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## **The Use of Widowhood Data for Investigation of Mortality Differentials in West Bengal — A District Level Analysis**

### **Introduction**

It is well known that direct measures of mortality from vital registration are only reliable in India in the case a limited number of spatial areas, mainly a few major cities. At the same time the Sample Registration System (SRS) has wide coverage but the level of aggregation is that of the state, not the district; and in the case of West Bengal these data have only been made available in recent years. Of the indirect methods of estimation of mortality, those using sample data on children ever born and children surviving and on questions regarding orphanhood are among the most frequently used. However, questions on widowhood, from which indirect estimates of mortality may also be obtained are unique in being asked at all the post Independent censuses and the data are available at the district level, separately for rural and urban areas. Unlike census survival techniques that could theoretically be applied at the district level, the almost insoluble problem caused by migration does not arise.

This is, therefore, a rich data source indeed. But as we will indicate in our discussion later, certain biases arise from employing the standard indirect techniques to data on widowhood obtained in this way, that tend to give systematic under-estimates of mortality, at least in the case of West Bengal. However, if one's main interest lies in the investigation of mortality differentials, for instance urban-rural, or in the ranking of units of analysis such as districts in order of mortality, and not so much in the level of mortality *per se*, then once again this method applied to the censuses may be exceedingly fruitful. The only alternative would be to mount costly sample surveys in each district of the State.

### **Theory of Widowhood Method and the Basic Equation**

The age specific proportions of ever married persons whose first spouse are still alive can be used for estimation of adult mortality. Theoretically information collected should refer to the survival of the first spouse. In most of the national censuses, data are not collected in this format and as a result bias arises in the estimation, the magnitude of such bias being

approximately proportional to the extent of remarriage. It is, however, believed that remarriage rates among widowed females are smaller than those among widowed males though quantitative estimates are lacking. This is one of the reasons why we have attempted to estimate the male adult mortality from information on widowhood status of females. As a first approximation estimates have been obtained assuming incidence of remarriage to be negligible for females. Subsequently the effect of remarriage on the estimated level of mortality has been examined.

The basic equation for estimation can be written as :

$$\frac{l_m(n)}{l_m(20)} = a(n) + b(n) \cdot MAM_f + c(n) MAM_m + d(n) NW_f(n - 5)$$

where  $NW_f(n)$  = proportions of ever married women not widowed in the age group  $(n, n + 5)$ ,  $MAM_m$  and  $MAM_f$  are the singulate mean ages at marriage for males and females.

$a(n)$ ,  $b(n)$ ,  $c(n)$  and  $d(n)$  are the estimated regression coefficients and  $\frac{l_m(n)}{l_m(20)}$  is the probability

of survival for males from age 20 to age  $n$ . (For details see UN Manual X, Indirect Techniques for Demographic Estimation).

### Discussion of the Method

There are certain sources of error in using the widowhood method and a brief description will be in order. To begin with there may be age misreporting in the census; *a priori* the direction of the bias this imparts will not be known, a problem shared by surveys also. •Secondly there may be misreporting of marital status. It is thought that young women in Indian society who have become widowed may declare themselves to be never married (Malaker 1981). This will impart an upward bias on estimates of survival. In both these cases of bias there is no reason to expect differences in the degree of bias according to districts in the state and hence our use of the method to detect differentials in mortality should not be vitiated.

A more serious problem is that for the widowhood method to be correctly applied the respondent should report his or her widowhood status with reference to the first marriage contracted in cases where remarriage has taken place. Whereas surveys designed for the purpose may specifically elicit this information, census investigation does not. There has been some discussion on the empirical importance of this problem (Bhat and Kambargi 1984). There is a general agreement supported by social surveys that the incidence of remarriage among the widowed is high among the Muslim population and generally higher for men than for women, men usually remarrying younger women. With regard to the Hindu population, surveys have come up with a wide range of results. The only study we know for West Bengal suggested a low incidence of remarriage (Malaker 1981).

It is worthwhile considering the quantitative effect on our estimates using the widowhood method for different degree of remarriage. Remarriage imparts an upward bias on survival

if the respondent reports her widowhood status in relation to her most recent marriage. For the sake of illustration let us assume that in the age group 30-34, 20 per cent of the widowed women have remarried and report themselves as 'married' rather than as 'widowed'. As a result, suppose 96% of the women in this age group are recorded as not widowed, rather than the true 95%. Using the Princeton West Model Life Tables (Coale and Demeny 1966) we would estimate the male survival level to be 20.2 when in fact the true level is 18.8. That is to say we overestimate male survival by 1.4 levels or about 3 years. If, however, remarriage rates were 10 percent in this age group at this level of mortality, the overestimation would be .6 level or about 1.5 years. This type of simulation is, however, sensitive to the model life tables used. For example if we had used instead the Princeton South Model Life Tables in the calculation above, assuming 20 percent remarriage, the estimated level would be 18.9 when the true level is 17.5. It is interesting to note that the difference between the levels corresponding to the two model life tables is 1.3, both for reported and the true proportions not widowed. In terms of life expectancy the difference is about 3 years. That is to say the bias involved in ignoring the problem of remarriage may be of much the same order as the bias involved in using the wrong life table. The details of the simulation exercise have been presented in the Appendix to this paper.

M. Bhat and R. Kambargi attempted to invert the simulation process we have used here. By assuming a particular level of mortality derived from other estimates, such as census survival, and assuming Princeton West Model they inferred the proportion of remarriage of widows that would be necessary to account for the proportions of widows as reported in the census. In the younger age group the proportion is around 40 per cent. Pursuing further the simulation attempted by us above, we find that if South Model is substituted for the West Model the inferred proportion of remarriage (according to Bhat and Kambargi methodology) turns out to be 20 percent. The fact is that we still know rather little about the actual incidence of remarriage among widows in India and from all indirect evidences the estimated 40 percent seems to be not acceptable in the present situation.

A final bias that has been mentioned in the literature relates to the incidence of mortality among the respondents themselves (Collver 1963). It has been shown to be the case in some Western Countries where mortality among the widowed is higher than that of the general population. If this is so we will again over estimate the survival levels. We have no evidence from India to help us with this problem. It should be noted that this bias affects any application of the widowhood method, whether to specifically designed survey data or to census reporting.

In order to minimise the effect of the potential bias arising from widow remarriage, and in particular to lessen the bias that might affect ranking of districts by mortality, in this analysis we have selected only those districts where the Muslim population was less than 25 per cent of the total in 1971. As has already been mentioned, analysis has been restricted to male mortality using data from female respondents for the age groups 30-34, 35-39 and 40-44. In practice the upward bias in survival seems to be more in the age groups 20-24 and 25-29 and age reporting is probably worse at the older ages though there are reasons to believe that women underestimate their age even when they reach their 40s. Princeton West Model Life Table has been used, though the implication of using the South Model has also been tested. The average of the survival levels obtained from the three age groups of women

has been used to obtain the level of mortality and an index of life expectancy at birth. The level so obtained would apply to the situation approximately six years prior to the census according to the time location technique (United Nations 1983). The details of such calculations have not, however, been presented here.

### Results of Estimation

Results have been presented for nine districts of West Bengal, separately for rural and urban, and for Calcutta metropolitan district. Estimates for West Bengal as a whole (rural and urban separately) have also been provided. Use has been made of the 1971 and 1981 censuses and the results obtained from a particular census will apply to the situation over the proceeding decade.

Combining rural and urban, the estimated mortality levels for West Bengal are 18.6 and 16.8 as obtained from the 1981 and 1971 censuses respectively (Table 1). The male life expectancy is around 60 and 56 years assuming the relationship between child and adult

TABLE 1 : ESTIMATED LEVELS OF SURVIVAL (PRINCETON WEST MODEL) FOR MALES  
FROM CENSUS DATA ON WIDOWHOOD : WEST BENGAL

Census Year	Age n	Survival Level		Census Year	Age n	Survival Level	
		Urban	Rural			Urban	Rural
1971	35	20.1	18.0	1981	35	20.5	20.0
	40	19.2	17.0		40	19.7	18.9
	45	13.5	13.5		45	17.7	16.1
Average of 35-4r		18.4 (59.8)	16.2 (54.6)			19.3 (16.9)	18.3 (56.6)
Urban—Rural Differential		+ 2.2 (5.2)				+ 1.0 (2.3)	
1981-1971 Differential				Urban		Rural	
				+ 9 (2.1)		+ 2.1 (5.0)	

SOURCE: *Census of India, 1971, 1981 West Bengal, Social and Cultural Tables.* Figures in parentheses denote life expectancies at birth.

mortality for the state to be the same as in the West Model Life Tables. Comparison with other estimates is difficult owing to lack of estimates for West Bengal. For India as a whole estimates relating to the 1971-81 decade put the life expectation at about 53 years (Census of India 1984). West Bengal is believed to enjoy lower mortality than India as whole. The SRS crude death rate (Government of India 1985) for India in 1981 was 12.5 per thousand compared with 11.0 for West Bengal which is consistent with 5 years difference in life expectancy. It would appear from this that our estimates may be on the high side by about

2 to 4 years (which would come out if *inter-alia* remarriage of widows was approximately 10-20%). Use of the South Model lowers the estimate by about the same magnitude but implies an infant mortality rate that is too high for West Bengal judging again from the SRS figures (Government of India 1987).

### The Differentials

There is a range of ten years of life from the lowest to the highest estimate of life expectancy over the nine rural districts v/e have analysed from the 1981 census data. The corresponding urban range, including additionally Calcutta metropolitan district, comes to 12 years; one district Bankura distorts this range, however, and it becomes 5 years if Bankura is treated as outlier. In general we can say that the range over the districts in 1981 is a little less than 10 years. For 1971 the rural range is 15 years, though once again the exclusion of a single district, Jalpaiguri would reduce it considerably to 10 years. Our first comment would be to draw attention to the extent of these regional differentials within a single State; we also note a tendency for it to decline over time.

The difference between the urban and the rural levels of life expectation in each district in 1981 ranges from about 7 years (in Bardhaman) to less than a year (in Darjiling and Bankura). In 1971 the range goes from 13 (in Hugh where, however, the rural data look deceptive) or 10 (in Bardhaman) to approximately zero. First it may be noted that no where is the rural life expectation clearly above the urban. Secondly the differential seems to be reducing over time. For West Bengal as a whole the rural-urban differential has reduced from 5 years to 2 years over the ten years in question (Table 1). The reduction in differentials deserves some comment. It is of course possible that some of the biases involved in this method of estimation may have changed over time. However, if our estimates are substantially correct then we can argue that either the rural and the more backward districts are catching up — a fairly optimistic interpretation, or that the improvements in the urban and more developed districts are slowing down — a more pessimistic interpretation. The latter would be consistent with deteriorating urban environments. What is also disturbing is the perpetuation of the rural-urban gap in a relatively well developed district such as Bardhaman. Clearly the urban development associated with the rapidly expanding Asansole-Durgapur industrial belt made little impact on the rural hinterland. This makes an interesting comparison with the differential we have found, in a separate study within Durgapur itself: the difference in life expectation in the 1980s between the working class areas of the township and the bustees was 8 years (Bapat, Crook and Malaker 1989). All this raises questions on the ability of industrial developments to become spontaneous catalysts for well distributed improvements in social welfare in the locality.

### Ranking of the Districts

It is immediately striking that the top three rural districts in terms of life expectancy in 1971 are from extreme north of the state (Table 2). It would be tempting to attribute this phenomenon to climatic factors; however the ranking is broken by 1981 with Koch Bihar

appearing much lower down the list. Hence social factors are perhaps much more likely to be at work. In this context it may be noted from the census employment data that these

TABLE 2 : RANKING OF SELECTED DISTRICTS (RURAL) BY SURVIVAL LEVELS DERIVED FROM WIDOWHOOD DATA FOR WEST BENGAL

1971			1981		
District	Level	$e^{\circ}_0$	District	Level	$e^{\circ}_0$
Jalpaiguh	19.0	61.2	Darjiling	19.9	63.4
Koch Bihar	16.7	55.8	Medinipur	18.7	60.5
Darjiling	16.7	55.8	Jalpaiguri	18.3	59.6
Harora	15.9	53.9	Haora	18.3	59.6
Barddhaman	15.6	53.2	Barddhaman	17.8	58.4
Medinipur	15.6	53.2	Hugli	17.7	58.2
Puruliya	14.7	51.2	Puruliya	17.1	56.7
Hugli	11.9	46.8	Bankura	16.4	55.1
Bankura	12.5	45.8	Koch Bihar	15.9	53.9

SOURCE: See Table 1.

northern districts have substantially lower proportions of the rural workforce classified as labourers than do the other districts we have selected for this study and further that by 1981 those proportions increased substantially in Koch Bihar and Jalpaiguri whereas in most of the other districts there was a decrease, or only a marginal increase. It would, however, require micro level work to establish the validity of a relationship between the percentage of landless labourers and mortality level within the state. Given the change of ranks just described the rank correlation coefficient between the 1971 and 1981 ordering works out at only .35. But notably also Puruliya, Hugli and Bankura remain the last four districts at both the censuses.

For urban areas there is somewhat greater stability in the ranking between the two censuses with the correlation coefficient coming to .60. Barddhaman with its major industrial developments in the Durgapur-Asansole complex tops the list of life expectancy in both 1971 and 1981 (Table 3). The components of the Calcutta urban agglomeraton contained within Harora, Hugli and Calcutta metropolitan district itself come further down the list. Bankura district, whose urban centres are poorly developed with very little modern industry, is at the bottom of the list at both censuses, and similarly Puruliya is lower in rank at both dates.

TABLE 3 : RANKING OF SELECTED DISTRICTS (URBAN) BY SURVIVAL LEVELS DERIVED FROM WIDOWHOOD DATA FOR WEST BENGAL

1971			1981		
District	Level	$e^{\circ}_0$	District	Level	$e^{\circ}_0$
Bardhaman	20.0	63.6	Bardhaman	20.8	65.5
Haora	19.7	62.9	Darjiling	19.6	62.7
Darjiling	19.7	62.9	Medinipur	19.4	62.2
Koch Bihar	19.0	61.2	Haora	19.3	61.9
Jalpaiguri	18.6	60.3	Calcutta	19.2	61.7
Hugli	18.3	59.6	Hugli	19.0	61.2
Medinipur	18.2	59.4	Puruliya	18.7	60.5
Calcutta	17.2	56.9	Koch Bihar	18.6	60.3
Puruliya	14.3	50.2	Jalpaiguri	18.6	60.3
Bankura	12.9	46.8	Bankura	15.8	53.7

SOURCE: See Table 1.

There is a degree of coincidence in ranking between the rural level and their respective urban levels at both the 1971 and 1981 censuses. The rank-correlation coefficients are .62 and -.58 respectively. Common social factors affecting the population of both rural and urban areas may be the cause - except in the larger towns the majority of the migrants are local in origin. If, for example, landlessness is a feature of a rural area that depresses its life expectancy, the migration of landless labour to nearby urban areas will lower life expectancy there also. However, we have *already* pointed to exception to this experience, for instance in Bardhaman district. The latter case is all the more striking when one considers that Bankura district is contiguous with Bardhaman separated by the Damodar river. Urban areas of Bardhaman, which include Durgapur, top the list of urban life expectation in the state whereas neighbouring rural Bankura remained at the bottom. According to our estimates there was over 10 years difference in life expectation between these two areas in the 1970s. Various socio economic indices have been used to show how pockets of rural backwardness exist alongside a relatively prosperous urban development, but till now contrasting indices of mortality have not been used to illustrate this fact.

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**APPENDIX**

**Effect of Remarriage on Survival Levels and Life Expectancy in Estimation of Adult Mortality by Widowhood method**

Let  $T$  and  $R$  be the true and the reported proportions never widowed out of evermarried (considering the survival of the first spouse) in an age groups;  $P$ =proportion of the widowed who remarry. Thus

$$R = 1 - (1 - T) (1 - P)$$

$$T = \frac{R - P}{1 - P}$$

In the following table calculations have been shown using data on widowhood for females from the 1981 census of West Bengal with three different values of  $P$  namely .1, .2 and .3.

PROPORTION NEVER WIDOWED

Age group	R	T		
		P=.1	P=.2	P=.3
30-34	.9578	.9531	.9472	.9397
35-39	.9256	.9173	.9070	.8937
40-44	.8518	.8353	.8148	.7883

MORTALITY LEVELS

n	<i>West Model</i>				<i>South Model</i>			
	Mortality level				Mortality level			
	T				T			
	R	P=.1	P=2	P=3	R	P=.1	P=2	P=3
35	20.2	19.6	18.8	17.8	18.9	18.3	17.5	16.4
40	19.1	18.4	17.5	16.4	17.8	16.9	15.9	14.5
45	16.5	15.5	14.2	12.7	14.6	13.4	12.0	10.2
Average	18.6 (60.2)	17.8 (58.4)	16.8 (56.0)	15.6 (53.2)	17.1 (56.6)	16.2 (54.6)	15.1 (52.1)	13.7 (49.0)

- NOTES**
1. The mortality levels are based on  $\frac{[1_m (n)]}{[1_m (20)]}$  values. Figures in parentheses denote the life expectancies at birth.
  2. If we allow for 10 to 20 percent of remarriage among widowed females, and the variations with different models, the range of life expectancy may be taken as 52 to 58 years for the decade 1971-81. This analysis is very illuminating and the results seem to be at par with those obtained from other sources.