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A comparative study of infant mortality behavior in Aligarh district due to different socio-economic determinants

Danish Qadeer*

Department of Geography, Aligarh Muslim University, Aligarh

***Corresponding author**

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Test of significance.

A B S T R A C T

This is a study of human mortality behavior due to different socio-economic determinants of phenomenon, based on a comprehensive field survey, conducted in Aligarh district of Uttar Pradesh, India during about two year period (June 2011- July 2013) and can be called Aligarh District Survey (ADS) for simplicity. For the purpose of survey stratified random sampling was applied. Two sampling frames rural and urban were designed to get a truly representative sample. The data was further categorized by the well known determinants namely education, religion, income and residence. Hindus and Muslim are two dominating religions of the district, so the mortality differential according to religious beliefs was also tested on the basis of averages Hindu and Muslim populations. The standard normal probability distribution was used to conduct Z-test for testing the significance of difference in means of the two populations. Subsequently a comprehensive statistical analysis of the data was carried out and the results were compared with the results of National Family Health Survey-2 (NFHS-2)..

Introduction

During the last two decades a lot of work has been done human mortality problems on global, continental and national scale by geographers. However, micro level regional studies are relatively few and it is now realized that small scale comprehensive are the need of the hour. In fact for better understanding of the nature and magnitude of human mortality problems facing the

world, micro regional studies are immensely important. In view of the above facts Aligarh district was chosen as the study area. The district falls in a politically and economically important area of North India.

Maternal mortality is a key indicator for maternal health and reveals dramatic

inequalities between and within countries that cannot be attributed to biological differences. Reducing maternal mortality relies on preventing unintended pregnancy through family planning and reproductive health. Skilled attendance at birth and emergency referrals are also required to reduce both maternal complications and resulting deaths. The characteristics of individual women like age, number of previous pregnancies, and education level play a role in determining whether they seek appropriate services, but the underlying factors influencing health behavior operate at inter-related levels of social influence: family and peers, the community in which women live and the health system available to them, wider cultural norms, the legal and policy environment and overarching governance structures.

Infant mortality is an indicator of population health and a measure of global health inequalities (Graham, 2007). Despite advances in medical sciences and acknowledgement of the role of hygiene and sanitation, survival of infants continues to be a challenge worldwide. Evidence suggests that the survival of infants after the age of one month is mainly influenced by the external environment in which the infant lives, (Bourgeois-Pichat, 1952), hence, non-health policies targeting the socioeconomic environment are as important as health policies for post-neonatal mortality (Marmot et al., 2006). Studies both in India and globally suggest that poverty and household income are important upstream determinants of infant mortality (United Nations Department of Economic and Social Affairs; 1954; Claeson et al., 2000). The Government of India's Mahatma Gandhi National Rural Employment Guarantee Act targets unemployment and underemployment, and

therefore poverty, by providing "at least 100 days of guaranteed paid employment every year to households whose adult members volunteer to do unskilled manual work" (The Mahatma Gandhi National Rural Employment Guarantee Act, 2005). Improved income triggers a cascade of structural and behavioural factors such as better housing and living conditions, food security, access to clean water and proper sanitation, access to health care, infant care and feeding practices that influence the proximal risk factors of infant mortality – malnutrition, diarrhoea and acute respiratory infections. Thus, while the employment programme addresses the central issues of rural poverty, it is likely to transcend its intended goals to improve infant survival.

A review of wage-for-employment programmes in 13 countries in Africa and three countries in Asia (Bangladesh, China and India) demonstrates their positive impact on household income and food security (Braun et al., 1992). However, these studies do not demonstrate the impact of such programmes on actual food consumption and nutrition of the target population, or the consequences on child health. Some studies have analysed the impact of employment programmes on infant-feeding practices (Saha et al., 2008) and child nutrition, (Mascie-Taylor et al., 2010) but none has demonstrated the composite pathways through which employment may influence child survival.

Education and Income are also the important variables for measuring the level of mortality of a nation. Many studies have shown that success in controlling mortality rate is very difficult to achieve without female literacy, studies have shown that education is the single most important variable which accounts for a large

reduction in mortality, in those countries which already experienced mortality decline. The higher the income level the better is expected to be the welfare status of the society. With the increase in income, parents opt for higher quality children rather than the numbers, devoting more of their time and income to their health and education.

In this context, the Population Division has undertaken the task of expanding its collection of mortality data disaggregated by sex and analyzing the data to estimate trends in sex differentials of childhood mortality using a consistent methodology. The major objective of this study, based on sample survey, is to estimate mortality levels, differentials and trends in Aligarh district. To facilitate the complete and accurate reporting of deaths several procedures were followed. Some basic points are taken into account while selecting the social factors of mortality differentials in the region of our selection, the Aligarh district. First point is that apart from availability and suitability of data, factors should be brief and effective. Secondly, they should be of current significance and indicative of current trends and attributes of social processes. Thus the present analysis is concerned with the selected social factors of mortality differentials, such as religion, education, economy and residence.

Methods

For conducting the survey, intensive questioning and probing was done for extracting accurate information from the respondents. In addition any available documents such as immunization card, ration card etc. were checked, that may provide important information. Finally for any interval of four or more years between

births, reasons were recorded, for long interval to help in identifying any live births that might have been omitted during the time period.

The respondents were separately asked about the number of daughters and sons who were still living with them, those living elsewhere and those who died. They were also asked about the year of their marriage and time taken before the first child was born. Enquires were made about their educational status, number of years spent in school, whether they were housewives or gainful workers, engaged in services or business. They were also enquired about the educational status of their husbands and children. As population size depends both on mortality and mortality, an important question about the number of children who died before reaching age 5 years, was also enquired. Despite, all the measures undertaken to improve quality of the data, the most common deficiencies in all sample surveys, namely omission of recording some births (especially births of children, who died at a very young age) and of determining the date of birth separately, may have remained in this survey too. This problem was especially found to be acute in rural areas where female literacy rate is quite low.

Sample Design, sample size and allocation

The sample design for this survey is a systematic, two stage stratified sampling for the households. The sample for the survey of Aligarh district was designed to provide statistical estimates for the district as a whole, for urban and rural areas, for Hindu-Muslim populations, for educated and illiterate. The universe in this case consisted of all rural and urban areas of the district. The overall target sample size was

set at completed interviews with eligible (14-49) married women. The target was set considering the size of the district, time and resources available for the survey and the need for separate estimates for various characteristics separately. The district was subdivided into four contiguous areas according to their geographical characteristics.

The Rural Sample: The Frame, Stratification and Selection

The list of inhabited villages in Aligarh district served as the rural sampling frame and a two stage sample design was adopted with the selection of villages in the first stage and house hold in selected villages in the next stage. The first level of stratification was geographic with the district subdivided into twelve blocks, considered different regions. The blocks are listed below:

1. Tappal
2. Chandous
3. Khair
4. Javan
5. Lodha
6. Dhanipur
7. Gaunda
8. Iglas
9. Atrauli
10. Bijoli
11. Gangiri
12. Akrabad

In the Rural Sample frame, villages five kilometers away from urban centers were considered. The villages in each block were divided into three strata according to the number of households in them.

Stratum 1: Villages with 750 or more households and more than 5kms away from urban centre.

Stratum 2: Villages with less than 750 households but more than 300 households.

Stratum 3: Villages with less than 300 households.

The next level of stratification was implicit and consisted of ordering the villages by the proportion of females to be selected. The overall sampling fraction, the probability of selecting a woman was computed as

$$f = n / N \text{ Where,}$$

n = number of women to be interviewed

N = population of eligible women in the village

Operation of listing of household was carried out in each of the selected primary sampling units four weeks prior to the data collection. This list provided the necessary frame for selecting household, at the second sampling stage. The household, to be interviewed were selected from the household lists using systematic sampling with equal probability. A random sample was selected using random number table.

The Urban Sample: The Frame, Stratification and Selection

For the urban sampling frame, the list of census enumeration blocks provided by District Population Office served as the sampling block. The Aligarh district information bureau booklet provided the details of urban centers in the district. There were thirteen urban centers in the district, the Aligarh city plus twelve block centers.

In the first level of stratification, all the urban centers were sub-divided into three strata according to direction of location. In the first strata the district headquarter was taken and in another two strata, urban

centers in northeastern and southwestern parts were clubbed. Apart from Aligarh in stratum one, the other two strata consisted of 7 and 5 urban centers respectively.

Strata 1: Aligarh city.

Strata 2: North-Eastern part of the district consisting of 7 urban centers that is Tappal, Chandaus, Khair, Jawan, Lodha, Gaundaand Iglas.

Strata 3: South-Western part of the district consisting of 5 urban centres that is Dhanipur, Atrauli, Bijoli, Gungeri and Akrabad.

In Aligarh city, two localities one predominantly Muslim (Jamalpur) and other predominantly Hindu (Vishnupuri) were selected randomly. A random sample of 50 household in each locality was selected for interview. Exhaustive questionnaire was presented to married woman and filled in presence of the male members in the family.

Similarly from stratum 2 and 3, one urban centre was randomly selected. From stratum 2 Jawan was selected and from stratum 3 Akrabad was selected. In second stage of sampling, primary sampling units, the household were again randomly selected.

The listing of households in selected places was done awarding them serial numbers. A random sample of 547 households was selected from urban frame, using random number tables. A total of 1422 sampling units were selected including 875 households from rural sample frame. It turned out that in the selected samples the religion wise breakup was 912 Hindus and 510 Muslims. The literacy breakup of the sample turned out to be that, it included

320 illiterates, 328 having education below High School and 774 above High School. The following table gives the sample breakup with regard to different characteristics.

Child mortality differentials

By Religion

The child mortality, death of children before age five has an important bearing on the overall population pressure on the country and ultimately the mortality potential. A very important question about the number of children who died before age five was asked in the questionnaire. The sex of the deceased child was also enquired into, which sheds light on sex discrimination information. Female infanticide being a very significant social phenomenon and a reality of Indian society, the question was asked directly and people somehow divulged the sex of the deceased children. This information was most difficult to extract.

Analysis of mortality differential on the basis of religion could be an interesting subject for population geographers. The average number of children who died before age 5 in Hindu families was much higher than Muslim families. For Muslim families it turned out to be 1.04 and for Hindu families it was 1.69.

Test of Significance

Again this apparent difference in the average has to be statistically tested for being the real difference or the mortality differential is due to sampling fluctuations only. For this, normal test of difference of means has to be applied, since the sample is quite large and asymptotic normal behavior of the variable is assured and justified. The

hypothesis to be tested is that there is no significant difference in the means or the samples have been drawn from same population. In other words the child mortality in both the Hindu and Muslim populations is same despite apparent difference in sample averages. The alternative hypothesis being that there is real difference in average child mortality religion wise.

Statistically it is written as,

To test $H_0 = M_1 = M_2$

against

$$H_1 = M_1 \neq M_2$$

where, M_1 & M_2 being the population averages of Hindus and Muslims respectively.

The test statistic is

$$Z = \frac{|\bar{X}_1 - \bar{X}_2|}{SE(\bar{X}_1 - \bar{X}_2)} \sim N(0, 1)$$

\bar{X}_1 = sample mean of Hindu population = 1.69

\bar{X}_2 = sample mean of Muslim population = 1.04

$$SE(\bar{X}_1 - \bar{X}_2) = .945$$

SE stand for standard error of the difference in sample means. The variable Z follows standard normal distribution and its critical value at 1% level of significance is 2.56.

The calculated value Z is,

$$Z = \frac{(1.69 - 1.04)}{0.945} = 0.687$$

The calculated value of Z (.6879) is less than the critical value of Z (2.56) at 1% level of significance. Thus the hypothesis is accepted and we conclude that there is no significant difference among child mortality between Hindus and Muslims despite the apparent difference in sample means. The figure 1 shows average number of children aged below five years who died in Muslim and Hindu families according to our survey.

Child and infant mortality rates reflect a country's level of socio-economic development, quality of life, and are used for monitoring and evaluating population welfare and health programs and policies. Questions on the number of death occurring to residents in each household during a particular time period have been included in demographic surveys in many countries and have often resulted in a substantial underreporting of deaths. In most countries male death rates are higher than female death rates, at nearly all ages, except south Asia, which has higher death rates for female over much of the age span (Tabutin, D. and Michal, 1998; Preston, Samuel, 1989). In Uttar Pradesh according to NFHS-2 death rates are higher for females than for males among children under age 5. An estimated CDR for Uttar Pradesh is 10.2 deaths per 1000 population based on NFHS-2 data (1997-98). For males and female it is 21.1 and 23.7 in NFHS-2 respectively. As compared to U.P. estimates, our estimates for Aligarh district, as a result of the survey, for males and female are 24.2 and 30.5 respectively. Table 2 shows child mortality by sex.

By Residence

According to NFHS-2, children in rural areas of U.P. experience a 55% higher death rate than urban children. It is

established that the underage five mortality rate has been falling at about the same rate in rural and urban areas. The overall infant mortality rate declines shortly with increasing education of mothers from a high of 105 deaths per 1000 live births to illiterate mothers to a low of 45 deaths per 1000 live births for mothers who have at least completed high school.

Rural mortality rates are considerably higher than urban mortality rate. Both infant and child mortality rates are more than 50% higher in rural areas than in urban areas. During the period ten years before the survey, all mortality rates declined in rural U.P. Under 5 child mortality rates declined in urban areas faster in rural areas (30%) than in urban areas (26%), according to NFHS-2.

According to the ADS, the child mortality rate for the Aligarh district is 75.2 deaths per 1000 live births in urban areas as compared to 110.4 deaths per 1000 live births of the children below age 5, in rural areas. Both these rates are lower than all U.P. rates for child mortality in rural as well as urban areas. The decline may be explained by the simple fact that NFHS-2 was conducted more than 10 years earlier than our survey.

Indicators of child health care

Children medical centers are almost nonfunctional in the district especially in rural areas. In most of the villages only traditional medication is available in the form of old time Vaid, Hakims and few registered medical practitioners, who have absolutely no knowledge of nature of child diseases. Even the most common disease namely cholera, cannot be treated in villages. The other important factor being the ignorance of parents about seriousness

of child diseases. They bring children to especial child clinics in the cities only at the last stage and due to poverty; most of them are unable to buy costly medicines.

NFHS-2 provides estimates of infant and child mortality and factors associated with the survival of young children in U.P. According to all UP survey conducted during 98-99, the infant mortality rate was 87 deaths at age 0-11 months per 1000 live births. Uttar Pradesh has the highest level of infant mortality among all states except Meghalaya. The child mortality rate, 39 deaths at age 1-4 years per 1000 children recorded in NFHS-2. Despite improvement in child survival in recent years, 1 in 12 children still die in first year of life and 1 in 8 die before reaching the age five.

Promotion of maternal and child health have been one of the most important objectives of the family welfare programme in India. The Government of India took steps to strengthen maternal and child health services as early as the first and second Five Year Plans (1951-56 and 1956-61). In 1992-93 the child survival and safe motherhood programme continued the process of integration by bringing together several key health activists. The programme seeks to integrate maternal health, child health with reproductive programmes for both women and men.

Child survival programmes should focus on specific groups of children with particularly high infant and child mortality rates, who live in rural and backward areas. Along with various socioeconomic groups, efforts to promote child survival need to concentrate on very young mothers and mothers whose births are closely spaced. Efforts to extend the use of temporary contraceptive methods for delaying and spacing births would help reduce infant

mortality as well as mortality. Promotion of maternal and child health should be most important part of child health programmes. It should encourage women deliver in a medical facility or if at home, with assistance from a trained professional and to receive checks ups after delivery. According to NFHS-2 only 15% of births in U.P. were delivered in a medical facility. Seventy five percent were delivered in the woman's own home and 10 percent in parents home. Trained health professional assisted with the delivery in only 22 percent of the cases. Thirty five percent of deliveries were assisted by a Dai (traditional birth attendant) and 43 percent were attended only by relatives, friends and other persons who were not health professionals. Although child immunization is an important component of child survival programmes in India, with efforts focusing on five preventable but serious disease, tuberculosis, diphtheria, tetanus, polio and measles, the results are not that encouraging. In U.P. only 21 percent of children age 12-23 months is fully vaccinated, another 49 percent have received some but not all of the recommended vaccinations and 30 percent have not been vaccinated at all. Immunization coverage has improved somewhat since NFHS-2 when 43 percent of children had not received any vaccination at all. Three most important causes of infant mortality have been identified in U.P., they are, fever, acute respiratory infection and diarrhea. Knowledge of appropriate treatment even for diarrhea is very low among the mothers. Only 36 percent of children received some form of oral rehydration therapy. The percentage of children who received some form of rehydration therapy has somewhat increased since NFHS-2. Undernourishment of both mother and child has remained a very important cause

of mortality in India as a whole. Overall 49% of women in U.P. have some degree of anemia.

During the survey in Aligarh district, it was found that a large majority of medical assistance seekers went to private practitioners rather than the Government Health Care Centers, complaining that government staff does not give them proper attention and they have to travel long distances (from rural areas to urban centers) for procuring proper medicines. It were mostly the RMP's who supplied fictitious (mostly) drugs to the patients. In government health centres, which are few and sparsely located, the question of distribution of drugs does not simply arise. All the government supplied drugs and medicines are sold to private medical practitioners. Unless government takes appropriate and stringent measure for improving the medical facilities in rural areas, the problem of child mortality will continue to be grave, thereby affecting the human mortality. Table 4 records the block-wise government primary health care.

Table 4 shows only a small improvement in the primary health centers in nine of the twelve blocks. While it is very distressing to note that in three blocks viz. Dhanipur, Iglas and Akrabad the number of primary health centers per lakh population has actually gone down during the last decade. In Dhanipur block it was 2.8 in 1990-91 but it has gone down to 2.1 in 2000-01. In Iglas block it was 3.1 in 1990-91, the number has actually decreased to 1.6 per lakh population, almost a 50% decline in the important facility as primary health centre. Similarly in Akrabad block the number of primary health centers per lakh population was 3.3 in 1990-91, but the number stands

Table.1 Sample Sizes

Income	Sample Size	Religion/ Residence	Sample Size	Education	Sample Size
A. <1000	400	Hindu	912	Illiterate	320
B. 1000-2000	300	Muslim	510	< High School	328
C. 2000-5000	500	Rural	875	>High School	774
D. >5000	222	Urban	547	-	-
Total	1422				1422

Fig.1 Average child mortality

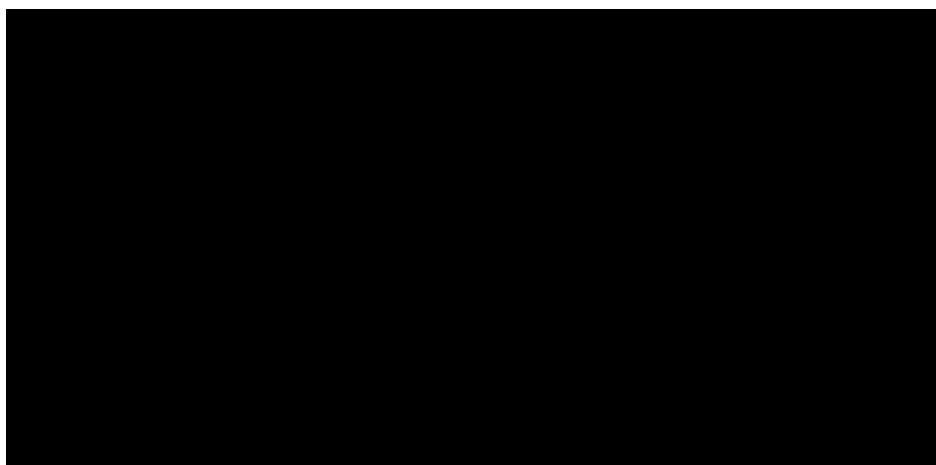


Table.2 Child Mortality by Sex

	Total	Male	Female
NFHS-2 (1997-98)	22.4	21.1	23.7
SRS (1997) U.P.	31.1	27.3	35.3
Aligarh Survey	27.35	24.2	30.5

(Source: NFHS-2, Aligarh District Survey)

Table.3 Child Mortality by Residence

	Urban	Rural
U.P.	85.8	129.5
ADS	75.2	110.4

(Source: NFHS-2, Aligarh District Survey)

Fig.2 Child Mortality by Residence

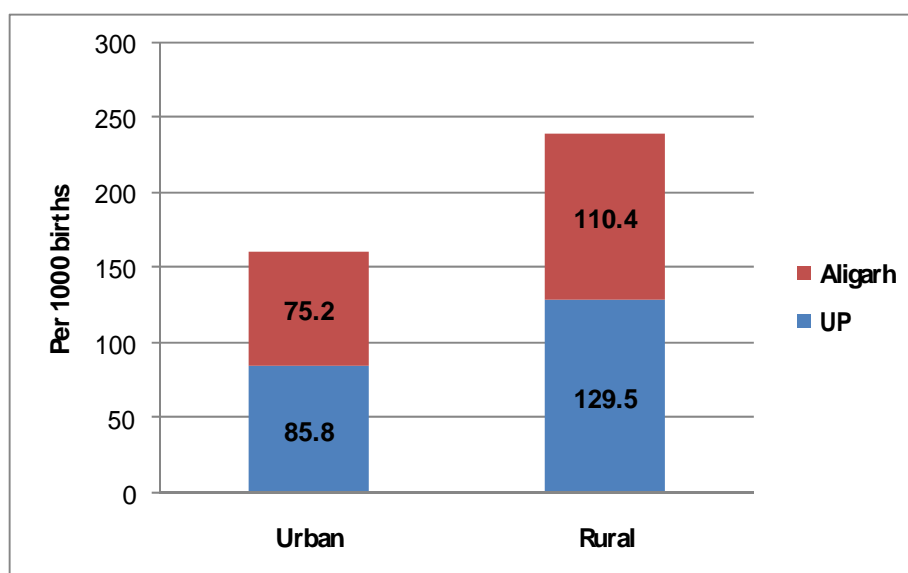


Table.4 Medical Facilities in Aligarh District

Number of Primary Health Centres/Lakh Population			
S. No.	Block	2000-01	2012-13
1.	Tappal	1.9	1.9
2.	Chandus	2.7	3.4
3.	Khair	2.8	2.8
4.	Javan	2.3	2.8
5.	Lodha	2.5	2.5
6.	Dhanipur	2.8	2.1
7.	Gonda	2.2	2.2
8.	Iglas	3.1	1.6
9.	Atrauli	2.4	4.3
10.	Bijauli	4.5	5.3
11.	Gangiri	1.5	1.5
12.	Akrabad	3.3	1.6

(Source: District Statistical Bulletin)

at 1.6 in 2000-01, a decrease of more than 50% in the facility.

Conclusions

It has long been understood that health outcomes are profoundly shaped not just by biological factors but also by the social, economic and cultural environment, including people's positions in various social hierarchies. So some basic points are taken into account while selecting the social factors of mortality differentials in the region of our selection, the Aligarh district. First point is that apart from availability and suitability of data, factors should be brief and effective. Secondly, they should be of current significance and indicative of current trends and attributes of social processes. Thus the present analysis is concerned with the selected social factors of mortality differentials, such as religion, education, economy and residence. Increasing evidence suggests that it is possible to improve health outcomes through action on these social determinants of health. Still, consensus on priority actions and investments to address these social determinants remains elusive.

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