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ORIGINAL ARTICLE

Prevalence and Determinants of Diarrhea among Children of Punjab, Pakistan

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ABSTRACT

Objective: The study investigates the effect of social, demographic, economic behavioral factor on the prevalence of diarrhea in the particular setting of Punjab.

Study Design: Cross-sectional survey.

Place and Duration of Study: Analysis of the Secondary data has been done at Statistics Department, Lahore College for Women University, Lahore. Duration of the research work was 3 months.

Material and Methods: Data from recent wave of Punjab Multiple Indicator Cluster Survey (2017-18) have been used for this study. Logistic regression model is used for identifying the risk factors responsible for diarrhea in Punjab. Descriptive measures are in the form of percentages, for bivariate analysis Pearson Chi-square and for multivariate analysis Binary Logistic regression model is used, to find the prevalence and the risk factors responsible for diarrhea in Punjab.

Results: 21% children of age 6-11 months have diarrhea (OR=1.336). 28.55% children have ARI (OR=2.305). The lowest (13.07%) number of children have diarrhea which belong to richest households (OR=0.735).

Conclusion: Two behavioral factors i.e. type of toilet facility and presence of soap at hand washing place is observed strong. Interventional programs to reduce diarrheal occurrence should be launched in other divisions with special focus on DG Khan.

Key Words: *Childhood diarrhea, Multiple indicator cluster survey, RVI, Punjab*

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INTRODUCTION

Diarrhea is the deadliest and most dreadful disease in under five children after pneumonia. It is the second most leading cause of child mortality and 1 in 9 children deaths occurred worldwide due to diarrhea.¹ According to World Health Organization, every year almost 525,000 children die due to diarrhea and 1.7 billion cases are reported globally.² In South Asia, most of the deaths among children under age 2 are caused by diarrheal illness.³

There is a significant decrease in diarrheal mortality but not in morbidity in poor countries. Dehydration with diarrhea affects mental and physical development of children. Three diarrheal incidence in a year are common among children below age three in developing countries.⁴ It slows down the physical and mental growth of child due to nutritional deficiency.⁵ Ill feeding and dehydration during diarrhea increases the risk of morbidity and mortality.

The Global Enteric Multicenter Study (GEMS) discovered that four pathogens (rotavirus, ETEC, shigella and cryptosporidium) are responsible for 70% of moderate-to-severe diarrhea in children of less than five years. Rotavirus is responsible for 40% of under five childhood hospitalization.⁵

Environment, nutrition and parental attitudes are undoubtedly important determinants of child's health. Many social, economic, demographic and biological factors may govern these determinants directly or indirectly. Popular framework comprise of biological as well as social factors to assess mortality and morbidity.⁶

Environmental factors specifically drinking water, type of toilet facility and main material of floor contribute to occurrence of diarrhea. Improved environmental condition of household regulate pathogens causing diarrhea particularly in children.⁷ Diarrhea is classified as a water born disease. Contaminated drinking water is one of the major cause of diarrhea. Poor quality of water is responsible for more than 20% of diarrheal incidence in community.⁸ Children living in urban setting enjoy access to resources and quality health care system. On the contrary if urbanization is unplanned, it may have negative impact on health.

Behavioral factors associated with health care and hygiene of household residents are eventually linked with diarrheal incidence like hand washing manner, child stool disposal system, vaccination and immunization. Biological factors like breastfeeding status, age of child and gender of child have vital role on the health of the child. Exposure to diarrhea varies with age of children. Occurrence of diarrhea is more prevalent in children over 6 months as compared to younger infants (less than 6 months).⁷ Exclusive breastfeeding strengthens immune system of child to fight against diseases.

Maternal education is the key contributory factor to reduce burden of disease as well as mortality by promoting healthy hygienic and life style.⁷ Educated mothers have good health care seeking behavior and her feeding or weaning practices are based on balanced diet. Education create awareness related to symptoms of disease and interpretation of its severity and the family takes timely action. Household characteristics are also

linked with health of the child. Sibling under 5 compete for health care resources and maternal attention. Deprivation of necessary facilities of life and malnutrition increases risk of both morbidity and mortality.

According to Pakistan Demographic Health Survey (PDHS),⁹ prevalence of diarrhea among under five children is 19%, which is decreased from previous reported diarrheal prevalence in PDHS 2012-13. This decrease may be attributable to 10% increase in the utilization of health care services in the form of proper advice from service providers. Prevalence of diarrhea in Pakistan is found highest (31%) among 6-11 months children and its prevalence gradually declines with increase in age.⁹

Prevention against diarrhea is necessary to attain the third sustainable goals (target 3.2) that is associated with reduction in under five mortality to 25 deaths per thousand live birth till 2030.¹⁰ Diarrhea can be prevented and cured if proper hygienic system is practiced in routine life. This necessitates to investigate effect of social, demographic, economic, behavioral factors along with biological factors on the prevalence of diarrhea in the particular setting of Punjab.

MATERIAL AND METHODS

To explore the prevalence and determinants of childhood diarrhea, recent most Multiple Indicator Survey (MICS, 2017-18) has been used to meet the objective. In this survey, the target population is urban and rural areas of Punjab as per definition of population census 2017. This survey was conducted by Punjab Bureau of Statistics with the support of UNICEF from December 2017 to March 2018.

Sample comprised of 42408 children of under age 5 (from birth to 5 years). After excluding non-respondents the sample reduced to 39,799 children. Information for breastfeeding status, vaccination and the disposal method of child stools (improved & not improved) is available only for those children who were born three or four years prior to survey. Sample size left after imposing the restriction that only those children were selected for analysis who were born three years prior to survey was 23,739. The analysis was carried out on STATA version 15.0.

Dependent variable for current study was whether a child had diarrhea in last two weeks before survey. Response obtained was binary i.e. yes or no. Following the definition from the MICS report 2017-18, various categories of variables like type of toilet facility and main source of drinking water are merged into two categories: improved and unimproved where improved category involves motorized pump, protected well, bottled water etc., while unprotected wells, surface water, unprotected spring comes under the category of unimproved drinking water by MICS data. Main material of floor was also dichotomized as natural and finished. Pearson Chi-square was used for bivariate analysis and for multivariate analysis Binary Logistic regression model was used.

RESULTS

Prevalence of diarrhea across various factors is explored through percentages computed in the form of cross tabulation (table 1). Diarrhea is highly prevalent among children of 6-11 months (21.78%). Overall trend of prevalence of diarrhea across different categories of age show inverted U shape pattern. It is observed that frequency of diarrheal incidence is lower for children residing in household who used improved child stool disposal method, household with more than 2 number of children, household in urban setting and household with finished floor as compared to their counterparts. Percentage of diarrheal episodes is alarmingly high for children who suffered from ARI (28.6%), residents of household with not improved (20.7%) or shared toilet facility (20.1%) and who did not bother about presence of soap at hand washing place (22.6%). It is evident from table 1 that prevalence of diarrhea decreases with an improvement in maternal education and economic status of household. Children living in DG Khan (30.5%) and Multan (19.5%) divisions are more prone to diarrheal disease as compared to other districts. Prevalence is less for Gujranwala (10.9%), Sahiwal (12.9%) and Lahore (13.4%). Minor or ignorable difference in the prevalence of diarrhea is found for different categories of vaccination status, gender of child, source and treatment of drinking water. Almost no difference is observed in the prevalence of diarrhea for breastfeeding status. Chi square shows that all factors are significantly associated with

occurrence of diarrhea except breastfeeding, vaccination, gender of child, source of drinking water, treatment of drinking water and sex of household head.

Binary logistic regression models were applied in the current study (table 2). In full model, all variables are accounted irrespective of their significance. While final model comprised of only those factors that are found significant in the bivariate analysis. The full model shows that child's age, ARI, wealth index quintile, mother's education level, divisions, soap present at place of hand washing and sex of household head are significantly associated with childhood diarrhea. The final model shows that risk of diarrhea is significantly higher for children of age 6-11 months [OR=1.336, 95% CI (1.17, 1.51)] as compared to reference category (0-5 months). On contrary, after 23 months of age risk is significantly lower [OR=0.696, CI (0.617, 0.785)] as compared to reference category. Children suffering from ARI are significantly more prone [OR=2.305, CI (2.126, 2.500)] to diarrheal incidence as compared to those who have not suffered from ARI. The households with at least two children of underage five have lesser risk of diarrhea [OR=0.897, CI (0.824, 0.976)] as compared to reference category (< two children). Children who lived in rural areas have significantly lower risk [OR=0.863, CI (0.782, 0.954)] to diarrheal disease as compared to children of urban areas. As the level of wealth index quintile increases the chances of diarrhea decreases respectively [OR=0.828, 0.822, 0.735 CI (0.702, 0.978), (0.679, 0.994), (0.593, 0.911)].

The children of D.G Khan, Multan, Rawalpindi and Sargodha [OR=2.142, 1.382, 1.197, 1.398, CI (1.813, 2.530), (1.181, 1.617), (1.017, 1.408), (1.180, 1.656)] are respectively on higher risk of diarrhea as compared to children of Lahore. The households with unimproved toilet facility have higher risk [OR=1.210, CI (1.052, 1.391)] of diarrhea as compared to children of households with improved toilet facility. Households which used soap for hand washing their children have lesser risk [OR=0.817, CI (0.729, 0.916)] of diarrhea as compared to those who did not use soap at hand washing place.

TABLE 1: Bivariate analysis of prevalence of diarrhea versus factors

Factors	Child had diarrhea		Chi square	Factors	Child had diarrhea		Chi Square
	No	Yes			No	Yes	
Breastfeeding				Child disposal Stool			
No	83.4	16.6	0.0986	Not Improved	81.5	18.5	21.9774*
Yes	83.1	16.9	(0.7689)	Improved	83.9	16.1	(0.000)
Vaccination				ARI			
No	83.6	16.4	2.6228	No	87.3	12.7	832.6392*
Yes	85.2	14.8	(0.1253)	Yes	71.5	28.6	(0.000)
Child's Age				Child's Sex			
0-5	83.8	16.2		Male	82.7	17.3	2.9391
6-11	78.2	21.8	186.7348*	Female	83.5	16.5	(0.10)
12-23	80.7	19.3	(0.000)	Area			
24-35	87.2	12.8		Urban	84.4	15.6	16.2151*
Divisions				Rural	82.4	17.6	(0.001)
Lahore	86.6	13.4		Wealth Index Quintile			
DG Khan	69.5	30.5	506.5240*	Poorest	77.3	22.7	
Faisalabad	82.6	17.4	(0.000)	Poorer	82.2	17.8	193.5027*
Gujranwala	89.1	10.9		Middle	84.3	15.7	(0.000)
Bahawalpur	85.3	14.8		Richer	85.3	14.7	
Multan	80.5	19.5		Richest	86.9	13.1	
Rawalpindi	82.8	17.2		Source of drinking water			
Sahiwal	87.1	12.9		Improved	83.0	17.0	2.4978
Sargodha	81.9	18.1		Not Improved	86.3	13.7	(0.0962)
Number of children under age five				Treat water for drinking			
Less than 2	81.8	18.2	10.9065*	No	83.0	17.0	0.8960
2 or more than	83.6	16.4	(0.002)	Yes	84.1	15.9	(0.4112)
Mother's Education				Type of toilet facility			
No Education	81.1	18.9		Improved	84.1	15.9	65.8134*
Primary	82.4	17.6		Not improved	79.3	20.7	(0.000)
Middle	83.1	17.0	78.2481*				
Secondary	85.9	14.1	(0.000)	Sex of household head			
Higher	86.6	13.4		Male	83.0	17.0	3.9274
Toilet facility shared				Female	84.1	16.0	(0.2523)
No	84.5	15.5		Main material of floor			
Yes	79.9	20.1	39.4329*	Natural floor	80.1	20.0	125.2971*
Soap present at place of hand washing				Finished floor	85.5	14.5	(0.000)
No	77.4	22.6	110.4823*				
Yes	84.2	15.8	(0.000)				

*Significant at 5%

TABLE 2: Logistic regression model for childhood diarrhea

Parameter	Full Model	Final Model	Parameter	Full Model	Final Model
	Exp (B) (95% CI)	Exp (B) (95% CI)		Exp (B) (95% CI)	Exp (B) (95% CI)
Breastfeeding			Wealth Index Quintile		
No	1	-	Poorest	1	1
Yes	0.77 (0.572, 1.047)	-	Poorer	0.927 (0.686, 1.251)	0.908 (0.789, 1.044)
Vaccination			Middle	0.685* (0.478, 0.980)	0.828 (0.702, 0.978)
No	1	-	Richer	0.621* (0.410, 0.940)	0.822 (0.679, 0.994)
Yes	1.150 (0.939, 1.408)	-	Richest	0.637 (0.401, 1.012)	0.735 (0.593, 0.911)
Child's Age			Mother's Education Level		
0-5	1	1	None/Pre School	1	-
6-11	1.565* (1.121, 2.184)	1.336 (1.174, 1.519)	Primary	0.966 (0.757, 1.233)	-
12-23	1.133 (0.863, 1.489)	1.154 (1.032, 1.289)	Middle	1.074 (0.795, 1.451)	-
24-35	0.685* (0.522, 0.900)	0.696 (0.617, 0.785)	Secondary	0.921 (0.677, 1.252)	-
Child Disposal Stools			Higher	0.652* (0.464, 0.917)	-
Improved	1	-	Source of Drinking Water		
Not Improved	0.909 (0.741, 1.115)	-	Improved	1	-
Child's Sex			Not Improved	0.664 (0.255, 1.727)	-
Male	1	-	Area		
Female	1.014 (0.853, 1.206)	-	Urban	1	1
ARI			Rural	0.799 (0.638, 1.001)	0.863 (0.782, 0.954)
No	1	1	Treat Water for Drinking		
Yes	2.384* (1.982, 2.868)	2.305 (2.126, 2.500)	Yes	1	-
Number of children under age five			No	0.920 (0.608, 1.393)	-
Less than 2	1	1	Type of toilet facility		
Greater than or equal to 2	0.881 (0.729, 1.064)	0.897 (0.824, 0.976)	Improved	1	1
Divisions			Not Improved	1.285 (0.949, 1.739)	1.210 (1.052, 1.391)
Lahore	1	1	Toilet facility shared		
DG Khan	1.928* (1.373, 2.707)	2.142 (1.813, 2.530)	Yes	1	-
Faisalabad	1.343 (0.963, 1.873)	1.173 (0.999, 1.377)	No	0.918 (0.718, 1.172)	-

Gujranwala	0.686*	0.884	Type of Floor	
	(0.480, 0.982)	(0.756, 1.034)	Natural Floor	1 -
Bahawalpur	1.126	1.019	Finished Floor	1.148 -
	(0.770, 1.646)	(0.844, 1.230)		(0.885, 1.490)
Multan	1.243	1.382	Soap present at place of handwashing	
	(0.891, 1.734)	(1.181, 1.617)	No	1 1
Rawalpindi	1.494*	1.197	Yes	0.761* 0.817
	(1.071, 2.085)	(1.017, 1.408)		(0.597, 0.970) (0.729, 0.916)
Sahiwal	0.633	0.873	Sex of Household Head	
	(0.366, 1.094)	(0.710, 1.071)	Male	1 -
Sargodha	1.275	1.398		
	(0.840, 1.935)	(1.180, 1.656)		

Significant at 5%

DISCUSSION

Age of child is important factor associated with childhood diarrhea. Risk of diarrhea is observed highest for post neo-natal period.¹¹ The children of age groups 6-11 months and 12-23 months have 1.33 fold and 1.15 fold higher risk of diarrhea as compared to children of less than six months whereas children of 24-35 months have 30% lesser risk of diarrhea. These results are universal and consistent with other studies.¹²⁻¹⁴ The child becomes malnourished and stunted then chances of diarrheal infection also increases. The children who suffered from ARI have 2.3 times more chances of diarrhea than the children who had not suffered from ARI. More children of age less than five years, present in household have lesser chances of diarrhea. Reason of this result may be the more experience to deal with diarrhea.¹⁵ The children of households with more than two children have 10% lesser risk of diarrhea as compared to their counterparts. Same findings are reported in other studies.^{16,17} More number of children under age five is also an indicator of short birth interval and ineffective family planning programs in the area.¹⁰

The lesser chances of diarrhea are found for children residing in rural areas than those who are residing in urban areas.^{18,19} Occurrence of diarrheal incidence are common in urban areas particularly in urban slums⁷. The children of rural areas have 13.7% lower risk of diarrhea as compared to children of urban areas. As it is mentioned in MICS Report (2017-18) that more

E.coli was found in urban water source.²⁰ Regional disparities in the prevalence of diarrhea in children are due to educational level, awareness level and access to health care facilities in that division or district. Risk of diarrheal prevalence is highest for children who lived in DG Khan as compared to Lahore. Lower risk of diarrhea among children of Gujranwala and Sahiwal is observed as compared to Lahore. The children of D.G Khan has 2.1 times, Multan has 1.38 times, Rawalpindi has 1.19 times and Sargodha has 1.39 times more risk of diarrhea as compared to children of Lahore. The water source of D.G Khan has more percentage of E. coli than of Lahore. The financial condition of any household is determined by its wealth index quintile. The children of middle, richer and richest households have 17%, 18% and 27% less risk of diarrhea as compared to children of poorest households. Findings are consistent with existing study.¹³ Hand washing attitude with soap is an effective preventive measure. When hands are washed with soap many bacterial agents are washed out and it decreases the risk of diarrheal incident. The children of households where soap is present at the place of hand washing were 18% less likely to have diarrhea as compared to children of households where soap was not present. Same is reported in other researches.^{21,22} Unimproved toilet facility is the one of the major reason that cause diseases in children. The structure of improved toilet lavatories prevents the spread of diarrheal disease pathogens due to insects and human interactions.⁷ Poor facility is a

source of unhygienic environment so the children of households with unimproved toilet facility have 1.2 times more risk of diarrhea as compared to children of households with improved toilet facility. Positive relationship of unimproved toilet facility with diarrheal incident is also found in literature.²³

CONCLUSION

Current study endorsed universal findings that occurrence of diarrhea is associated with age and risk is highest in the 6-11 months. Burden of diarrheal disease is higher for children who suffered from ARI. Poor and urban children are more exposed to diarrheal illness. Effect of urbanization is suspected and there is need to further probe in. Contribution of two behavioral factors i.e. type of toilet facility and presence of soap at hand washing place is observed strong. Household deprived of improved toilet facilities and who had not used soap for hand washing are at excess risk of disease. All eight divisions of Punjab are at higher risk of diarrheal incidence as compared to Lahore. Children of DG Khan have faced double risk of diarrheal disease as compared to children residing in Lahore.

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