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Research Article

RURAL-URBAN DIFFERENCES OF INFANT AND CHILD MORTALITY: ROLE OF MATERNAL EDUCATION AND OTHER FACTORS

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ABSTRACT

In most of the developing countries, rural area experiences more neo-natal, post neo-natal mortality as compared to urban area (A.K. Jain, 1985; Myint, 1990; Shuzhuo and Feldman, 1995; Pandey *et al*, 1998; Poel *et al*, 2009, NFHS-3, 2005-06). The causes of such differences as cited in most of the studies includes low standard of living, lack of health care facilities, inadequate modern means of connectivity, lack of availability of electricity, lack of mass media etc. in rural area. Over the years the rural-urban ratios of infant mortality and child mortality are higher in Assam than in India. While the rural-urban gaps of all components of infant and child mortality has declined over the years in India, but in case of Assam though it has declined for child mortality it has increased for neonatal, post-neonatal mortality and infant mortality. This study confirms the findings of other studies that mortality rates in rural area are higher than in urban area. Again with some exception, maternal education was unable to reduce the rural-urban gap. There are some differences regarding factors affecting each of the outcome variables in rural and urban area which may explain the gap. Again rural area lacks in infrastructural facility which might be responsible for more death experiences in rural area.

INTRODUCTION

Most of the developing countries experience rural-urban differences in infant and child mortality. There are rural-urban differences regarding standard of living, health care facilities, modern means of connectivity, availability of electricity, mass media etc. Rural areas are generally lacking as compared to urban areas regarding these facilities which have influences on infant and child mortality.

It is interesting to know whether women's education help to reduce the rural-urban gap of infant and child mortality. At the all India level, the infant mortality rate in rural areas decreases with an increase in the level of women's education. The basic inverse relationship between infant mortality and mother's education is also found for each rural area of each state except Assam and Andhra Pradesh (Jain, 1985). Another study conducted in Gujarat by Jain (1994) found that mothers with at least eight years of schooling are twice as likely to use health services for preventive medical care as those with no schooling. In urban areas, the likelihood of the use of these services for preventive medical care increases by 50% with increase in mother's education from none to eight years of schooling.

REVIEW OF LITERATURE

A number of studies have been carried out to find out the rural urban differences of infant and child mortality and also the causes for such differences (A.K. Jain, 1985; Myint, 1990; Pandey *et al* 1998; Shuzhuo and Feldman, 1995; Poel, O'Donnell and Doorslaer, 2009). Shuzhuo and Feldman (1995) observed better socio-economic development, medical care; standard of living in urban area compared to rural area and hence observed higher infant and child mortality in rural area than in urban area. Using the NFHS-1 data, Pandey *et al* (1998) found large unadjusted rural-urban differences of infant and child mortality in India, but most of the differences disappeared when the effects of other variables were controlled, which suggests that factors which are closely related to residence rather than to residence itself are responsible for large rural-urban differences. The adjusted rural-urban differences of mortality tend to increase with the child's age (Pandey *et al*, 1998). In each state of India, infant mortality in urban area is found to be lower than in rural area (NFHS, 2005-06). A.K. Jain (1985) grouped all the determinants of infant mortality into three categories, namely individual, household and community environment. He

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presumed schematic presentation of the relationships among community, household and individual factors and infant mortality. Individual level factors are closest to dependent variable. They have direct effect on infant mortality. They include maternal factors such as age, parity, interval between pregnancies, nutrient availability factors, environmental contamination factors, injury factors and personal illness controlling factors. Another important individual factor is the degree of care with which the infant is brought up which may be medical and non-medical. The second priority factor is the physical, social and economic environment of the household. Physical environment is the condition of house, toilet facilities, crowding, quality of drinking water, source of fuel and lighting, social environment such as mother's education and economic environment of the household. The third important group of factors is the community level factors which comprises physical, social and economic environment at the community or village level. These include availability of basic infrastructure facilities like medical services, community education, water supply, school, transport and communications. These factors have effect on infant mortality through individual level factors. Another study conducted by Poel *et al* (2009) in six Sub-Saharan countries on community and household factors explaining rural-urban gap used Mosley and Chen (1984) framework of proximate and socio-economic determinants. Out of the five proximate determinants identified by Mosley and Chen, they used maternal factors such as mother's age at birth, birth order and an indicator of short birth interval (<24 months). Regarding socio-economic factors, Mosley and Chen distinguished between individual, household and community level factors. At the individual level, they included maternal education. Household level factors include household income and wealth, safe drinking water, sanitation and hygiene. Regarding community factors, they took into account availability of health care services and public transport facility.

In Myanmar, over the years from 1969 to 1982, both IMR and CMR in rural areas are found considerably higher than in urban areas. Again, though there were declining trends of both infant and child mortality rates in both rural and urban areas, the rates of reduction were considerably higher in urban areas than in rural areas. Differences in socio-economic development and uneven distribution of medical services were cited as reasons for such differences (Myint, 1990).

Data from six Sub-Saharan African countries viz., Benin, Central African Republic, Chad, Guinea, Mali and Niger shows that major part of rural-urban gap of infant mortality is attributed to household level characteristics (67%). Socio-economic determinants account for 40% of the gap. Among the socio-economic determinants, the most important contribution comes from environmental conditions such as safe drinking water, electricity supply which have great influence on infant mortality in both rural and urban areas. Even in urban slum areas, mortality risk is very high among households living in premises with no finished floor. The second important factor for rural-urban gap constitutes the community characteristics. Among the community characteristics, the most important contribution comes from unobserved community heterogeneity. Though the existence of health facility is correlated with a reduced risk of death, the effect is stronger in urban area than the rural area. It may be because of low quality of health services, with frequent absence of staff and medicine or lower probability of seeking health care in rural areas because of high opportunity cost. Though transportation has no significant influence on infant mortality it is negatively correlated (Poel, O'Donnell and Doorslaer, 2009).

Objectives

1. To study the rural urban differences of infant and child mortality among the SAARC countries.
2. To study rural-urban differences of infant and child mortality by different states of India
3. To study the trend of rural-urban differences of infant and child mortality in India and Assam.
4. To study rural-urban differences of NNMR, PNNMR, IMR AND CMR in the three selected districts of Assam.
5. To study the rural-urban differences of NNMR, PNNMR, IMR AND CMR with respect to educational level of mothers.
6. To study the other factors explaining rural-urban differences of NNM, PNNM, INFANT Mortality and Child Mortality

METHODOLOGY

This study is based on both primary and secondary data. To find out the rural-urban differences of infant and child mortality in the SAARC countries, data have been collected from Demographic and Health Survey of Pakistan (2012-13), Sri Lanka (2006-07), Bangladesh (2011), Nepal (2011), India (2005-06), Afghanistan Mortality Survey (2010) and Analytical Report, Census of the Maldives (2000). To study the rural-urban differences of Infant and Child mortality by different states of India, NFHS-3 (2005-06) data are used. To make a comparative study of the trend of rural-urban mortality gap between India and Assam, data are collected from the NFHS-1 (1992-93), NFHS-2 (1998-99) and NFHS-3(2005-06). Here, rural-urban ratios of mortality have been found out over the selected period to see whether the gap has reduced or widened.
A total of 633 currently married women who gave birth to at least one live birth during the five years (2009-2014) were selected by using multi-stage random sampling technique. It excludes those births which took place before the 5 years, as it is assumed that some of the conditions like household environment as well as govt. programmes might have changed over a long period of time. Another reason is that respondents might find it difficult to recall all of the happenings for a too past period. Three districts viz., Dibrugarh, Kamrup (metro) and Barpeta were selected considering female literacy rate and locational characteristics. Among the selected respondents, 940 live births were born in the reference period, out of which 555 were in rural area and 385 were in urban area.

Cross tabulation and contingency analysis are used to test significance association between selected factors and NNM, PNNM, Infant Mortality and child mortality on the basis of classification of variables or attributes by applying the Chi-square (x^2) test in which $x^2 = \sum \frac{O_{ij}}{E_{ij}} - N$, follows a distribution with (r-1) (c-1) degrees of freedom.

RESULTS AND DISCUSSION

Rural-urban differences of Infant and Child mortality among the SAARC countries

It is observed from the **Table-**1 that all of SAARC countries experienced rural disadvantage in neonatal, post-neonatal and infant mortality. In case of child mortality, except Sri Lanka which experienced rural advantage, all other countries experienced rural disadvantage. Again, Bangladesh experienced same rural-urban post-neonatal mortality. However compared to other selected countries, Sri Lanka experienced highest rural-urban ratio of neonatal mortality. In Pakistan, Afghanistan, India and Bangladesh, rural-urban ratio is highest in case of child mortality. Again in case of child mortality, Afghanistan experienced highest rural disadvantage.

In Maldives**,** though rural-urban gap has narrowed over the years, yet rural (Atolls) area experienced higher infant and under-5 mortality than urban (Male') area. The Analytical Report, Census of the Maldives (2000) stated that in 1998 rural area experienced 39% higher infant mortality rates than in urban area. The rates of infant mortality in rural and urban area were 46 and 33 per 1,000 live births respectively. In case of under-5 mortality, rural area experienced 15 per 1000 live births and urban area experienced 9 per 1000 live births i.e. rural area experienced 67% higher mortality than urban area.

Rural-urban differences of Infant and Child mortality by different states of India

Table-2 explains the rural urban differences of neo-natal, post-neonatal, infant and child mortality in India and in different states of India. The NFHS-3 shows excess mortality in rural area than in the urban area in all the components of infant and child mortality. The rural-urban differences tend to rise with the increase in child age i.e., from 1.49 in case of NNMR to 1.51 in case of PNNMR and again to 1.98 in case of child mortality which indicate the importance of exogenous factors in explaining excess rural mortality.

Table 1 Rural-Urban Differences of Neonatal, Post-neonatal, Infant and Child Mortality in SAARC Countries

Countries	NNMR[1]			PNNMR[2]			IMR[3]			CMR[4]		
	R	U	R/U	R	U	R/U	R	U	R/U	R	U	R/U
Pakistan (2012-13)	62	47	1.32	26	17	1.53	88	63	1.40	20	11	1.82
Sri Lanka (2006-07)	15	6	2.5	4	3	1.33	19	10	1.9	3	9	0.33
Bangladesh (2011)	33	32	1.03	10	10	1.00	43	42	1.02	12	8	1.5
Afghanistan excluding South zone (2010)	30	24	1.3	40	24	1.7	70	47	1.5	23	10	2.3
Nepal (2011)	36	25	1.44	19	13	1.46	55	38	1.45	10	7	1.43
India (2005-06)	43	29	1.5	20	13	1.5	62	42	1.49	21	11	1.98

Sources: Pakistan Demography and Health Survey (DHS), 2012-13; Sri Lanka DHS (2006-07); Bangladesh DHS (2011), Afghanistan Mortality Survey (2010); Nepal (DHS), 2011; India (NFHS-3, 2005-06)

1. Neo-Natal Mortality Rate, Infants who die before reaching 4 weeks of life
2. Post Neo-Natal Mortality Rate, Infants who die between 28 days and 365 days of life
3. Infant Mortality Rate, Infants who die within first year of life
4. Child Mortality Rate, Children who die between the age 1 and 5 years

Table 2 Rural-urban differences of Neonatal, Post-neonatal and Child Mortality Rates by Different States of India, 2005-06

State	NNMR			PNNMR			IMR			CMR		
	Rural	Urban	R/U	Rural	Urban	R/U	Rural	Urban	R/U	Rural	Urban	R/U
Northern Region												
Delhi	*	27.2	N.A	*	13.4	N.A	*	40.6		*	8.2	N.A
Haryana	29.2	11.6	2.52	19.6	18.7	1.05	48.8	30.3	1.61	16.4	11.5	1.42
Himachal Pradesh	30.2	25.9	1.17	9.1	3.7	2.46	39.2	29.6	1.32	5.1	0.0	
Punjab	32.0	26.2	1.22	14.2	16.4	0.87	46.2	42.6	1.08	10.5	9.2	1.14
North Central Region												
Bihar	42.1	42.2	0.99	23.1	21.2	1.09	65.2	63.4	1.03	33.1	25.4	1.30
Madhya Pradesh	54.3	41.2	1.32	30.5	30.3	1.01	84.8	71.6	1.18	32.0	16.2	1.97
Rajasthan	49.1	46.2	1.06	25.6	18.9	1.35	74.6	65.1	1.15	24.8	12.0	2.07
Uttar Pradesh	57.7	43.8	1.32	28.1	28.4	0.99	85.8	72.2	1.18	34.0	24.3	1.39
Eastern Region												
Assam	49.7	42.9	1.16	23.9	7.7	3.10	73.5	50.6	1.45	27.4	17.6	1.56
Orissa	49.1	30.0	1.64	23.0	10.9	2.11	72.2	40.9	1.77	30.7	19.2	1.59
West Bengal	39.8	32.0	1.24	13.9	14.4	0.97	53.7	46.4	1.16	16.0	6.8	2.35
Western Region												
Goa	15.8	17.9	0.88	10.0	7.9	1.27	25.8	25.9	0.99	5.6	7.1	0.79
Gujarat	49.0	37.9	1.29	24.4	6.7	3.64	73.4	44.6	1.65	18.5	9.9	1.87
Maharashtra	47.2	21.8	2.17	12.3	6.6	1.86	59.5	28.4	2.09	8.2	8.8	0.93
Southern Region												
Andhra Pradesh	61.2	32.4	1.89	16.6	15.3	1.08	77.8	47.7	1.63	12.5	8.0	1.56
Karnataka	44.1	26.9	1.64	16.3	13.1	1.24	60.3	40.0	1.50	18.2	6.2	2.93
Kerala	17.1	8.8	1.94	3.4	2.9	1.17	20.5	11.6	1.76	1.7	2.2	0.77
Tamilnadu	31.6	19.4	1.62	11.2	11.6	0.96	42.8	31.0	1.38	10.6	3.8	2.78
India	42.5	28.5	1.49	19.7	13.0	1.51	62.2	41.5	1.49	21.0	10.6	1.98

Source: NFHS-3 (2005-06); *Not shown, based on fewer than 250 unweighted cases

In case of NNMR, except Bihar, Goa, all other states experienced excess mortality in rural area than in the urban area. The rural disadvantage in mortality is the highest in Haryana (2.5). In case of PNNMR, except Punjab in the northern region, Uttar Pradesh in the north-central region, West Bengal in the eastern region and Tamil Nadu in the Southern region, all other states experienced excess mortality rates in rural areas than in the urban areas. In case of infant mortality rate, except Goa, all other states experienced excess mortality in rural area than in the urban area. Child mortality rates also showed excess mortality in rural area except Goa, Maharashtra and Kerala. The rural-urban difference is highest in Karnataka (2.93), followed by Tamil Nadu (2.78), West Bengal (2.35) and Rajasthan (2.07) respectively.

The rural-urban differences of infant and child mortality of north eastern states are shown in the following **Table-3**. Regarding neonatal mortality, while Arunachal Pradesh, Manipur and Sikkim experienced excess mortality in urban area, Assam, Meghalaya, Mizoram and Tripura experienced excess mortality in rural areas. The rural-urban difference is highest in Tripura. In case of PNNMR, except Mizoram, all other states experienced excess mortality in rural areas. The rural-urban difference is highest in Sikkim followed by Assam. IMR also indicates excess mortality in rural areas except in Arunachal Pradesh. Regarding child mortality, except Arunachal Pradesh, all other states experienced excess mortality in rural areas. The rural-urban difference is highest in Meghalaya.

and child mortality in rural areas as compared to urban areas both in India and Assam. Over the years, the rural-urban ratios of infant mortality and child mortality are higher in Assam than in India. In India, regarding NNMR, the rural-urban ratios indicate that over the period i.e. from 1992-93 to 2005-06 the rural-urban gap has been gradually declining due to excess reduction of mortality in rural area. However, in Assam, the rural-urban gap has been gradually rising. In case of PNNMR, while the rural-urban differences in India has remained more or less same, in Assam it has increased from 1.24 in 1992-93 to 3.10 in 2005-06 due to rapid reduction of PNNMR in urban area and slow reduction in rural area. In the case of IMR a decline in rural-urban gap is seen in India which is reversed in Assam. However, in case of CMR, rural-urban ratios are lower in Assam than in India and both in India and Assam, rural-urban ratios show declining trend. Thus, while the rural-urban gaps of all components of infant and child mortality has declined over the years in India, but in case of Assam though it has declined for child mortality it has increased for neonatal, post-neonatal mortality and infant mortality.

Rural-Urban Differences of NNMR, PNNMR, IMR AND CMR in the Selected Three Districts of Assam

The rural-urban distribution of NNM, PNNM, Infant and Child mortality in the three selected districts are shown in the following Table-5 and Figure-5. There exists rural-urban gap in case of each of the outcome variables. Rural area experiences higher mortality than urban area. Rural-urban mortality ratio for NNM, PNNM, infant mortality and child mortality in all the

Table 3 Rural-urban differences of Neonatal, Post-neonatal, Infant and Child Mortality Rates by States of North East India, 2005-06

State	NNMR			PNNMR			IMR			CMR		
	Rural	Urban	R/U	Rural	Urban	R/U	Rural	Urban	R/U	Rural	Urban	R/U
Arunachal Pradesh	30.8	50.2	0.61	31.7	29.1	1.09	62.4	79.3	0.79	31.6	38.8	0.81
Assam	49.7	42.9	1.16	23.9	7.7	3.10	73.5	50.6	1.45	27.4	17.6	1.55
Meghalaya	22.2	22.1	1.00	26.9	20.7	1.29	49.0	42.8	1.14	32.1	6.1	5.26
Manipur	24.1	25.5	0.95	12.5	8.7	1.44	36.6	34.2	1.07	16.6	9.9	1.67
Mizoram	23.5	14.6	1.61	13.3	14.7	0.90	36.8	29.3	1.25	19.1	11.8	1.61
Tripura	42.4	9.8	4.33	20.4	-	-	62.8	-	-	17.0	15.3	1.11
Sikkim	21.7	27.2	0.79	14.2	4.6	4.6	35.9	31.8	1.12	7.0	7.0	1
India	42.5	28.5	1.49	19.7	13.0	1.51	62.2	41.5	1.49	21.0	10.6	1.98

Source: NFHS-3

Table 4 Rural-Urban Differences of Infant and Child Mortality in India and Assam

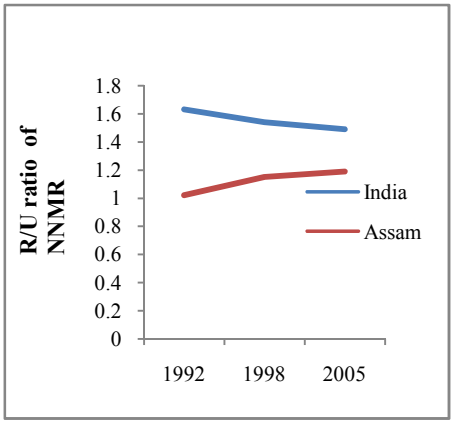
	India											
	NNMR			PNNMR			IMR			CMR		
	R	U	R/U	R	U	R/U	R	U	R/U	R	U	R/U
NFHS-1(1992-93)	57.7	35.5	1.63	36.6	23.9	1.53	94.3	59.4	1.59	40.4	20.1	2.00
NFHS-2 (1998-99)	51.7	33.5	1.54	28.0	15.8	1.77	79.7	49.2	1.62	34.6	17.0	2.03
NFHS-3 (2005-06)	42.5	28.5	1.49	19.7	13.0	1.51	62.2	41.5	1.49	21.0	10.6	1.98
	Assam											
	NNMR			PNNMR			IMR			CMR		
	R	U	R/U	R	U	R/U	R	U	R/U	R	U	R/U
NFHS-1(1992-93)	55.8	54.5	1.02	37.8	30.4	1.24	93.6	84.9	1.10	58.6	31.5	1.86
NFHS-2(1998-99)	37.3	32.5	1.15	25.3	11.4	2.22	62.6	43.9	1.42	19.7	11.4	1.73
NFHS-3 (2005-06)	49.7	42.9	1.19	23.9	7.7	3.10	73.5	50.6	1.45	27.4	17.6	1.56

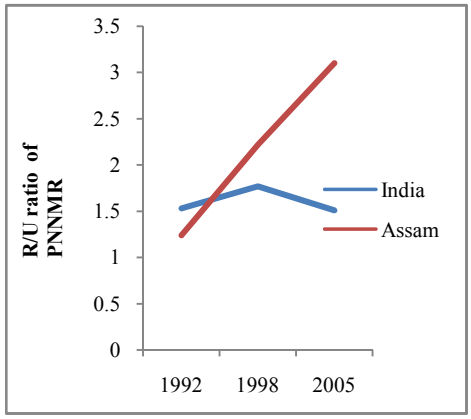
Source: NFHS-1, NFHS-2 and NFHS-3

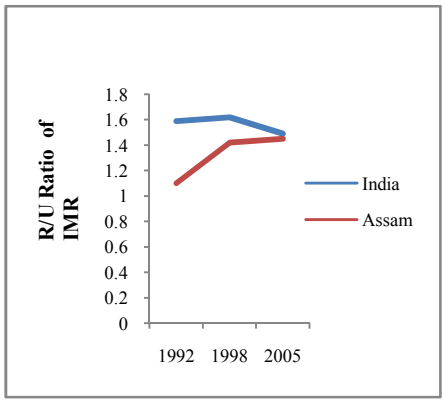
Trend of Rural-Urban Differences of Infant and Child Mortality in India and Assam

All the three rounds of NFHS (Table-4, Fig-1, Fig-2, Fig-3 and Fig-4) show excess mortality at neonatal, post-neonatal, infant

three districts taken together are 1.59, 1.28, 1.39 and 1.12. Here, in spite of rural-urban differences of exogenous factors, differences in demographic factors such as teenage pregnancy, premature birth may be more prominent for experiencing highest rural-urban gap in NNM.







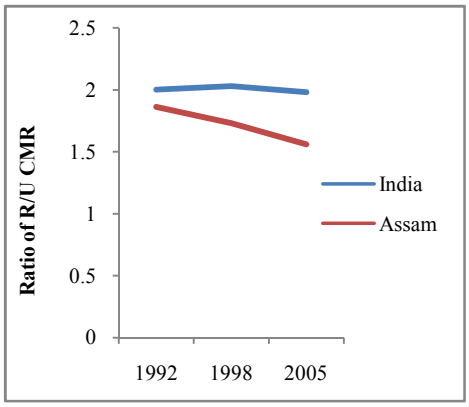


Table 5 Rural-Urban Differentials of NNM, PNNM, Infant Mortality and Child Mortality in Three Districts of Assam

Place of Residence	NNM							
	Kamrup (Metro)		Dibrugarh		Barpeta		Three Districts	
	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births
Rural	3 (4.16%)	72	15 (5.9%)	254	12(5.24%)	229	30(5.40%)	555
Urban	9 (4.14%)	217	2 (2.7%)	73	3(3.16%)	95	14(3.64%)	385
R/U	1.01		2.18		1.66		1.48	
Total	12	289	17	327	15	324	44	940
x^2test (d.f)	.000 (1)		1.153 (1)		.659 (1)		1.59(1)	
Place of Residence	PNNM							
	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births
Rural	3(4.34%)	72	7 (2.8%)	254	8 (3.5%)	229	18(3.43%)	555
Urban	5(2.3%)	217	2(2.7%)	73	3 (3.2%)	95	10 (2.69%)	385
R/U	1.80		1.04		1.13		1.28	
Total	8	289	9(2.8%)	327	11	324	28	940
x^2 test (d.f)	.698(1)		.002 (1)		.034 (1)		.386	
Place of Residence	Infant Mortality							
	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births	Deaths	Total Births
Rural	6(8.33%)	72	22 (8.66%)	254	20 (8.73%)	229	48(8.65%)	555
Urban	14(6.45%)	217	4(5.48%)	73	6(6.31%)	95	24 (6.23%)	385
Rural /Urban ratio of Mortality	1.29		1.58		1.38		1.39	
Total	20	289	26	327	26	324	72	940
x^2 test (d.f)	.784		.784(1)		.532(1)		1.874(1)	
	Child Mortality[1]							
Rural	2(3 %)	66	6(2.6%)	232	6 (2.9%)	209	14(2.8%)	507
Urban	5 (2.5%)	203	2(2.9%)	69	2(2.2%)	50	9 (2.5%)	361
R/U	1.20		0.89		1.32		1.12	
Total	7	269	8	301	8	259	23	868
x^2 test (d.f)	.063(1)		.020(1)		.093(1)		.059(1)	

Source: Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution; [1] Total infants alive at age 1, *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d. f. degrees of Freedom

Again, rural area experiences more death than urban area in each of the selected districts. However, in Dibrugarh though NNMR, PNNMR, IMR are higher in rural area but CMR is found to be higher in urban area. Here, urban area experienced 11.53 % more child death as compared to rural area.

Within the districts, rural-urban gap of NNM as well as infant mortality is highest in Dibrugarh and lowest in Kamrup (metro). Barpeta district also experienced considerably more rural neo-natal death than urban death.

Again rural-urban gap of post-neonatal mortality is highest in Kamrup (metro) and lowest in Dibrugarh. In case of child mortality, Barpeta experienced highest rural-urban difference and Dibrugarh experiences lowest. As compared to other two districts, rural-urban differences of health facility as well as transport facility might be more acute in Barpeta which may explain the gap.

The chi-square test of significance shows no significant association between place of residence and each of the components of infant mortality and child mortality.

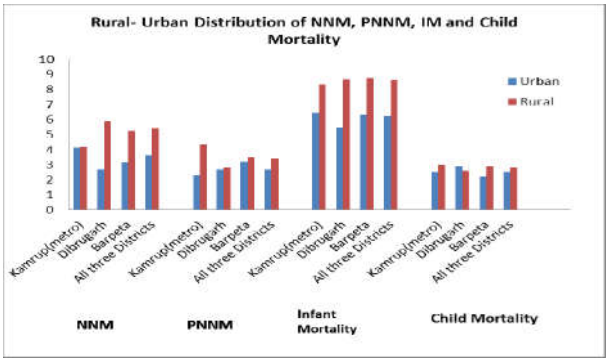


Fig 5 Percent

Rural-Urban Differences of NNMR, PNNMR, IMR And CMR With Respect to Education Level of Mothers

Maternal Education and Rural–Urban Differences of Neo-natal Mortality

It is seen from the **Table-6** that in case of NNM, though education of mothers helps to reduce death in both rural and urban area in Kamrup (metro) but the reduction is significant in rural area which helps to reduce rural urban gap. In Dibrugarh, education does not work to reduce death in rural area.

In all the three districts taken together, education of mothers is a factor to reduce death in rural and urban areas. However, percentage of reduction is more in urban area than in rural area which increases the rural urban gap.

Maternal Education and Rural –Urban Differences of Post neo-natal Mortality

Following **Table-7** shows that though education of mothers helps in reducing PNNM in both rural and urban area, but reduction has been found significant in rural Dibrugarh, urban Barpeta and in urban area of all the three districts taken together (vide x^2 test of significance).

Maternal Education and Rural –Urban Differences of Infant Mortality

It is seen from the **Table-8** that in each of the three districts and all the three districts taken together, though maternal education reduces infant mortality in both rural and in urban area but reduction is significant in rural Kamrup (metro), urban Dibrugarh and both urban and rural area in all the three districts taken together.

Table 6 Association between Rural-urban Differences of NNM and Education of Mother in the Three Districts of Assam

Education Level of Mothers	Kamrup (Metro)					Dibrugarh				
	Rural death(%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death(%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	2(20)	4(6.3)	3.17	10	63	5(4.3)	2(7.7)	0.55	116	26
Literate	1(1.6%)	5(3.2)	0.5	62	154	10(7.2)	-	-	138	47
Chi2 Test (d.f)	7.291***(1)	1.082(1)				.978(1)	3.71* (1)			
Education Level of Mothers	Barpeta					All three Districts				
	Rural death(%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death(%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	6(9.0)	-	-	67	5	13(6.7)	6(6.4)	1.04	193	94
Literate	6(3.7%)	3(3.3)	1.2	162	90	17(4.7)	8(2.7)	1.74	362	291
Chi2 Test (d.f)	2.63(1)	.17(1)				1.02(1)	2.67(1)			

Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution; *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d.f: Degree of Freedom

Table 7 Association between Rural-urban Differences of PNNM and Education of Mother in the Three Districts of Assam

Education Level of Mothers	Kamrup (Metro)					Dibrugarh				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	-	3(4.8)	-	10	63	6(5.2)	1(3.8)	1.36	116	26
Literate	3(4.8)	2(1.3)	3.69	62	154	1(0.7)	1(2.1)	0.33	138	47
Chi2 Test (d.f)	.505(1)	2.38(1)				4.652**(1)	.186(1)			
Education Level of Mothers	Barpeta					All three Districts				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	3(4.5)	1(20)	3	67	5	4.7(9)	5.3(5)	0.88	193	94
Literate	5(3.1)	2(2.2)	2.5	162	90	2.5(9)	1.7(5)	1.47	362	291
Chi2 Test(d.f)	.272(1)	4.89**(1)				1.901(1)	3.64*(1)			

Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution; *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d.f: Degree of freedom

Table 8 Association between Rural-urban Differences of Infant Mortality and Education of Mother in the Three Districts of Assam

Education Level of Mothers	Kamrup (Metro)					Dibrugarh				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	2(20)	7(11.1)	1.80	10	63	11(9.4)	3(11.5)	0.81	116	26
Literate	4(6.5)	7(4.5)	1.44	62	154	11(8.0)	1(2.1)	3.08	138	47
Chi2 Test (d.f)	3.193*(1)	2.069(1)				.182(1)	2.826*(1)			
Education Level of Mothers	Barpeta					All three Districts				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	9(13.4%)	1(20)	0.67	67	5	22(11.4)	11(11.7)	0.97	193	94
Literate	11(6.8%)	5(5.6%)	1.21	162	90	26(7.2)	13(4.5)	1.6	372	291
Chi2 Test (d.f)	2.624(1)	1.670(1)				2.833*(1)	6.362**(1)			

Source: Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution; *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d.f: Degree of Freedom

Maternal Education and Rural –Urban Differences of Child Mortality

In case of child mortality **(Table-9)**, reduction is significant in urban Kamrup (metro), both rural and urban Barpeta and both rural and urban area in all the three districts taken together.

From the above discussion it is cleared that rural-urban gap is highest in case of NNM, followed by post-neonatal mortality and child mortality. Maternal education has not been successful in reducing the rural-urban gap in all cases. This is also evident when we consider the rural-urban ratio.

Table 9 Association between Rural-urban Differences of Child Mortality and Education of Mother in the Three Districts of Assam

Education Level of Mothers	Kamrup (Metro)					Dibrugarh				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	-	5(8.9)	-	8	56	4(3.7)	1(4.0)	0.93	108	25
Literate	2(3.4)	-	-	58	147	2(1.6)	1(2.3)	0.69	124	44
Chi2 Test (d.f)	.284(1)	13.456*** (1)		66	203	1.002(1)	.169(1)		232	69
Education Level of Mothers	Barpeta					All three Districts				
	Rural death (%)	Urban Death (%)	R/U	Rural Birth	Urban Birth	Rural death(%)	Urban Death (%)	R/U	Rural Birth	Urban Birth
Illiterate	5(8.6%)	1(25)	0.34	58	4	9(5.2)	7(8.2)	0.63	174	85
Literate	1(0.7)	1(1.2)	0.58	151	85	5(1.5)	2(0.7)	2.14	333	276
Chi2 Test (d.f)	9.518***(1)	9.870*** (1)				5.736** (1)	15.080***(1)		507	361

Source: Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution; *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d.f: degree of freedom

Thus, maternal education which reduces significantly NNM in rural area in Kamrup (metro), but become significant in case of infant and child mortality reduction in urban area. In Dibrugarh, maternal education is significant in case of reduction of NND and infant death in urban area and PNND in rural area respectively. In Barpeta, maternal education is a significant factor in reduction of PNND in urban area and in case of child death in both rural and urban area. Thus advantage of mother's education is found more significant in Barpeta in reducing child death in both rural and urban area than in other two districts respectively. When all the three districts are taken together, maternal education becomes significant in case of PNNM reduction in urban area, infant and child mortality reduction in both rural and urban area respectively.

Other Factors Explaining Rural-Urban Differences of NNM, PNNM, Infant Mortality and Child Mortality

Since data are not comparable for explaining the rural-urban gap in individual district, we consider all the three districts together for finding out other factors which may explain rural urban differences of mortality experiences at different stages of infancy and childhood.

Another, important observation is that importance of education increases at higher ages of infancy and childhood as compared to lower ages. There might be some other factors which may act differently in rural and urban area that may explain the gap more clearly.

We consider individual level factors such as birth order, age of the mother at the time of birth, birth interval, sex of the child, type of birth. To capture the physical environment of the household, a household environment index is constructed by taking into consideration type of house, type of toilet, source of drinking water, measures used to purify water, availability of separate room for cooking. Social factors of the household include father's education; economic factors include economic status of the household, health care factors include ante-natal care and institutional delivery, immunization and breastfeeding. **Table-10** explains the factors responsible for differences in mortality in rural and urban area. In case of NNM, in rural area among the selected factors, birth interval, premature birth, receiving full ante-natal care, institutional delivery and fathers' education respectively has significant association with NNM whereas in urban area premature birth, economic status, receiving of full antenatal care and institutional delivery have emerged as significant factors in reducing NNM.

Table10 Percentage distribution of NNM, PNNM, IM and CM with Respect To Different Characteristics by Place of Residence

Explanatory Variables	Neo-natal Death			Post Neo-natal Death			Infant Death			Child Death		
	R	U	R /U	R	U	R/ U	R	U	R /U	R	U	R/ U
Birth Order												
First	6.1	3.7	1.64	2.9	2.9	1	8.8	6.5	1.35	1.1	1.5	0.73
2-3	4.3	2.7	1.59	3.5	2.1	1.67	7.6	4.7	1.61	3.1	2.8	1.11
4^{+}	6.2	11.1	0.56	6.8	6.2	1.79	12.5	16.7	0.74	11.9	13.3	0.89
Ch2 (d.f)	.86 (2)	3.256(2)		1.80 (1)	1.02 (1)		1.21 (2)	4.00 (2)		15.9*** (2)	8.16**(2)	
Maternal Age												
<20	7.4	5.5	1.35	3.4	5.8	0.59	10.5	11.0	0.95	1.8	3.1	0.58
20-34	4.3	2.7	1.59	3.6	1.6	2.25	7.7	4.3	1.79	3.4	2.0	1.7
35^{+}	6.2	5.0	1.24	-	-	-	6.2	5.0		-	5.3	-
Ch2 (d.f)	2.29 (2)	1.78 (2)		.560(2)	5.4* (2)		1.33 (2)	5.94*(2)		1.569(2)	.949 (2)	
Sex of the children												
Male	6.8	5.1	1.33	2.6	2.2	1.18	9.2	7.2	1.27	2.6	2.2	1.18
Female	3.8	2.1	1.80	4.4	3.2	1.37	8.0	5.3	1.51	2.9	2.8	1.03
Ch2 (d.f)	2.38 (1)	2.51 (1)		1.32 (1)	.400 (1)		.227 (1)	.605 (1)		.120 (1)	.041 (1)	
Birth interval												
<15months	11.3	3.7	3.05	3.7	3.8	0.97	8.9	6.6	1.35	2.3	3.0	0.77
15-30	2.1	2.9	0.72	4.8	2.2	2.18	12.2	5.9	2.07	2.2	2.3	0.96
30^{+}	4.2	4.3	0.98	2.0	2.3	0.87	5.0	5.7	0.88	3.5	2.3	1.52
Ch2 (d.f)	14.8*** (2)	.429 (2)		2.389 (2)	.730 (2)		4.34** (2)	.095 (2)		.700 (2)	.147 (2)	
Type of Birth												
On Time	4.4	2.4	1.83	3.4	2.5	1.36	7.6	4.8	1.58	-	-	-
Before Time	21.9	11.8	1.86	4.0	4.4	0.91	25	15.7	1.59	-	-	-
Ch2 (d.f)	18.01***(1)	11.08*** (1)		.026(1)	.597 (1)		11.4*** (1)	8.986***(1)				
Religion												
Hindu	4.6	4.0	1.15	3.4	3.1	1.09	7.9	7.0	1.12	2.7	2.1	1.28
Muslim	7.0	2.4	2.92	3.5	1.2	2.92	10.1	3.6	2.81	3.0	3.8	0.79
Ch2 (d.f)	1.319 (1)	.42 (1)		.107(2)	.843 (1)		.715 (1)	1.24(1)		.037 (1)	.708	
Caste												
General	5.5	2.6	2.11	3.4	1.8	1.88	8.7	4.4	1.97	3.5	2.3	1.52
Scheduled caste	7.3	6.8	1.07	5.1	4.4	1.16	11.9	11	1.08	5.4	3.0	1.8
ST	4.5	-	-	4.8	-	-	9.1	-	-	1.7	-	-
OBC	5.2	3.9	1.33	2.8	4.1	0.68	7.9	7.8	1.01	1.9	2.8	0.68
Ch2 (d.f)	.415 (3)	2.9 (3)		.956(3)	2.14 (3)		.744 (3)	4.87 (3)		2.21 (3)	.298 (3)	
Type of family												
Nuclear	4.7	2.9	1.62	3.4	3.1	1.09	8.8	5.9	1.49	2.8	1.5	1.87
Joint	7.1	4.8	1.47	3.4	1.2	2.83	8.3	6.8	1.22	2.8	3.1	0.90
Ch2 (d.f)	1.25 (1)	.90 (1)		.000(1)	.843 (1)		.027	.152		.000 (1)	.97 (1)	
Education of Father												
Illiterate	8.8	5.7	1.54	3.4	5.7	0.59	12.2	11.5	1.06	3.8	6.5	0.58
Literate	4.2	3.0	1.4	3.2	1.7	1.88	7.4	4.7	1.57	2.4	1.4	1.71
Ch2 (d.f)	4.505**	1.429		.012(1)	4.408** (1)		3.153*(1)	5.321** (1)		.766	6.44**(1)	
Economic Status												
Low	6.0	3.7	1.62	3.5	3.9	0.89	9.2	7.5	1.23	3.3	5.6	0.59
Medium	4.7	6.1	0.77	4.2	3.3	1.27	8.7	9.2	0.95	2.2	0.8	2.75
High	2.6	0.8	3.25	-	.8	-	2.6	1.7	1.53	-	0.8	-
Ch2 (d.f)	.954 (2)	4.976*(2)		1.588 (2)	2.39(2)		1.90(2)	6.548** (2)		1.55 (2)	7.72 (2)**	
Household Environment												
Poor	7.6	3.1	2.45	5.1	6.2	2.45	13.8	9.9	1.39	3.7	5.5	0.67
Medium	3.7	5.8	0.63	1.5	2.4	0.63	4.1	7.5	3.85	2.7	2.4	1.23
High	5.6	2.0	2.8	6.0	.7	0.46	10	2.6	3.85	-	0.7	-
Ch2 (d.f)	3.585(2)	3.15(2)		5.68 *(2)	6.855**(2)		14.306***(2)	6.019***(2)		2.438(2)	5.361*(2)	
Full Ante-natal care												
Yes	4.8	2.9	1.65	3.2	2.7	1.18	7.8	5.4	1.44	2.7	1.5	1.8
No	16.7	11.1	1.50	8.0	3.1	2.58	23.3	13.9	1.67	4.3	12.9	0.33
Ch2 (d.f)	7.86***(1)	6.332**(1)		1.657	.025		8.656***(1)	3.981** (1)		.226 (1)	15.118*** (1)	
Place of Delivery												
Institutional	3.6	2.5	1.44	-	-	-	6.9	5.3	1.30	1.7	1.5	1.33
Home	9.6	6.9	1.39	-	-	-	12.7	8.9	1.42	5.5	5.4	1.01
Ch2 (d.f)	8.3***(1)	4.24**(1)		-	-	-	4.801**(1)	1.679(1)		5.744**(1)	4.395**(1)	

Home	9.6	6.9	1.39	-	-	-	12.7	8.9	1.42	5.5	5.4	1.01
Ch2 (d.f)	8.3***(1)	4.24**(1)		-	-	-	4.801**(1)	1.679(1)		5.744**(1)	4.395**(1)	
						Immunization						
Yes	-	-	-	3.3	2.4	1.37	6.5	5.9	1.10	2.9	1.9	1.52
No	-	-	-	4.5	4.8	0.94	22.1	8.9	2.48	1.6	7.5	0.21
Ch2 (d.f)	-	-	-	.284(1)	.771 (1)		20.408***(1)	.615 (1)		.369 (1)	4.369** (1)	
						Breastfeeding Status						
Yes	-	-		3.2	2.3	1.39	7.4	6.1	1.21	2.5	2.1	1.90
No	-	-		9.1	8.0	1.14	33.3	8.0	4.16	10.0	8.7	1.15
Ch2 (d.f)				2.224 (1)	2.876*(1)		21.88***(1)	.143 (1)		4.063** (1)	3.888** (1)	

Source: Field Survey, 2014-15; Note: R indicates rural area and U indicates urban area; *** significant at 1% level, ** significant at 5% level, * significant at 10% level; d.f : Degree of Freedom

Thus, in rural area biological factors together with health care factors and education of father are significant factors affecting NNM. However, in urban area besides biological factors, i.e. premature birth and health care factors, economic status is also an important factor of NNM.

In case of PNNM, in rural area only household environment has significant association with mortality whereas in urban area, besides household environment, other factors viz., maternal age, education of father and breastfeeding status respectively also has significant association with mortality experiences.

In case of infant mortality, in rural area, birth interval, premature birth, education of father, household environment, full ante-natal care, institutional delivery, immunization and breastfeeding status respectively has significant association with mortality whereas in urban area, maternal age, premature birth, education of father, economic status, household environment, full antenatal care has significant association.

In case of child mortality, in rural area, birth order, place of delivery and breastfeeding status has significant association with mortality whereas in urban area, birth order, education of father, economic status, household environment, full antenatal care, place of delivery, immunization, breastfeeding status has significant association with child mortality.

Rural-Urban Differences of Community (Physical, Social) Infrastructural Facility

Since rural area experiences higher mortality than urban area, it is necessary to examine whether there are some gap regarding social infrastructure like medical facility and transport facility which might be reasons for high mortality experiences in rural area.

Here we examine distance of health facility centre and availability of sufficient transport facility in both rural and urban area.

Provision of Health Centre

From the above **Table-11**, it is clear that the health centres in rural areas are relatively far away in comparison to the urban area. 47.7% mothers in the rural areas responded that their health centres are three and more k.m. distant from their house. However, only 18.7% mothers said the same in urban area.

Availability of Transport

Adequate transport facility at the right time which is a necessity, may explain the rural-urban differences of mortality.

Table11 Rural-Urban Differences of Distance to the Nearest Health Centre

	Within 1 K. m	Within 2-3 K.m	3 and above K.m	Total
Rural	163 (29.5%)	126 (22.8%)	266 (47.7%)	555
Urban	185(48.1%)	128(33.2%)	72(18.7%)	385
Total	346 (37.2)	252(27.1)	332(35.7)	940

Source: Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution

Following **Table-12** shows that as compared to urban area (2.1%) a large percentage of mothers in rural area (29.73%) responded that they do not have sufficient transport facility.

Table 12 Rural-Urban Differences of Adequate Availability of Transport

Rural-Urban Differences of Adequate Availability of Transport			
Residence	Replied in the affirmative	Replied in the negative	Total
Rural	390 (71.7%)	165(29.73%)	555
Urban	377(97.9%)	8(2.1%)	385
Total	767	173	940

Source: Field Survey, 2014-15; Note: Figures in Brackets represent the percentage distribution

Thus, from the above analysis, it is clear that rural area lacks in infrastructural facility which might be responsible for more death experiences in rural area.

CONCLUSION

Analysis of mortality experiences in SAARC countries shows higher neo-natal, post neonatal, infant and child mortality in rural area than in urban area. Again, most of the states in India (NFHS-3) experience higher rural mortality than urban mortality. While the rural-urban gap of all components of infant and child mortality has declined over the years in India as a whole, but in case of Assam though it has declined for child mortality however, it has increased for neonatal, post-neonatal mortality and infant mortality.In our sample survey, except child mortality in Dibrugarh, rural areas experienced more death than urban areas in case of NNM, PNNM, infant mortality and child mortality in each of the three districts. Except NNM and infant mortality in Kamrup (Metro) and PNNM in Dibrugarh, maternal education has not been able to reduce the rural-urban gap. Among the individual level factors, birth interval and premature birth are found significant factors for NNM and infant mortality in rural area while premature birth is found to be significant in case of NNM and along with maternal age, it is also found significant for infant mortality in urban area. However, in case of PNNM, none of the individual

level factors is found significant in rural area, while in urban area maternal age is found significant. Birth order is seen as a significant factor in case of child mortality in both rural and urban area. Household environment is found to be a significant factor for PNNM and infant mortality both in rural and urban area and for child mortality in urban area only. Education of father is significant in case of NNM in rural area, PNNM in urban area, infant mortality both in rural and urban area and child mortality in urban area only. Household economic status is found to be significant in case of NNM, Infant mortality and child mortality in urban area only. Again among the health care variables, both full ANC and place of delivery are found significant in case of NNM in both rural and urban area, which loses its significance in case of PNNM. In case of infant mortality, full ante-natal care, institutional delivery, immunization and breastfeeding status are found significant in rural area whereas, full ANC is the only significant factor in urban area. In case of child mortality, breast feeding status has significant association in rural area whereas along with breastfeeding, full antenatal care, place of delivery and immunization are found significant in urban area.

Again, we have examined whether there are some gaps regarding social infrastructure like medical facility and transport facility which might be reasons for high mortality experiences in rural area. It is observed that

- The health centres in rural areas are relatively far away in comparison to the urban area.
- Again, as compared to urban area (2.1%), a large percentage of mothers in rural area (29.73%) responded that they do not have adequate transport facility.

Thus, rural area lacks in infrastructural facility which might be responsible for more death experiences in rural area.

Thus, our study confirms the findings of other studies that mortality rates in rural area are higher than in urban area. Again with some exception, maternal education was unable to reduce the rural-urban gap. There are some differences regarding factors affecting each of the outcome variables in rural and urban area which may explain the gap. Again rural area lacks in infrastructural facility which might be responsible for more death experiences in rural area.

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