 =1,otherwise 0
Child Sickness No Yes	 Reference category =1,otherwise 0
Diarrhoea Morbidity No Yes	 Reference category =1,otherwise 0

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Appendix Table: 4
Prevalence rate (%) of poverty Incidence in 2004-05 for the sampled children

Agro-climatic zones	Poverty Headcount
	2004-05
Rural Areas	**33.0**
Rice/wheat Punjab	24.7
Mixed Punjab	34.1
Cotton/Wheat Punjab	45.9
Low-Intensity Punjab	34.3
Barani Punjab	9.1
Cotton/wheat Sindh	27.5
Rice/other Sindh	28.7
NWFP	37.9
Balochistan	29.9
Urban Areas	**21.1**
MUCs	14.3
OUCs	25.7

Source: computed from PSLM 2004-05.

Appendix Table: 5
Prevalence rate (%) of diarrhoea morbidity rate by geographical Zones and gender

Geographical zones	Male	Female	Total
Rice/wheat Punjab	17.1	13.8	15.4
Mixed Punjab	18.7	16.6	17.6
Cotton/wheat Punjab	24.4	15.8	20.1
Low intensity Punjab	17.7	18.0	17.8
Barani Punjab	10.8	10.5	10.7
Cotton/ wheat Sindh	21.1	18.5	19.8
Rice/other Sindh	18.9	16.5	17.7
NWFP	17.6	17.3	17.5
Balochistan	13.4	9.8	11.0
Overall rural areas	18.3	15.6	16.9
Urban Areas			
MUCs	12.8	13.7	13.2
OUCS	16.1	14.1	15.2
Overall Urban areas	14.8	13.9	14.4
All areas	17.0	15.0	16.0

Source: computed from PSLM 2004-0

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Appendix Table: 6
Prevalence rate (%) of Diarrhoea Morbidity among children under five, By Age Controlling for Gender

Child's Age (years)	Male	Female	Total
<1	22.9	22.5	22.7
1	25.9	22.0	23.6
2	19.0	15.3	17.1
3	12.7	10.9	11.8
4	9.0	7.5	8.3

Source: computed from PSLM 2004-05

Appendix Table: 7
Prevalence Rate (%) of Diarrhoea morbidity by gender and age while controlling for urban zones

Child age	MUCS		OUCS		Urban	
(years)	Male	Female	Male	Female	Male	Female
<1	21.2	21.4	23.9	23.7	22.9	22.6
1	15.2	18.1	24.4	18.6	20.5	18.4
2	16.1	12.9	17.2	14.2	16.8	13.7
3	9.1	9.8	10.4	8.5	9.9	9.0
4	4.7	8.0	8.0	9.4	6.6	8.8
Total	12.8	13.7	16.1	14.1	14.8	13.9

Source: computed from PSLM 2004-05

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Appendix Table: 8
Prevalence Rate (%) of Diarrhoea morbidity by gender and age while controlling for rural zones

Child age	Rice Wheat Punjab		Mixed Punjab		Cotton Wheat Punjab		Low Intensity Punjab		Barani Punjab	
years	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<1	25.0	23.0	28.6	16.9	30.5	22.2	3.4	29.2	12.5	22.2
1	27.6	18.8	19.0	25.4	42.7	29.4	33.3	25.0	16.7	20.8
2	18.5	15.8	21.9	16.9	25.0	14.3	23.9	16.3	17.9	9.1
3	9.1	6.6	9.9	13.2	14.5	11.4	17.5	13.0	3.4	-
4	4.3	6.8	14.1	10.8	14.3	4.4	10.9	5.0	4.3	3.2
Child age	Cotton/ Wheat Sindh		Rice /Other Sindh		NWFP		Balochistan		Total (RURAL)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<1	27.0	26.2	26.0	25.4	20.5	20.4	11.5	22.0	22.9	22.5
1	37.2	28.7	24.3	24.4	25.9	24.0	17.3	15.2	27.8	23.8
2	14.8	19.0	21.4	15.3	21.2	18.7	18.4	13.0	20.3	16.2
3	19.3	16.4	18.9	14.7	13.2	14.8	12.1	5.4	14.2	11.8
4	13.6	6.2	8.6	9.3	9.8	9.5	7.4	2.3	10.2	6.8

Source: computed from PSLM 2004-05

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Appendix Table 9
Prevalence rate (%) of diarrhoea morbidity among children under five, by environmental conditions controlling for rural/urban and ecological zones

Economic Characteristics	Urban Areas			Rural Areas										Total Sample
	MUCs	OUCs	All	Rice/ wheat Punjab	Mixed Punjab	Cotton/ Wheat Punjab	Low-Intensity Punjab	Barani Punjab	Cotton /wheat Sindh	Rice/ other Sindh	NWFP	Balochistan	All	
Water source Piped water within house/Motor pump	12.1	13.8	13.0	15.3	15.5	14.9	21.1	9.5	20.2	11.7	18.7	11.0	16.0	14.3
Others	18.1	18.2	18.2	15.5	19.0	23.2	16.7	11.8	19.7	18.5	16.8	11.7	17.3	17.5
Toilet Facility No	11.7	18.2	16.4	11.8	20.5	23.4	17.8	16.4	12.3	14.5	21.8	12.9	17.5	17.4
Flush to Sewerage	12.6	14.3	13.0	20.0	25.0	24.1	18.2	16.7	28.6	8.0	21.2	13.0	19.6	13.8
Others	14.6	15.0	14.9	17.9	14.7	15.4	17.9	4.5	22.6	19.0	15.8	10.5	16.4	15.9

Source: computed from PSLM 2004-05

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Appendix Table 10
Prevalence rate (%) of diarrhoea morbidity among children under five, by mother's characteristics controlling for rural /urban areas and ecological zones

Mother's Characteristics	**Urban Areas**			**Rural Areas**										Total Sample
	MUCs	OUCs	All	Rice /wheat Punjab	Mixed Punjab	Cotton /Wheat Punjab	Low-Intensity Punjab	Barani Punjab	Cotton/ wheat Sindh	Rice/other Sindh	NWFP	Balochistan	All	
Mother's age														
15-19	16.7	36.8	29.0	16.7	55.6	30.4	30.0	-	33.3	9.1	20.0	3.6	20.9	23.0
20-24	18.0	16.2	16.9	20.0	21.1	24.1	25.9	11.4	28.7	18.6	17.6	15.7	20.1	19.0
25-29	13.1	16.0	14.7	15.9	14.5	19.5	17.7	12.7	19.0	18.9	19.1	10.9	16.8	16.0
30-34	12.1	12.9	12.5	12.3	19.3	21.8	16.2	10.8	17.6	17.7	16.7	7.6	15.9	14.6
35-39	8.6	16.1	13.4	16.2	16.4	20.3	10.6	7.7	18.9	17.1	18.4	13.1	16.9	15.6
40 and above	14.3	13.6	13.8	6.8	15.6	11.9	16.9	-	15.5	15.7	12.6	14.0	13.6	13.7
No Response	14.3	3.0	8.2	50.0	-	4.5	12.5	50.0	15.4	23.8	34.3	5.3	19.7	16.1
Mother's Education														
Illiterate	14.3	15.4	15.0	13.5	19.0	21.7	17.6	7.8	18.7	17.6	17.4	11.7	16.8	16.4
Primary	13.7	18.4	16.3	16.0	13.7	17.0	17.4	17.4	23.5	20.0	15.9	12.1	16.8	16.5
Matric and above	11.6	11.8	11.7	21.3	18.8	11.4	25.0	6.3	42.9	10.0	15.0	9.5	17.7	13.4
No Response	14.3	3.0	8.2	50.0	-	4.5	12.5	50.0	15.4	23.8	34.3	5.3	19.7	16.1

Source: computed from PSLM 2004-05

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Appendix Table 11
Prevalence rate (%) of diarrhoea morbidity among children under five, by economic characteristics controlling for rural /urban areas and ecological zones

Economic Characteristics	Urban Areas			Rural Areas										Total Sample
	MUCs	OUCs	All	Rice /wheat Punjab	Mixed Punjab	Cotton /Wheat Punjab	Low - Intensity Punjab	Barani Punjab	Cotton/ wheat Sindh	Rice/ other Sindh	NWFP	Balochistan	All	
Have You own an Agriculture land Yes	13.3	13.3	13.3	13.6	17.6	18.0	18.1	12.2	17.9	16.1	16.1	13.2	16.1	15.7
No	13.2	15.5	14.5	16.6	17.6	21.6	17.4	9.6	21.2	18.8	19.5	10.2	17.7	16.2
Have You own an Animal Yes				12.5	18.5	19.1	16.6	13.7	18.2	18.3	16.6	12.6	16.7	16.7
No	-	-	-	18.1	16.3	21.1	21.9	8.3	22.6	16.8	18.5	11.0	17.1	15.6

Source: computed from PSLM 2004-05

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Appendix Table 12
Logistic regression effects of predictors on diarrhoea morbidity among children under five, 2004-05 PSLM (Odd Ratios)

Characteristics	Model 1 (Full)	Model 2 Rice/ Wheat Punjab	Model 3 Mixed Punjab	Model 4 Cotton/wheat Punjab
Child Characteristics				
Child's Gender				
Female	1.00	1.00	1.00	1.00
Male	1.181*	1.341	1.043	1.825*
Child's Age				
<1	1.00	1.00	1.00	1.00
1	0.965	1.698**	1.193	1.192
2	0.658*	1.109	0.958	0.547**
3	0.399*	0.432**	0.532**	0.286*
4	0.294*	0.302*	0.660	0.268*
Total No of Children born				
1-2	1.00	1.00	1.00	1.00
3-4	0.926	1.045	0.766	0.993
5-6	0.986	1.171	0.830	0.979
7 and more	1.184**	1.209	1.182	1.305
Mother's Characteristics				
Mother's age	0.992**	0.968**	0.960*	0.979**
Mother's education				
Illiterate	1.00	1.00	1.00	1.00
Primary	0.994	0.901	0.639**	0.832
Matric and above	0.850**	1.695**	0.887	0.583
Mother's working status				
No	1.00	1.00	1.00	1.00
Yes	1.038	0.881	1.040	1.249
Immunization				
Measles Immunization				
No	1.00	1.00	1.00	1.00
Yes	0.979	0.348*	0.742	1.013
Environmental Characteristics				
Type of Toilet Facility				
No toilet in house	1.00	1.00	1.00	1.00
Flush system(B)	1.035	2.437	3.308*	1.214
Others	0.972	1.772**	0.969	0.771
Source of Drinking water				
Others	1.00	1.00	1.00	1.00
Piped water within the House / Motorized Pump	0.807*	0.682	1.113	1.228

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Characteristics	Model1	Model 2	Model 3	Model 4
	Full	**Rice/ Wheat Punjab**	**Mixed Punjab**	**Cotton/wheat Punjab**
Economic Characteristics				
Own Agriculture Land				
No	1.00	1.00	1.00	1.00
Yes	0.907**	0.838	1.089	1.017
Own Animals				
No	1.00	1.00	1.00	1.00
yes	0.981	0.691**	1.221	1.037
Material used in roof of House Others	1.00	1.00	1.00	1.00
RCC/RBC	0.831*	0.640**	0.598**	1.090
Material Used in walls				
Others	1.00	1.00	1.00	1.00
Brick	0.987	1.592	0.719	0.822
Source of Light				
Others	1.00	1.00	1.00	1.00
Electricity	1.101	1.600	0.569**	1.228
Geographical zones				
Ecological Zones (Rural)				
Rice wheat Punjab	1.00	-	-	-
Mixed Punjab	1.168	-	-	-
Cotton Wheat Punjab	1.492*	-	-	-
Low Intensity Punjab	1.210	-	-	-
Barani Punjab	0.676**	-	-	-
Cotton Wheat Sindh	1.794*	-	-	-
Rice Other Sindh	1.139	-	-	-
NWFP	1.145	-	-	-
Balochistan	0.949	-	-	-
Ecological zones (urban)				
MUCS	0.961	-	-	-
OUCS	1.102	-	-	-
N	10096	616	570	850

SOURCE: Computed from the 2004-05 PSLM
(A)Primary category include primary and middle (till 8th class)
(B)The flush system includes Flush system connected to Public Sewerage.
* Shows significance at 5 percent or lower level of confidence.
** Shows significance at 10 percent or lower level of confidence.

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Appendix Table 13.
Logistic regression effects of predictors on diarrhoea morbidity among children under five, by rural ecological zones, 2004-05 PSLM (Odd Ratios)

Characteristics	Model 5	Model 6	Model 7	Model 8
	Low/intensity Punjab	Barani Punjab	Cotton /wheat Sindh	Rice/ Other Sindh
Child Characteristics				
Child's Gender				
Female	1.00	1.00	1.00	1.00
Male	1.027	1.203	1.329**	1.233
Child's Age				
<1	1.00	1.00	1.00	1.00
1	1.740	0.317	1.626	0.914
2	0.777	0.298	0.744	0.508**
3	0.527	0.054*	0.565**	0.372*
4	0.311*	0.101*	0.305*	2.52*
Total No of Children born				
1-2	1.00	1.00	1.00	1.00
3-4	0.598	1.181	0.629**	0.846
5-6	1.027	0.408	0.828	0.831
7 and more	2.975**	1.386	1.386	1.008
Mother's Characteristics				
Mother's age	0.946*	1.020	0.999	1.012
Mother's Education				
Illiterate	1.00	1.00	1.00	1.00
Primary	1.566	2.609**	0.955	1.089
Matric and above	2.491**	1.449	2.691*	0.593
Mother's working Status				
No	1.00	1.00	1.00	1.00
Yes	1.438	0.848	0.763	0.663
Immunization				
Measles Immunization				
No	1.00	1.00	1.00	1.00
Yes	0.637	0.852	1.786**	1.231
Environmental Characteristics				
Type of Toilet Facility				
No toilet in house	1.00	1.00	1.00	1.00
Flush system(B)	1.610	1.860	1.423	0.383
Others	0.886	0.094*	3.082*	1.749**
Source of Drinking water				
Others	1.00	1.00	1.00	1.00
Piped water within the House / Motorized Pump	2.376*	0.422	0.602**	0.692

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Characteristics	Model 5	Model 6	Model 7	Model 8
	Low/intensity Punjab	Barani Punjab	Cotton /wheat Sindh	Rice/ Other Sindh
Economic Characteristics				
Own Agriculture Land				
No	1.00	1.00	1.00	1.00
Yes	0.757	1.723	0.821	0.923
Own Animals				
No	1.00	1.00	1.00	1.00
yes	0.731	4.043**	0.789	0.874
Material used in roof of House				
Others	1.00	1.00	1.00	1.00
RCC/RBC	0.368*	1.583	0.975	0.341*
Material Used in walls				
Others	1.00	1.00	1.00	1.00
Brick	0.401*	2.679	0.960	1.952*
Source of Light				
Others	1.00	1.00	1.00	1.00
Electricity	2.125**	0.594	1.131	1.969*
N	340	201	587	686

SOURCE: Computed from the 2004-05 PSLM
(A)Primary category include primary and middle (till 8th class)
(B)The flush system includes Flush system connected to Public Sewerage.
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Appendix Table 14
Logistic regression effects of predictors on diarrhoea morbidity among children under five, by ecological zones, 2004-05 PSLM (Odd Ratios)

Characteristics	Model 9	Model 10	Model 11	Model 12
	NWFP	Balochistan	MUCs	OUCs
Child Characteristics				
Child's Gender				
Female	1.00	1.00	1.00	1.00
Male	1.020	1.496**	0.928	1.180**
Child's Age				
<1	1.00	1.00	1.00	1.00
1	1.375**	0.566	0.539*	0.740**
2	1.040	0.669	0.430*	0.517*
3	0.710**	0.255*	0.320*	0.274*
4	0.430*	0.169*	0.160*	0.268*
Total No of Children born				
1-2	1.00	1.00	1.00	1.00
3-4	1.183	0.621**	1.013	1.007
5-6	1.145	1.502	0.988	0.885
7 and more	1.516**	1.568	1.003	0.857
Mother's Characteristics				
Mother's age	0.989	1.003	0.955	1.003
Mother's Education				
Illiterate	1.00	1.00	1.00	1.00
Primary	0.978	2.153	0.811	1.128
Matric and above	0.860	0.851	0.740**	0.666*
Mother's working Status				
No	1.00	1.00	1.00	1.00
Yes	0.748	1.201	0.842	1.055
Immunization				
Measles Immunization				
No	1.00	1.00	1.00	1.00
Yes	0.784	0.607	1.800*	1.049
Environmental Characteristics				
Type of Toilet Facility				
No toilet in house	1.00	1.00	1.00	1.00
Flush system(B)	0.849	0.234**	1.386	1.149
Others	0.544*	0.745	1.401	1.049
Source of Drinking water				
Others	1.00	1.00	1.00	1.00
Piped water within the House / Motorized Pump	1.208**	1.044	0.590*	0.708*

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Characteristics	Model 9	Model 10	Model 11	Model 12
	NWFP	Balochistan	MUCs	OUCs
Economic Characteristics				
Own Agriculture Land				
No	1.00	1.00	1.00	1.00
Yes	0.696*	1.017	1.124	0.827
Own Animals				
No	1.00	1.00	1.00	1.00
yes	0.907	1.276	1.374	1.171
Material used in roof of House				
Others	1.00	1.00	1.00	1.00
RCC/RBC	0.893	0.572	0.863	0.866
Material Used in walls				
Others	1.00	1.00	1.00	1.00
Brick	1.071	0.328**	0.826	0.968
Source of Light				
Others	1.00	1.00	1.00	1.00
Electricity	1.071	0.990	0.336*	0.799
N	1616	636	1637	2357

SOURCE: Computed from the 2004-05 PSLM
(A)Primary category include primary and middle (till 8th class)
(B)The flush system includes Flush system connected to Public Sewerage.
* Shows significance at 5 percent or lower level of confidence.
** Shows significance at 10 percent or lower level of confidence.