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Changes in Incidence of Morbidities of Children and its Determinants in Northeast India

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Abstract: Morbidities during childhood are deterrent to the growth of children and an appraisal of factors influencing childhood morbidities is important to keep those under control. Keeping this in view, this study tracks the changes in morbidities among children and its determinant in the context of northeast India during 2004-2012. It is found that the overall incidence of fever remains more or less unchanged but that of cough and diarrhoea among children in northeast India have declined considerably during 2004-05 to 2011-12. Further, girls are found to be 58 percent less likely to have suffered from diarrhea than the boys; age also has a significant effect on the risk of children suffering from fever and cough, higher older children. Having toilet and having access to improved sources of drinking water are found to lower the risk of childhood morbidities.

Keywords: Childhood morbidities, Incidence, Toilet and drinking water, North east India.

Introduction

The trajectory of good health of individuals is the childhood less burden with common morbidities of cough, fever and diarrhea. It is therefore of paramount importance to reduce the burden of common childhood morbidities by moulding the determinants of childhood morbidities. In northeast (NE) India and also elsewhere there exist social stratification of community by social groups predominantly based on castes, such as, scheduled castes (SC), scheduled tribes (ST), other backward classes (OBC) and general castes (GC) and families from same castes live together in villages and urban settlements. These social groups have different child feeding and bringing up practices, as such, social groups can be treated as different communities of NE India. Place of residence of parents is yet another contextual background which determines the health of infant and children for the simple reason that better healthcare facilities for child immunization and treatment of childhood morbidities are available in urban areas. Most importantly, basic amenities including toilet in the household and access to improved sources drinking water plays catalytic roles in lowering the risk of childhood morbidities. It is also well documented that economic status relates to the capacity to invest in the health of children and also provide education to children. India is a traditional society known of discrimination by gender in all walks of life both in and outside the household. This extends to discrimination in feeding and healthcare utilization by sex of the child with a male child getting parental preferential care. The extended family system of couples living together with elderly parents and other blood relatives is conducive to the health of a child as not only the parents but also other members of extended family extend support in providing care to children. From this perspective, it is imperative to assess the significance of child

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living in a joint family as far as the health of a child is concerned. The number of children of couples also merits consideration in a comprehensive assessment of factors which support the health of children. The reason being that an individual child's share tends to reduce when limited resource of the household is to be shared for bringing up many children. Age is one important biological correlates of child's health as the metabolism and immune system is deterrent to morbidities related to age.

The focus of this study is to analyze changes in childhood morbidities, namely, fever, cough and diarrhea among children in northeast India from 2004-05 to 2011-12 and provide an assessment of factors responsible for bringing favorable change for reducing burden of childhood morbidities. The health outcomes of children considered in this study are childhood morbidities, namely, diarrhea, cough and fever among children under five years (60 months).

A number of studies in the past and also many recent research has provided an assessment of levels and risk factors of childhood morbidities. Globally and particularly in developing countries diarrhea and pneumonia are the leading infectious causes of childhood morbidity and mortality. In 2011 an estimated 700000 and 1.3 million deaths of children under five years in the world is attributed to diarrhea and pneumonia (Walker et al., 2013). Though between 2000 and 2010 there were large reductions in child mortality globally, diarrhea and pneumonia remain major causes of avoidable childhood deaths and account for about 30% of all child deaths worldwide (Liu et al., 2012; United Nations, 2012). In 2013; India, Nigeria, Pakistan, Democratic Republic of Congo and China 3.094 million children under five years die and it constitutes 49.3 percent of worldwide deaths (Liu at al. 2015). In India as a result of successful expansion universal immunization under five mortality has reduced from 2.5 million in 2001 to 1.5 million in 2012 (Bhan, 2013). An estimated 3 lakhs children under five years die every year from diarrhea and is responsible for 13 percent of all deaths in this age (Million Death Study, 2010). Laskminarayana and Jayalakshmy (2015) opined the need for addressing social determinants of health for reducing further the burden of diarrheal disease. From the analysis of DHS (Demographic Health Survey), Prasad et al. (2015) found that the extent of fever reported is at par as for the cough and much more than diarrhea among children under five years in the low-resource countries. Going by the present trend India is predicted to have 700 million episodes of acute respiratory infection (ARI) and 52 million episodes of pneumonia every year (Selvaraj et al., 2014). As per National Family Health Survey (NFHS) rounds the prevalence of ARI among children declines 5.8 to 2.7 percent during NFHS III (2005-06) to NFHS IV (2015-16).

Cough among children is usually associated with ARI as it is defined as cough or difficult breathing with an elevated respiratory rate above the age-specific according to WHO criteria. India being a big country with different agro-climatic regions there exists considerable regional and inter-state variation. In localized studies in Meerut in north India prevalence of ARI among children under five years was found to be 67.1 percent (Goel et al., 2012), 26.8 percent in Lucknow (Arun et al., 2014), 27.7 percent in Moradabad (Choube et al., 2014), 62.2 percent in rural Kancheepuram (Sharma et al., 2013) and 53.7 percent in rural Puducherry (Kumar et al, 2015). The latest NFHS-4 (2015-16) report shows that prevalence of ARI is the highest in Meghalaya (5.8 percent) and the lowest is in Sikkim (0.3 percent), and is above the national average of 2.7 percent in Haryana, Jammu and Kashmir, Punjab, Uttrakhand, Uttar Pradesh, Jharkhand, West Bengal, Puducherry, Tamil Nadu and Chandigarh.

From systematic a review of 77 studies from 39 countries, Sonego et al. (2015) have found poverty, lack of female education, and poor environmental conditions as the important risk factors of acute lower respiratory infections among children in low and middle income countries. Poor feeding practices, not washing hand and poor sanitation are found to be associated significantly with the incidence of childhood pneumonia from a community based cross-sectional study by Gothankar et al. (2018). Incidence of ARI among children is also found to be higher during winter (October-January) and children in households with pets and households using firewood for cooking are more likely to be infected from ARI is reported by Ramani et al., (2016) from a cohort study in South India. Assessment of prevalence of diarrhea ARI among children in urban slums of India (Singh and Singh, 2014) reveals that children with normal birth and from households are less likely to suffer from diarrhea and ARI and prevalence of the two childhood morbidities is lower in the slums in South India than in other parts of the country. In yet another cross-sectional study from Tiruvallur district in Tamil Nadu, the significant risk factors of diarrhea are found to be lower socioeconomic status, overcrowded houses and unsatisfactory personal hygiene of the care giver (Samya and Stanly, 2015). Sebastian (2018) found a significant association between ARI and under-nutrition, low birth weight, poor breast feeding practices, poor parental education, exposure to passive smoking and inadequate indoor ventilation in the case of children in Kerala. Access to improved sanitation was associated with lower mortality, a lower risk of childhood diarrhea and a lower risk of mild or severe stunting Fink et al. (2011). The aforesaid available studies are relevant for other context and the findings may or may not be pertinent in the context of northeast India. Studies mentioned in the foregoing review of literature indicate the vulnerability of children to morbidities invariant of countries, state, place and time except for the variation. Social-economic, demographic and parental factors which have a significant bearing on childhood morbidity are also found common in some context, but different in some of the studies. It is also noted most studies are based on a cross-sectional survey at a point of time though have made assessment of changes in the levels of childhood morbidities.

It is also further noted that national level studies are ample and regional studies are scanty more so of studies from the northeast (NE) India. From the few studies of this region cited in the aforesaid review, it is not feasible to assess and ascertain whether associated risk factors of child morbidity in NE India is in agreement with that of the findings from studies in other regions of the country. Secondly, the few studies from the region are mostly snapshot studies and cannot evaluate whether the associated factors of child morbidity have changed over time or not. Lastly, most studies from the region are localized based on small surveys and have limited scope for regional level planning for intervention programmes and implementation.

The present study is an attempt to fill the research gap and enrich the literature on NE India by assessing changing levels and determinants of childhood morbidity over time for children in NE India. The study also integrates economic and social change as an important correlate of child morbidity in the context of northeast India. The study is expected to provide key evidence based inputs for strengthening programmes for the prevention of child morbidity and malnutrition.

Data Source and Methodology

Data

The unit level data from two rounds of India Human Development Survey - I (2004-05) and India Human Development Survey - II (2011-12) were used for this study. The University of Maryland and the National Council of Applied Economic Research (NCAER, India) carried out both rounds of the surveys and the data collected are representative at the state, union territory and national levels. Similar survey designs and instruments were used in the two rounds of IHDS, and as such they were comparable in most cases. The assessment of the prevalence of morbidities is based on 536 children for 2004-05 and 564 children for 2011-12 respectively. The information collected included basic amenities, assets, income with source, and demographic particulars of members at household level and age, sex, educational and marital status and relationship with the head of household at the individual level.

There are three distinct advantages of using the IHDS data. First, it contains additional questions which are not asked in the NSS or NFHS. Second, the IHDS generate data on the actual years of schooling in place of the levels of schooling completed which is generally reported in NSS data. Third, it provides the facility to follow the educational progress of children. In panel data set follows a sample of individuals in successive surveys over a period of time and collects qualitative and quantitative data, with each sampled individual appearing on more than one occasion. Panel data are ideal for an assessment of changes associated with the individuals over time. Panel surveys are rare in India and IHDS is one of the well design longitudinal surveys in India conducted at the national level. The demerits of panel data concern the dropouts and selectivity in dropouts which can introduce a bias in the estimates of change. The other limitation in the context of the present study is the sample size from the northeastern states of India.

Methods

Childhood morbidities, namely, diarrhea, fever and cough are assess in terms of prevalence rate defined as the number children reported having the morbidity in the period of one month prior to the survey per 100 children under five years. Descriptive statistics, bivariate analysis and chi-square test are used to test the significance of the association between childhood morbidities and background characteristics. Multinomial regression is used to assess the adjusted odds of suffering from diarrhea, fever and cough during childhood. Multinomial regression is applied to assess the adjusted effect of child, parental and household factors on the likelihood of suffering from fever, cough and diarrhea.

The equations of adjusted relative risk ratios for multinomial logistic regression are as follows:

$$\mathbf{Log}\,(\boldsymbol{P_1/P_0}) = \boldsymbol{\alpha_1} + \sum_j \boldsymbol{\beta_{1_j}} \boldsymbol{X_j j} = \mathbf{1, 2}, \ldots\ldots\ldots \quad \mathbf{(1)}$$

$$\mathbf{Log}(\boldsymbol{P_2/P_0}) = \boldsymbol{\alpha_2} + \sum_j \boldsymbol{B_{2_j}} \boldsymbol{X_j j} = \mathbf{1, 2} \ldots\ldots\ldots \quad \mathbf{(2)}$$

$$\mathbf{Log}(\boldsymbol{P_3/P_0}) = \boldsymbol{\alpha_3} + \sum_j \boldsymbol{B_{3_j}} \boldsymbol{X_j j} = \mathbf{1, 2}, \ldots\ldots\ldots \quad \mathbf{(3)}$$

$$\boldsymbol{P_0} + \boldsymbol{P_1} + \boldsymbol{P_2} + \boldsymbol{P_3} = \mathbf{1} \quad \mathbf{(4)}$$

Where
P_0 = probability of not having any childhood morbidity
P_1 = probability of suffering from fever
P_2 = probability of suffering from cough
P_3 = probability of suffering from diarrhea
P_0 = reference category

$$Z_1 = \exp\left[\alpha_1 + \sum_j B_{1_j} X_j\right], Z_2 = \exp\left[\alpha_2 + \sum_j B_{2_j} X_j\right], \; Z_3 = \exp\left[\alpha_3 + \sum_j B_{3_j} X_j\right] \quad (5)$$

$$Z_0 = 1 + Z_1 + Z_2 + Z_3 \quad (6)$$

$$P_0 = 1/Z_0 \;, P_1 = Z_1/Z_0, P_1 = Z_1/Z_0 \quad (7)$$

$$P_1 = Z_1/Z_0 \;, P_2 = Z_2/Z_0, \; P_3 = Z_3/Z_0 \quad (8)$$

Results

Burden of childhood morbidity, namely, fever, cough and diarrhea for children under five years in northeast India for 2004-05 and 2011-12 are shown in table 1. Burden of fever among children in northeast India is about 4 percent and has not changed during 2004-05 to 2011-12. However the burden of cough has declined from 14.6 to 12.4 percent and that of diarrhea has also declined from 4.5 to 2.5 percent during this period. As on 2004-05 about 4 and 14 percent of children regardless were reported to have suffered from fever and cough respectively during the one period preceding the survey. However, there is considerable gender gap in the case of diarrhea among children with 6.4 percent of boys and 2.6 percent of girls reported having diarrhea in 2004-05. Children reported having fever has decline to 2.4 percent among the boys but has increased to 6.3 percent among the girls in 2011-12. As for diarrhea among children it has declined to 3.1 and 1.9 percent among the boys and the girls respectively in 2011-12.

As regards the association between age of the child (in months) and incidence of morbidity, no consistent pattern of association is found in the case of incidence of fever and cough among children and it remains more or less at the same level over the year. The burden of diarrhea among children shows a declining trend with increasing age and are consistent over time. No rural-urban differential is noticed in the burden of cough among children and the incidence rate is nearly 14.5 percent in 2004-05 which declines to about 12.9 percent in 2011-12. On the other hand, the burden of fever among children is higher in urban than in rural with an incidence rate of 5.1 and 3.8 percent and 6.9 and 3.6 percent respectively in 2004-05 and 2011-12. Assessment of association between household economic statuses as measured by monthly per capita expenditure (MPCE) quintiles and child morbidity reveals that the incidence of fever and diarrhea show declining trend concomitantly with increasing MPCE quintile but not so in the case of children suffering from cough. No consistent pattern of association between literacy status of mother and child morbidity is noticed from the analysis. The proportion of children from joint family reported having a fever 5.4 percent as compared 3.2 percent among children from nuclear family in 2004-05 but has reversed to 2.4 and 5.7 percent respectively in 2011-12. On the other hand children suffering from cough in the one period preceding the survey among children in the joint and nuclear family were 12.7 and 15.9 percent respectively in 2004-05 and the gap e become narrower in 2011-12 with an incidence rate of nearly 12 percent for both the family types. When it comes to differential in child morbidity by social group affiliation of household head it is found that incidence of fever and cough are higher among children from other backward castes (OBC) and diarrhea among children from general castes in 2004-05 and for all morbidities it is highest among children from other backward castes (OBC) in 2011-12. Again no consistent pattern of association between the number of children in the household and child morbidity is observed.

Table 1: Percent of children reported having fever, cough and diarrhea by selected background characteristics in northeast India for 2004-05 and 2011-12

Background Characteristics	2004-05				2011-12			
	Fever	Cough	Diarrhoea	N	Fever	Cough	Diarrhoea	N
Sex								
Boy	4.1	14.2	6.4	267	2.4	11.2	3.1	295
Girl	4.1	14.9	2.6	269	6.3	13.8	1.9	269
Child Age (months)								
0-11	8.3	8.3	5.6	36	2.5	8.8	2.5	80
12-23	2.7	25.7	2.7	74	4.3	17.1	5.7	70
24-35	0.0	13.0	5.4	92	8.3	17.4	2.8	109
36-47	3.6	15.5	3.6	110	3.0	9.0	2.0	100
48-59	6.3	11.6	3.6	112	1.8	14.7	0.9	109
60	5.4	12.5	6.3	112	5.2	7.3	2.1	96
Residence								
Rural	3.8	14.6	3.5	398	3.6	12.3	2.5	448
Urban	5.1	14.5	7.3	138	6.9	12.9	2.6	116
MPCE quintile								
First	2.2	17.8	5.6	90	0.0	16.4	5.5	55
Second	6.9	15.7	2.9	102	8.2	9.4	3.5	85
Third	6.5	17.4	5.4	92	6.0	10.5	0.8	134
Fourth	4.2	9.3	5.1	118	1.9	10.6	1.0	104
Fifth	1.5	14.2	3.7	134	3.8	15.1	3.2	186
Mother's Literacy								
Non-Literate	4.1	14.9	4.3	491	4.2	12.7	2.6	550
Literate	4.4	11.1	6.7	45	7.1	0.0	0.0	14
Family Type								
Joint	5.4	12.7	4.1	221	2.4	12.2	2.4	246
Nuclear	3.2	15.9	4.8	315	5.7	12.6	2.5	318
Caste								
OBC	8.0	19.0	4.0	100	6.3	12.5	2.1	48
SC	5.8	21.2	3.9	52	5.8	11.5	3.9	52
ST	4.2	11.1	3.2	190	2.1	11.7	3.7	188
Other	1.6	13.9	6.2	194	5.1	13.0	1.5	276
Number of Children								
1-2	4.8	16.0	4.3	231	3.8	11.8	2.5	473
3+	3.6	13.4	4.6	305	6.6	15.4	2.2	91
Improved drinking water								
Others	8.5	22.0	5.1	118	5.3	18.1	3.8	133
Improved water	2.9	12.4	4.3	418	3.9	10.7	2.1	431
Toilet Facility								
No	11.0	24.2	6.6	91	6.5	6.5	2.6	77
Yes	2.7	12.6	4.0	445	3.9	13.4	2.5	487
Total	4.1	14.6	4.5	536	4.3	12.4	2.5	564

Source: Authors computation from IHDS-I (2004-05) and II (2011-12)

Table 2: Relative risks ratios of suffering from fever, cough and diarrhea among children in northeast India for 2004-05 and 2011-12

Background Variables	2004-05			2011-12		
	Fever/ No Disease	Cough/ No Disease	Diarrhoea/ No Disease	Fever/ No Disease	Cough/ No Disease	Diarrhoea/ No Disease
Sex						
Boys®						
Girls	0.80	0.95	0.42*	1.53*	1.24	0.60
Child months						
0-11®						
12 to 23	1.43	2.50	0.39	2.56*	2.40*	2.11
24-35	1.00	1.33	0.92	3.34***	2.23*	1.21
36-47	1.09	1.43	0.54	1.30	1.01	0.71
48-59	1.05	1.00	0.54	1.79	1.65	0.27
60	1.10	1.41	0.89	1.18	0.86	0.89
Residence						
Rural®						
Urban	1.90**	1.48	2.65*	1.45	1.09	1.55
MPCE quintile						
First®						
Second	1.04	0.65	0.53	0.92	0.54	0.87
Third	1.24	0.98	0.86	0.62	0.37**	0.16
Fourth	0.78	0.65	0.97	0.44*	0.41*	0.16
Fifth	0.78	0.82	0.74	0.96	0.73	0.70
Mother's Literacy						
Non-Literate®						
Literate	1.94	1.55	2.59	0.57	1.00	1.00
Family Type						
Joint®						
Nuclear	0.99	1.15	0.92	1.32	1.22	1.02
Caste						
OBC®						
SC	0.73	0.97	0.79	1.10	1.04	2.20
ST	0.46**	0.45**	0.80	1.15	1.51	2.56
Other	0.62	0.88	1.75	1.21	1.38	0.76
Number of Children						
1-2®						
3+	0.92	0.81	0.95	1.29	1.14	0.89
Improved drinking water						
Others®						
Improved water	0.45***	0.60*	0.68	0.45***	0.53**	0.45
Toilet facility						
No ®						
Yes	0.35***	0.43***	0.43	1.33	0.28*	1.38
UrbanxMother's Literacy						
Others						
Urban -literate mother's	0.24*	0.24	0.22	0.38*	1.00	1.00
Constant	2.18	0.94	0.51	0.06***	0.06***	0.10

Note: RRR-Relative risks ratios, ®: Reference category; ***: P<0.01, **: P<0.05, *: P<0.10

The proportion of children who had suffered from fever and cough among children from households with 1-2 and 3 & more children were 4.8 and 16 percent respectively in 2004-05 and for the period corresponding figures are 3.6 and 13.4 percent respectively and these have changed to 3.8 and 11.8 percent and 6.6 and 15.4 percent respectively in 2011-12. In only 2.9 percent of children who have access to drinking water from improved sources have reported to have suffered from fever as compared to 8.5 percent among children who do not have access to drinking water from improved sources, but has reversed to 3.9 and 5.3 percent respectively in 2011-12. Likewise in 2004-05 the burden of fever is higher by 11 percent among children from households with no toilet facility than 2.7 percent among children from households with toilet facility and the corresponding figures are 6.5 and 3.9 percent respectively in 2011-12.

Multinomial regression is applied to assess the adjusted effect of child, parental and household factors on the likelihood of suffering from fever, cough and diarrhea. Table 2 shows the adjusted relative risk ratios (RRR) of having fever, cough and diarrhea among children by selected background. In terms of relative risks ratios (RRR), it is found that there is 58 percent lower likelihood of girls having diarrhea than the boys in 2004-05 when other in demographic, mother's and household factors are adjusted and this is significant at $P<0.10$, but no gender differentials in the incidence of fever and diarrhea among children. Assessment of adjusted RRR shows no significant gender differential in the likelihood having, cough and diarrhea is noted in 2011-12. However, the likelihood of having fever among the girls is found to be 53 higher than that of boys in 2011-12 and significant at $P<0.10$. Older children show higher RRR of suffering from fever and cough than infants both in 2005-05 and 2011-12. Among children in 12-23 months the adjusted RRR of suffering from cough is 2.50 and 2.56 times higher than infants in 2004-05 and 2011-12 respectively and statistically significant at $P<0.10$ in 2011-12. For children in 12-23 months the adjusted RRR of suffering from diarrhea is 2.11 times higher than infants in 2011-12. The adjusted RRR of having suffered from fever and cough among children older between 24-35 months are 3.34 and 2.23 times respectively higher than that of infants and significant at $P<0.01$ and $P<0.10$ respectively. The adjusted RRR of urban children have suffered from fever, cough and diarrhea are found to be higher than the rural children but are found to be statistically significant. In terms of adjusted RRR children from economically better off households as measured by higher MPCE quintiles are less likely to be suffering from fever, cough and diarrhea in 2004-05 but are not statistically significant. Children of the literate mother are less likely to suffer from childhood morbidity than children of the non-literate mother while on the other hand, children in nuclear households more likely to suffer from child morbidity as compared to children in joint family and are true for 2004-05 and 2011-12 but the differentials are not statistically significant. Children from households headed by ST are 55 percent less likely to have cough than children from households headed by OBC in terms of adjusted RRR and is found to be significant at $P<0.05$. Children from households with more children have higher adjusted RRR of having childhood morbidity as compared to children from households with 1-2 children but are not statistically significant. Children from households having access to drinking water from improved sources, such as, pipe water, public tape, stand pipe, tube well/borehole protected well etc. to have 55 and 40 percent lower RRR of suffering from fever and cough respectively in comparation to children from households with no access to drinking water from improved sources and are statistically significant at $P<0.01$ and $P<0.10$ in 2004-05. Similar pattern of 55 and 47 percent lower RRR statistically significant at $P<0.01$ and $P<0.05$ respectively are found in 2011-12. Among children from households having toilet, the RRR of suffering from fever and cough are found to be 75 and

57 percent lower than among children from households with no toilet facility in 2004-05 and both are statistically significant at P<0.01. Having toilet in the household have lowered the RRR of fever among children by 78 percent and significant at P<0.10. With interest of finding whether morbidities among children varies by interaction literacy of mother and place residence, the interaction effect on incidence of childhood morbidities is included in the model and it is found that the interaction effect has significant effect to lower the RRR of suffering from fever by 76 and 62 percent in 2004-05 and 2011-12 respectively, both significant at P<0.10.

Summary and Conclusion

This study provides an assessment of the extend of change over time in the prevalence of childhood morbidities and its determinants in the context of northeast India. The childhood morbidities considered in the study are, diarrhea, cough and fever among children under five years (60 months). It is found that the incidence of fever among children remains more or less at the same level of 4 percent during 2004-05 to 2011-12 while that of cough and diarrhoea among children in northeast India have considerably declined by 2 percent during the 2004-05 to 2011-12. This is in concordance with the higher prevalence of rate of ARI in states of northeast India reported in NFHS-5 (2015-16). No gender difference is evident as far as the incidence of fever and cough among children under five years are concerned, but the incidence of diarrhea is found to be higher among the boys than among the girls. No consistent pattern of association between the incidences of fever over time can be noticed from the present study though in the recent the incidence of fever among children from nuclear families are found to be higher than among children from joint families. From the results of a multivariate analysis it is to infer that girls are 58 percent less likely to have suffered from diarrhea than the boys adjusting for mothers and household background and the differential is found to be statistically significant. Age of children is found to have a significant effect on the risk of children suffering from childhood morbidities. The adjusted relative risk ratios of having suffered from fever and cough among children aged between 24-35 months are found higher than that of infants and are statistically significant. This is an indication of the fact that children are exposed to dirt and other risks once they start crawling and walking. In all possibilities there seems to have more consciousness of childhood morbidities in urban as indicated by the significantly higher likelihood of incidence of fever and diarrhea than in rural children in 2004-05 but the differential evaporate out in 2011-12. Household's accessibility to drinking water from improved sources, such as, pipe water, public tape, stand pipe, tube well/borehole protected well etc. has significantly lower the risk of children suffering from fever, cough and diarrhea. Toilet in the household is the other basic amenity which can reduce the incidence of childhood morbidities among children in northeast India. There is also interaction effect of residence and literacy status of mother as children of literate mother in urban have lower risk of suffering from fever. In conclusion in the case of northeast India the incidence rate of morbidities among children under five years have declined over the period 2004-05 to 2011-12 and so is the level of child malnutrition. There exists no gender differential in the incidence of fever and cough.

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