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Mortality Change In India: 1970-85

Introduction

MORTALITY transition has been a neglected area in demographic research in India in recent years. This neglect has largely been due to the overriding concern about exceptionally high levels of fertility in the country and their implications to population growth. Of late, there has been some attention towards infant and child mortality but even this attention has largely been in the context of the relationship of fertility with the survival of infants and young children.

But this does not mean that all is satisfactory on the mortality front in the country. There is ample evidence to suggest that mortality decline had slowed down considerably during the 1970s. Moreover, despite the fact that there has been a secular decline in mortality, very little is known about the structure of mortality change. There has been some attempt to analyze the age pattern of mortality in the country (Roy and Lahiri, 1988; Parasuraman, 1990) but the emphasis of these studies has not been on the contribution of different age groups to the total change in mortality. While Roy and Lahiri had restricted the analysis and discussion to the levels and trends of mortality in the country, Parasuraman has concentrated on identifying the most appropriate model life table for describing mortality in the country and for its different States. Very little is known at present on how different age groups have contributed to the mortality change that has taken place in the country.

The present paper is an attempt in this direction. It attempts to analyze the contribution of the mortality in the first year of life and mortality beyond the first year of life to total mortality change in the country during the period 1970 through 1985 that has taken place in the country as well as in its major States. The analysis is extended to different sub-groups of the population also to discuss mortality differentials too.

Data Source

The analysis is built upon the information provided through the Sample Registration System in the country. Using this information, the Registrar General of India has prepared life tables for the periods 1970-75, 1976-80 and 1981-85 for the country as a whole as well as for its 15 major States (Government of India, 1984, 1986, 1989). These life tables have been prepared for the combined population as well as separately for male, female, rural and urban populations. The information on the expectation of life at birth and expectation of life at age one available from these life tables has been used in this analysis.

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Although there has been some discussion about the quality of information generated through the Sample Registration System, yet the life tables prepared by the Registrar General of India are not based on the adjusted age specific death rates. Rather, unadjusted age specific death rates have been used in the construction of the life tables as it was implicitly assumed that the under-reporting in the Sample Registration System is not age selective. It may, however, be pointed out that whatever under-reporting in the Sample Registration System has been detected, it is for the period prior to 1980. After 1980, the quality of the data generated through the Sample Registration System have been found to be quite satisfactory.

Methodology

The method that we employ here decomposes total change in mortality from all ages into two components—change due to the change in the risk of death in the first year of life and the change due to the change in the risk of death beyond the first year of life. We have reasons to divide the whole population in the above manner. First, determinants of mortality in the first year of life are entirely different than those for the rest of the *life*. Second, the approach to reduce mortality in the two groups is based upon entirely different considerations.

The indicator that has been used to measure mortality in this analysis is the expectation of life at birth (e_0). If $p(a)$ is the probability of survival up to age a , then we can write

$$e_0 = 0.5 [1 + p(1)] + e_1 p(1) \quad (1)$$

where e_1 is the expectation of life at age 1. It is now easy to show that

$$e_0 = p(1) e_1 + (0.5 + e_1) p(1) \quad (2)$$

where

$$e_0 = e_0(t_1) - e_0(t_2)$$

$$e_1 = e_1(t_1) - e_1(t_2)$$

$$p(1) = p_1(t_1) - p_1(t_2)$$

$$e_1 = (e_1(t_1) + e_1(t_2))/2$$

$$p(1) = (p_1(t_1) + p_1(t_2))/2$$

Noting that $p(1) = (1 - q(1))$ where $q(1)$ is the risk of death in the first year of life, equation (2) can also be written as

$$e_0 = (1 - q(1)) e_1 - (0.5 + e_1) q(1) \quad (3)$$

First part of the right hand side of equation (2) or (3) gives the contribution of the change in the risk of death after first year of life while the second part measures the contribution of change in the risk of death in the first year of life. It may, however, be noticed that the expectation of life at age one is some sort of a weighted average of age specific death rates beyond age 1. Hence, it may so happen that two different age schedules of mortality may lead to same value of the expectation of life at age 1.

Mortality Change in India: 1970-85

According to the life tables prepared by the Registrar General of India, the expectation of life at birth in country during 1970-75 was 49.7 years which increased to 55.5 years during the period 1981-85—an increase of almost 5.8 years. In other words, the expectation of life at birth in the country increased, on average, by about 0.58 years per year between 1970 and 1985. This increase in the expectation of life at birth, however, was not uniform throughout the period under reference. This increase was relatively slow during the first half of the period but gained some momentum after 1978.

TABLE 1 : LEVELS AND CHANGES IN EXPECTATION OF LIFE AT BIRTH IN INDIA : 1970-85

Level	1970-75	1976-80	1981-85	Total gain
< 45	Uttar Pradesh (15)			
45-50	Andhra Pradesh (9) Assam (14) Gujarat (10) Madhya Pradesh (12) Orissa (13) Rajasthan (11) Tamilnadu (8)	Madhya Pradesh (13) Orissa (14) Uttar Pradesh (15)		
50-55	Himachal Pradesh (7) Maharashtra (6)	Andhra Pradesh (9) Assam (12) Gujarat (10) Haryana (7) Rajasthan (11) Tamilnadu (8) India	Assam (13) Madhya Pradesh (14) Orissa (12) Rajasthan (11) Uttar Pradesh (15)	6.41 4.43 7.33 5.13 7.04
55-60	Haryana (3) Jammu & Kashmir (4) Karnataka (5) Punjab (2)	Himachal Pradesh (4) Jammu & Kashmir (3) Karnataka (6) Maharashtra (5)	Andhra Pradesh (8) Gujarat (9) Tamilnadu (10) India	9.52 8.74 7.35 5.79
60-65	Kerala (1)	Punjab (2)	Haryana (7) Himachal Pradesh (6) Jammu & Kashmir (5) Karnataka (4) Maharashtra (3) Punjab (2)	2.80 7.80 4.25 5.43 6.01 5.20
565		Kerala (1)	Kerala (1)	6.36

Note : Figures in the parentheses denote rank.

Across the major States of the country, expectation of life at birth varied widely in terms of both level as well as change. But the State with highest expectation of life at birth (Kerala) and the State with the lowest expectation of life at birth (Uttar Pradesh) remained unchanged throughout the period. Other States whose rank did not change during the period are Punjab and Rajasthan. On the other hand, 8 States improved their ranks on the scale of expectation of life at birth with maximum improvement observed in Maharashtra, while four states lost

their ranks with maximum loss noticed in Haryana which slipped from 3rd rank during 1970-75 to 7th during 1976-80. Since then, however, rank of the state has remained unchanged.

Changes in the rank of different states on the scale of expectation of life at birth have been due to the difference in the gain in the expectation of life at birth in different states during the period under reference. In Haryana, for example, expectation of life at birth increased by only 2.8 years during the period. In this state, expectation of life, in fact, decreased from 57.5 years to 54.9 years in between 1970-75 to 1976-80. It showed an increasing trend only after 1980. By contrast, maximum gain in the expectation of life during the period under reference has been observed in Andhra Pradesh where the average life of an individual increased by more than 9.5 years during this period. In Gujarat too, expectation of life increased at the rate of almost one year per year.

Compared to the expectation of life at birth, there has been much less variation in the expectation of life at age one across the states of the country. For the country as a whole, expectation of life at age one increased by 4.7 years during the period under reference—from 56.2 in 1970 to 60.9 in 1981-85. Interestingly, unlike the expectation of life at birth, increase in the expectation of life at age one was more or less uniform throughout the period under reference.

TABLE 2 : LEVELS AND CHANGES IN EXPECTATION OF LIFE AT AGE ONE IN INDIA : 1970-85

Level	1970-75	1976-80	1981-85	Total change
< 55	Andhra Pradesh (12) Assam (14) Madhya Pradesh (11) Orissa (12) Uttar Pradesh (15) Tamilnadu (10)	Uttar Pradesh (15)		
55-60	Gujarat (8) Himachal Pradesh (7) Jammu & Kashmir (5) Karnataka (4) Maharashtra (6) Rajasthan (9)	Andhra Pradesh (9) Assam (12) Gujarat (8) Madhya Pradesh (13) Orissa (14) Rajasthan (11) Tamilnadu (10)	Assam (15) Madhya Pradesh (13) Rajasthan (12) Uttar Pradesh (14)	5.2 4.1 4.1 6.6
60-65	Haryana (3) Kerala (1) Punjab (2)	Haryana (5) Himachal Pradesh (3) Jammu & Kashmir (7) Karnataka (6) Maharashtra (4)	Andhra Pradesh (9) Himachal Pradesh (4) Jammu & Kashmir (6) Karnataka (5) Maharashtra (6) Orissa (11) Tamilnadu (10) India	8.50 6.40 4.90 4.60 5.70 8.00 6.20 4.70
2 65		Kerala (1) Punjab (2)	Haryana (3) Kerala (1) Punjab (2)	3.10 4.90 3.40

Note : Figures in the parentheses denote rank.

Among the major states of the country, expectation of life at age one remained highest in Kerala. But it was lowest in Uttar Pradesh in 1970-75 and 1976-80 only. In 1981-85, lowest expectation of life at age one has been observed in Assam. Similarly, highest gain in the expectation of life at age one was again noticed in Andhra Pradesh while in Haryana gain in the expectation of life at age one was also lowest among the major states of the country. As may be seen from Table 2, in many states of the country, gain in expectation of life at age one during the period under reference was not sufficient enough to maintain their ranks.

Finally, the probability of survival during infancy increased from 0.868 in 1970-75 to 0.896 in 1981-85 in the country. This means that 28 more infants could be saved from dying during infancy in 1981-85 as compared to 1970-75. Most of this increase in the probability of survival during infancy has been confined to the period after 1976-80 during which, this probability improved by 0.020 absolute points. By contrast, prior to 1976-80, infant survival probability increased by only 0.008 absolute points.

Variations in the infant survival probability across the major states of the country have been found to be extremely wide. In Kerala, only 32 of the 1000 new born failed to reach their first birth day around 1981-85 whereas in Uttar Pradesh, this number was found to be 150. Both these states have remained at the two extremes on the scale of infant survival probability during the period under reference. On the other hand, eight states improved their ranks while two states lost their ranks on this scale. Maximum gain in the infant survival probability has been observed in Gujarat while in Haryana, there has been a steep decline in the rank. In Jammu and Kashmir, infant survival probability decreased instead of increasing during the period under reference.

TABLE 3 : LEVELS AND CHANGES IN FIRST SURVIVAL PROBABILITY IN INDIA: 1970-85

<i>Levels</i>	<i>1970-75</i>	<i>1976-80</i>	<i>1981-35</i>	<i>Total change</i>
< 0.850	Uttar Pradesh (15)	Uttar Pradesh (15)		
0.850-0.875	Assam (10) Gujarat (13) Madhya Pradesh (14) Orissa (12) Rajasthan (11) India	Madhya Pradesh (14) Orissa (13) Gujarat (12) Rajasthan (11)	Madhya Pradesh (12) Orissa (13) Uttar Pradesh (14)	0.016 0.008 0.026
0.875-0.900	Andhra Pradesh (8) Himachal Pradesh (7) Punjab (6) Tamilnadu (9)	Andhra Pradesh (10) Assam (10) Haryana (8) Himachal Pradesh (5) Punjab (7) Tamilnadu (6)	Assam (9) Gujarat (10) Rajasthan (11) India	0.034 0.035 0.028 0.028
0.900-0.925	Haryana (4) Karnataka (3)	Karnataka (3) Maharashtra (4)	Andhra Pradesh (6) Haryana (8) Himachal Pradesh (5) Tamilnadu (7)	0.031 0 0.032 0.030
0.925-0.950	Jammu & Kashmir (2) Kerala (1)	Jammu & Kashmir (2)	Jammu & Kashmir (4) Karnataka (2) Maharashtra (3) Punjab (4)	-0.005 0.019 0.026 0.031
≥ 0.950		Kerala (1)	Kerala (1)	0.025

As far as mortality situation in different sub-groups of population is concerned, there has remained a big gap between rural and urban populations in all the three mortality indicators used here. But the pace of mortality decline appears to be faster in the rural areas as compared to the urban areas of the country. The expectation of life at birth in the rural areas increased by 5.73 years during the period under reference whereas, in the urban areas of the country, this increase was of the order of 4.14 years only. Corresponding figures for the expectation of life at age one are 4.7 and 2.7 years respectively. On the other hand, the infant survival probability increase was by 0.029 absolute points in the rural areas whereas it increased by only 0.025 absolute points in the urban areas during the period. Increase in the expectation of life at age one in the urban areas of the country was extremely slow during the period 1970-75 to 1976-80 whereas the infant survival probability was fairly rapid in the rural areas during the period 1976-80 to 1981-85.

TABLE 4 : MORTALITY LEVELS AND CHANGES IN DIFFERENT POPULATION SUB-GROUPS IN INDIA : 1970-85

Group	Level			Change		
	1970-75	1976-80	1981-85	1970-75 to 1976-80	1976-80 to 1981-85	1970-75 to 1981-85
<i>e(0)</i>						
Rural	48.0	50.6	53.7	2.54	3.19	5.73
Urban	58.6	60.2	62.8	1.58	2.56	4.14
Male	50.5	52.4	55.4	1.92	2.98	4.90
Female	49.0	52.1	55.7	3.06	3.61	6.67
<i>e(1)</i>						
Rural	54.6	57.4	59.6	2.50	2.20	4.70
Urban	63.3	64.0	66.0	0.70	2.00	2.70
Male	57.0	58.6	60.8	1.60	2.20	3.80
Female	55.6	58.6	61.1	3.00	2.50	5.50
<i>q(1)</i>						
Rural	0.142	0.135	0.113	0.007	0.022	0.029
Urban	0.089	0.074	0.064	0.015	0.010	0.025
Male	0.130	0.121	0.104	0.009	0.017	0.026
Female	0.135	0.127	0.104	0.008	0.023	0.031

A similar situation exists in case of male and female populations at the national level. The pace of mortality decline has been faster in females as compared to males. Because of this differential pace of mortality decline, the expectation of life at birth which was higher for males in 1970-75 became higher for females in 1981-85. During the period 1970-75 to 1976-80, expectation of life at birth as well as at age one increased very slowly. On the other hand, increase in the expectation of life at birth as well as at age one was almost uniformly spread over the period under reference. In case of infant survival probability, in both males as well as females, the increase was extremely slow during the period 1970-75 to 1976-80. But in the period after 1976-80, infant survival probability increased at a much faster rate in females as compared to males.

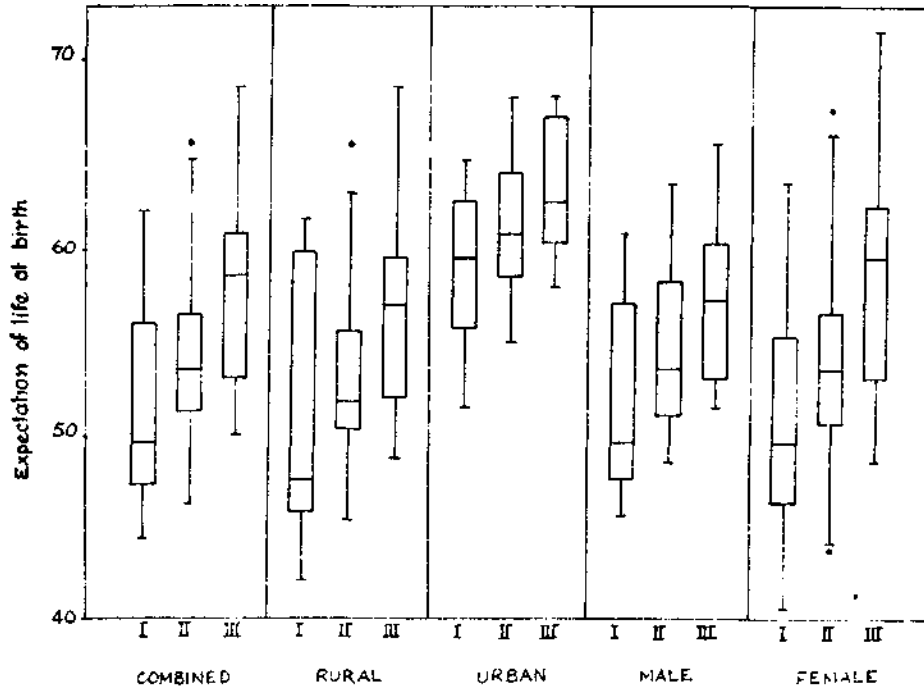


Fig. 1. Expectation of Life at Birth in India : 1970-85

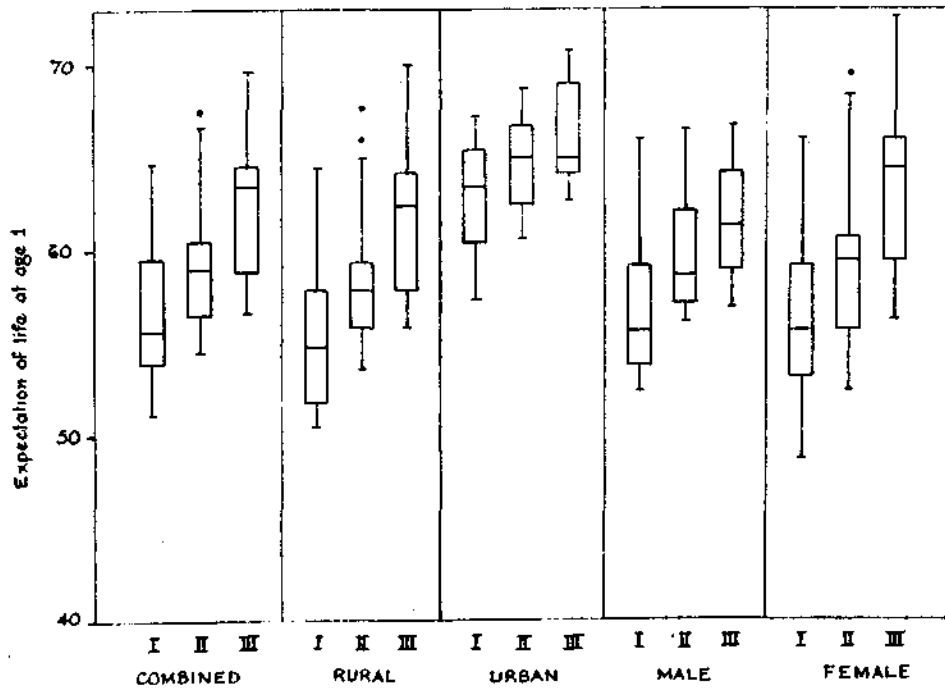


Fig. 2. Expectation of Life at Age One in India : 1970-85

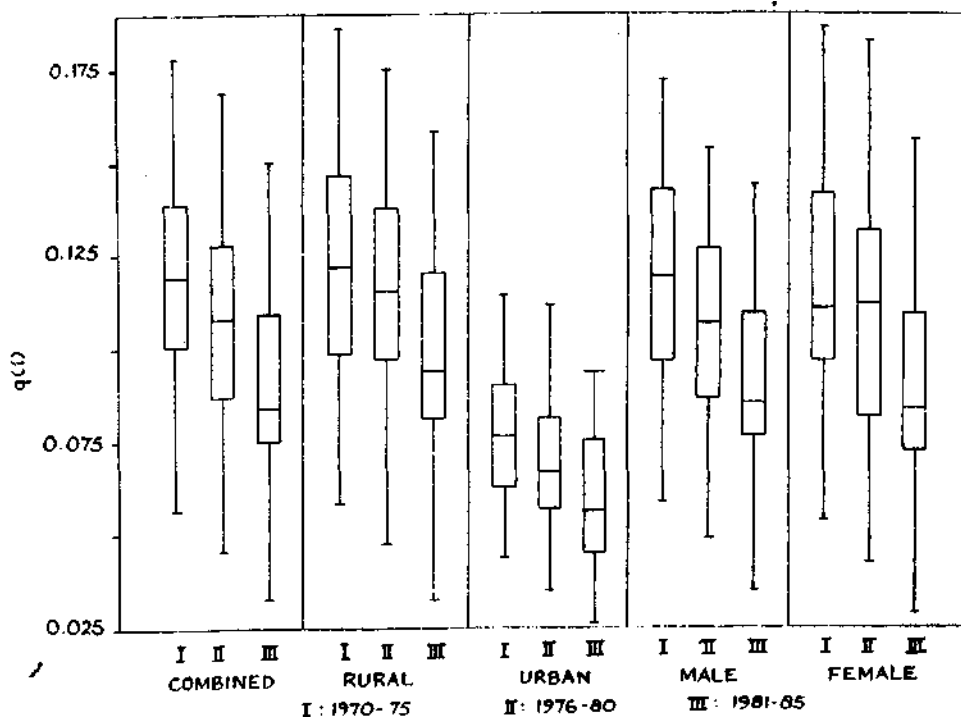


Fig. 3. Infant Mortality in India: 1970-85

Regional variations of the three measures of mortality in different sub-populations are summarised in Tables 5 through 7 and are presented in box and whisker plots in Figures 1 through 3. These tables reveal interesting variation in the inter-quartile range (IQR) in different sub-populations. In both expectation of life at birth as well as expectation of life at age one, IQR decreased during the period 1976-80 from a high of 1970-75 but increased again during 1981-85. On the other hand, in case of probability of death during first year of life, the IQR showed a continuous declining trend in all sub-populations except the urban population where, like the expectation of life, it also increased during the period 1981-85. This shows that during the period 1976-80, inter-state disparities in mortality levels appear to have reduced. But these disparities have increased again during the period 1981-85. This variation in the inter-state disparities in mortality is largely due to the variation in the inter-state disparities in mortality after age 1 as the inter-state disparities in the probability of death during the first year of life have reduced monotonically since 1970 in all sub-populations except the urban population.

Another interesting observation of Figures 1-3 is the presence of outliers. It was only during the period 1976-80 that outliers could be detected in case of expectation of life at birth as well as expectation of life at age one. No outlier could be detected in case of probability of death during the first year of life in any of the period under reference. In case

of expectation of life at age one, Kerala and Punjab were having mortality after age one significantly lower than the rest of the states of the country. However, in case of expectation of life at birth, only Kerala was having a significantly lower mortality than the rest of the states. On the other hand, Uttar Pradesh was having a significantly higher mortality than the rest of the states of the country. However, there was no outlier in the inter-state distribution of all the three measures of mortality during the period 1970-75 as well as during the period 1981-85.

TABLE 5 : SUMMARY MEASURES OF REGIONAL DISTRIBUTION IN $e(t)$

<i>Population</i>	<i>Period</i>	<i>Min</i>	Q_1	Q_2	Q_3	<i>Max</i>	<i>IQR</i>
Combined	1970-75	43.0	47.2	49.6	56.1	62.0	8.9
	1976-80	46.3	51.2	53.5	56.6	65.5	5.4
	1981-85	50.0	53.0	58.4	60.7	68.4	7.7
Rural	1970-75	42.1	45.7	47.5	54.8	61.7	9.1
	1976-80	45.2	50.3	51.7	55.4	65.5	5.1
	1981-85	48.7	52.1	57.1	59.6	68.5	7.5
Urban	1970-75	51.5	55.8	59.6	62.5	64.2	6.7
	1976-80	54.9	58.4	60.8	64.1	65.8	5.7
	1981-85	57.9	60.3	62.6	67.1	68.2	6.8
Male	1970-75	45.5	47.6	49.6	56.9	60.8	9.3
	1976-80	48.5	51.1	53.5	58.2	63.6	7.1
	1981-85	51.4	53.1	57.2	60.2	65.4	7.1
Female	1970-75	40.6	46.3	49.5	55.2	63.4	8.9
	1976-80	43.9	50.4	53.4	56.6	67.6	6.2
	1981-85	48.5	53.0	59.4	62.2	71.5	9.2

TABLE 6 : SUMMARY MEASURES OF REGIONAL DISTRIBUTION IN $e(t)$

<i>Population</i>	<i>Period</i>	<i>Min</i>	Q_1	Q_2	Q_3	<i>Max</i>	<i>IQR</i>
Combined	1970-75	51.2	54.0	55.8	59.6	64.7	5.6
	1976-80	54.6	56.6	59.1	60.6	67.6	4.0
	1981-85	56.8	59.0	63.4	64.5	69.6	5.5
Rural	1970-75	50.6	51.9	54.9	58.1	64.6	8.2
	1976-80	53.7	55.9	58.0	59.5	67.8	3.6
	1981-85	56.0	57.9	62.6	64.2	69.9	6.3
Urban	1970-75	57.5	60.5	63.5	65.4	67.3	4.9
	1976-80	60.7	62.7	65.1	66.8	68.8	4.1
	1981-85	62.8	64.3	65.1	69.1	70.8	4.8
Male	1970-75	52.4	53.9	55.8	60.3	64.5	6.4
	1976-80	56.3	57.3	58.8	60.2	66.5	4.9
	1981-85	57.1	59.0	61.4	64.3	66.8	5.3
Female	1970-75	48.7	53.3	55.8	59.2	66.0	5.9
	1976-80	52.6	55.8	59.4	60.8	69.6	5.0
	1981-85	56.4	59.4	64.4	66.0	72.6	6.6

TABLE 7 : SUMMARY MEASURES OF REGIONAL DISTRIBUTION IN $q(1)$

Population	Period	Min	Q ₁	Q ₂	Q ₃	Max	IQR
Combined	1970-75	0.057	0.094	0.112	0.139	0.178	0.045
	1976-80	0.046	0.087	0.107	0.128	0.169	0.042
	1981-85	0.032	0.075	0.084	0.109	0.150	0.034
Rural	1970-75	0.059	0.099	0.122	0.147	0.186	0.048
	1976-80	0.048	0.097	0.115	0.138	0.175	0.041
	1981-85	0.033	0.081	0.094	0.120	0.159	0.039
Urban	1970-75	0.044	0.063	0.076	0.090	0.120	0.027
	1976-80	0.035	0.057	0.067	0.081	0.111	0.024
	1981-85	0.026	0.045	0.056	0.075	0.094	0.030
Male	1970-75	0.059	0.096	0.119	0.142	0.172	0.046
	1976-80	0.049	0.086	0.106	0.126	0.154	0.040
	1981-85	0.035	0.076	0.085	0.109	0.144	0.033
Female	1970-75	0.054	0.090	0.110	0.141	0.186	0.045
	1976-80	0.042	0.087	0.111	0.131	0.183	0.044
	1981-85	0.029	0.073	0.084	0.109	0.153	0.036

Contributors to Mortality Change

An application of identity (2) for the whole country suggests that of the 5.79 years increase in the expectation of life at birth between 1970 and 1985, 4.12 years was due to the improvements in mortality after first year of life while 1.67 years was due to the improvements in infant survival probability. Interestingly, while the contribution of improvements in mortality after first year of life was almost evenly distributed throughout the period under reference, the contribution of improvements in infant survival probability was confined mostly to the period after 1976-80. In the period prior to 1976-80, improvements in the infant survival probability contributed to only 0.49 years to the expectation of life at birth.

TABLE 8 : CONTRIBUTION TO MORTALITY CHANGE IN INDIA: 1970-85

1970-75	Total	2.58	2.54	1.58	1.92	3.06
to	Due to $e(1)$	2.09	2.15	0.64	1.40	2.61
1976-80	Due to $q(1)$	0.49	0.39	0.94	0.52	0.45
1976-80	Total	3.21	3.19	2.56	2.98	3.61
to	Due to $e(1)$	2.01	1.88	1.86	1.96	2.22
1981-85	Due to $q(1)$	1.20	1.30	0.70	1.01	1.39
1970-75	Total	5.79	5.73	4.14	4.90	6.67
to	Due to $e(1)$	4.12	4.06	2.49	3.36	4.85
1981-85	Due to $q(1)$	1.67	1.68	1.65	1.53	1.82

Pattern of contribution of mortality decline before and after first year of life to total mortality decline in the rural areas was almost similar to that of the whole population but

the pattern in the urban areas was found to be different. In the urban areas, the pace of mortality decline in population above age 1 appears to have increased over time while it appears to have decreased in case of infant survival probability.

But the pattern of contribution in males and females has been found to be more or less similar. In both the populations, bulk of the contribution of mortality decline in population below one year of age was confined to the period after 1976-80 while that of population above age one was more or less evenly distributed throughout the period under reference. The only difference is that the pace of mortality decline after age 1 appears to have increased in male population but the amount of increase is quite small.

Among different states of the country, contribution of mortality decline below and above age one varies widely. In Gujarat and Punjab, contribution of mortality decline in population below age 1 was highest among all the states of the country. Other states where this contribution was above average are Andhra Pradesh, Assam, Himachal Pradesh and Rajasthan. In Karnataka, Madhya Pradesh and Orissa, this contribution was below average while in Haryana and Jammu and Kashmir, this contribution was found to be negative which has resulted in a decrease rather than an increase in the expectation of life at birth.

Contribution of mortality decline in population above age one, on the other hand, has been found to be highest in Andhra Pradesh followed by Orissa and Gujarat. This contribution has been above average in Himachal Pradesh, Maharashtra and Uttar Pradesh also. In Haryana, Punjab, Rajasthan and Madhya Pradesh, on the contrary, this contribution has been found to be below average with the least contribution observed in Haryana.

As far as change in the contribution over time is concerned, in all but three states of the country, there has been a marked increase in the contribution of the improvements in the first year survival probability. The states where this contribution has decreased over time are Assam, Jammu and Kashmir and Maharashtra. In Assam and Jammu and Kashmir, this decrease has been quite substantial but in Maharashtra, this decrease has been only marginal. By contrast, contribution of the mortality decline after first year of life has shown a declining trend in ten states and an increasing trend in only five states. In only three states—Gujarat, Haryana and Karnataka—contribution of mortality decline in both the populations— population below age one and population above age one—has increased over time. Similarly, in Assam both the contributions have decreased over time. In this state, practically all the mortality decline was confined to the period prior to 1976-80.

In the rural areas of different states, contribution of improvements in the first year survival probability during the period 1970-85 was highest in Assam closely followed by Andhra Pradesh. On the other hand, in Haryana and Jammu and Kashmir, this contribution was negative largely because of the increase in the risk of death in the first year of life during the period 1970-75 through 1976-80. In Orissa and Madhya Pradesh too, this contribution was quite small. One reason for this small contribution was that during the period 1970-75 through 1976-80, the risk of death during the first year of life practically remained unchanged in the rural areas of these states. Even in Andhra Pradesh too, the risk of death during the first year of life in the period 1970-75 to 1976-80 practically remained unchanged.

Like the contribution of improvements in first year survival probability, the contribution of improvements in mortality after age one in the rural population has also been found to be

highest in Andhra Pradesh followed by Orissa, Gujarat and Tamilnadu. On the other hand, this contribution was found to be least in Punjab and Haryana — the two most advanced states of the country. In Haryana, mortality above age one actually increased during the period 1970-75 through 1976-80 whereas in Punjab, there has been practically no change in the mortality above age one during the period 1976-80 through 1981-85.

In the urban populations, contribution of first year survival probability was found to be highest in Gujarat among all states of the country. This contribution was above average in the states of Maharashtra, Uttar Pradesh and Punjab. In Jammu and Kashmir, this contribution has been found to be negative because of a very sharp decline in the first year survival probability in the state during the period after 1976-80. Other states where this contribution has been found to be below average are Haryana, Orissa, Rajasthan, Assam and Andhra Pradesh.

On the other hand, contribution of improvements in mortality above age one in the urban population has been found to be highest in Andhra Pradesh followed by Punjab, Himachal Pradesh and Uttar Pradesh. By contrast, in Jammu and Kashmir, this contribution has been found to be negative again because of a very sharp decline in mortality above age one during the period 1976-80 through 1981-85. In Rajasthan and Karnataka also, this contribution has been found to be quite small as compared to other states of the country. This small contribution is due to an increase in the mortality above age one in Karnataka during 1970-75 through 1976-80 and in Rajasthan during 1976-80 through 1981-85. [

Regional variations in the contribution of improvements in mortality in the- first year of life as well as in life above age one are also substantial in both the sexes. However, the overall pattern remains more or less same. Thus in Haryana as well as in Jammu and Kashmir, the contribution of improvements in the first year survival probability has been abysmal in both male as well as female populations. Similarly, in Assam, Gujarat and Himachal Pradesh, contribution of improvements in first year survival probability has been found to be above average in both the sexes. There are, however, divergences too. In Orissa and Rajasthan, for example, contribution of improvement in first year survival probability has been found to be quite small in males as compared to females whereas in Tamilnadu, an entirely opposite pattern can be observed. In Uttar Pradesh, on the other hand, the contribution of improvements in the first year survival probability has been found to be same in both the sexes.

In case of contribution of improvements in the mortality above one year of age, however, no similarity in the two sexes could be observed across the states of the country. As far as male population is concerned, highest contribution of improvements in mortality above age one has been observed in Orissa and Andhra Pradesh whereas lowest contribution has been observed in Punjab and Haryana. But in case of females, this contribution has been found to be highest in Haryana and Assam but lowest in Rajasthan and Madhya Pradesh.

Conclusions

The analysis carried out here suggests that transition in mortality in India during the period 1970-85 has not been uniform. It has varied widely in populations below and above age one as well as over time. This is true not only for the country as a whole and its constituent

major states but also to different sub-populations. There are even some states, where mortality in the two age segments has either remained unchanged or even increased during the period under reference. This suggests that the determinants of mortality transition vary widely across different states of the country as well as in different population groups. Moreover, changes in the structure of mortality transition over time suggest that the determinants of mortality change in the country have also changed over time.

One simple yet direct implication of differential mortality transition as revealed through this analysis is the differential impact of health policies and programmes not only in different parts of the country as well as in different sub-populations but also over time. Though the analysis carried out here should not be treated as a critique of the health policy yet, it is clear that the effectiveness of the policy has varied not only in different populations but even among different age segments of the population. No doubt, mortality has declined in the country, but this decline, as the present analysis reveals, has not been uniform either in different age groups or in different sub-populations or in different times.

In any case, the analysis presented here advocates a strong case for the need of a regional orientation in health policies and programmes evolution and development. Unfortunately, development of health policies and programmes in India has largely been an exercise at the national level. Regional bias in health policies and programmes evolution is sadly lacking. There is a need to identify the reasons behind a typical type of mortality transition observed in specific population groups and regions as revealed through this analysis. Once this is , regional orientation in health policies and programmes will become a possibility.

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Appendix-A

TABLE A1 : REGIONAL VARIATIONS IN CONTRIBUTION TO MORTALITY CHANGE IN INDIA : 1970-85

State	1970-75 to 1976-80			1976-80 to 1981-85			1970-75 to 1981-85		
	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total
AP	4.26	-0.00	4.26	3.32	1.94	5.27	7.66	1.86	9.53
ASS	4.38	1.30	5.68	0.14	0.59	0.73	4.55	1.86	6.41
GUI	2.85	0.76	3.61	3.81	1.32	5.13	6.67	2.07	8.74
HAR	-1.80	-0.83	-2.63	4.59	0.84	5.43	2.81	-0.01	2.80
HP	3.40	0.62	4.02	2.39	1.40	3.79	5.81	1.99	7.81
JK	0.65	-0.01	0.64	3.92	-0.31	3.61	4.57	-0.32	4.25
KAR	0.64	0.46	1.10	3.58	0.75	4.32	4.21	1.22	5.42
KER	2.75	0.73	3.48	1.95	0.93	2.88	4.71	1.65	6.36
MP	1.80	0.10	1.90	1.72	0.81	2.53	3.53	0.90	4.43
MAH	1.63	0.82	2.45	3.60	0.76	4.36	5.21	1.60	6.81
ORI	3.44	-0.03	3.41	3.42	0.51	3.93	6.88	0.45	7.34
PUN	2.33	0.26	2.59	0.77	1.84	2.60	3.13	2.07	5.20
RAJ	2.95	0.55	3.50	0.55	1.07	1.62	3.53	1.60	5.12
TN ¹	3.21	0.68	3.89	2.36	1.10	3.45	5.59	1.76	7.35
UP	2.81	0.50	3.31	2.66	1.07	3.73	5.48	1.56	7.04

TABLE A2 : REGIONAL VARIATIONS IN CONTRIBUTION TO MORTALITY CHANGE IN INDIA (RURAL) : 1970-85

State	1970-75 to 1976-90			1976-80 to 1981-85			1970-75 to 1981-85		
	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total
AP	4.39	0.02	4.41	3.31	2.09	5.40	7.79	2.02	9.81
ASS	4.10	1.44	5.54	0.12	0.63	0.75	4.25	2.04	6.29
GUJ	2.65	0.84	3.49	4.20	1.02	5.22	6.84	1.86	8.71
HAR	-1.88	-1.01	-2.89	4.44	0.87	5.31	2.59	-0.17	2.43
HP	3.39	0.77	4.16	2.40	1.40	3.79	5.81	2.14	7.95
JK	0.74	-0.09	0.65	4.51	-0.33	4.17	5.25	-0.43	4.82
KAR	0.82	0.42	1.23	4.07	0.72	4.78	4.87	1.15	6.02
KER	3.03	0.77	3.80	1.99	0.98	2.97	5.03	1.74	6.77
MP	1.78	0.07	1.85	1.68	0.75	2.43	3.48	0.80	4.28
MAH	1.44	0.68	2.12	4.19	0.80	4.99	5.61	1.50	7.11
ORI	3.42	-0.00	3.42	3.46	0.47	3.93	6.89	0.45	7.35
PUN	2.22	0.39	2.61	0.09	1.75	1.84	2.35	2.11	4.46
RAJ	3.26	0.53	3.78	0.52	1.18	1.71	3.82	1.67	5.49
TN	4.13	0.70	4.83	2.52	1.21	3.73	6.68	1.88	8.56
UP	2.54	0.57	3.11	2.60	0.89	3.49	5.15	1.45	6.60

TABLE A3 : REGIONAL VARIATIONS IN CONTRIBUTION TO MORTALITY CHANGE IN INDIA (URBAN): 1970-85

State	1970-75 to 1976-80			1976-80 to 1981-85			1970-75 to 1981-85		
	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total
AP0	3.17	0.26	3.43	2.47	0.65	3.12	5.65	0.90	6.55
ASS	4.48	0.55	5.03	-0.77	0.18	-0.59	3.72	0.72	4.44
GUJ	1.52	0.59	2.12	1.96	1.66	3.62	3.49	2.24	5.74
HAR	-0.38	0.35	-0.02	3.72	-0.15	3.58	3.34	0.21	3.55
HP	3.29	0.42	3.71	1.56	0.83	2.39	4.86	1.23	6.09
JK	0.29	0.35	0.63	-1.59	-0.36	-1.95	-1.30	-0.02	-1.32
KAR	-0.47	0.32	-0.15	2.18	0.85	3.03	1.70	1.19	2.88
KER	1.63	0.55	2.18	1.27	0.62	1.89	2.90	1.17	4.07
MP	1.09	0.69	1.79	1.48	0.42	1.90	2.57	1.12	3.69
MAH	2.23	1.26	3.50	1.31	0.40	1.71	3.54	1.67	5.20
ORI	2.39	0.39	2.78	1.07	0.26	1.33	3.46	0.65	4.11
PUN	1.85	-0.07	1.79	3.58	1.55	5.13	5.46	1.46	6.91
RAJ	-0.09	0.79	0.70	0.88	-0.11	0.77	0.78	0.69	1.46
TN	-0.28	0.37	0.09	1.80	1.01	2.81	1.51	1.39	2.91
UP	2.83	0.53	3.36	1.90	1.07	2.98	4.75	1.59	6.34

TABLE A4 : REGIONAL VARIATIONS IN CONTRIBUTION TO MORTALITY CHANGE IN INDIA (MALE) : 1970-85

State	1970-75 to 1976-80			1976-80 to 1981-85			1970-75 to 1981-85		
	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total
AP	3.79	-0.06	3.73	2.88	2.13	5.01	6.75	2.00	8.74
ASS	3.65	1.76	5.41	-0.17	0.58	0.41	3.51	2.32	5.83
GUJ	1.91	0.90	2.80	2.70	1.17	3.88	4.61	2.07	6.68
HAR	-1.45	-0.86	-2.31	3.68	1.09	4.78	2.25	0.22	2.47
HP	2.60	1.41	4.01	-0.08	0.42	0.34	2.53	1.82	4.35
JK	1.57	-0.32	1.25	2.11	-0.06	2.05	3.69	-0.39	3.30
KAR	0.09	0.72	0.81	2.89	0.66	3.55	2.96	1.39	4.36
KER	2.08	0.65	2.73	0.95	0.91	1.86	3.04	1.55	4.59
MP	1.80	-0.02	1.79	1.55	0.56	2.11	3.37	0.53	3.89
MAH	1.18	1.07	2.25	3.40	0.62	4.02	4.55	1.72	6.27
ORI	3.72	0.20	3.91	3.03	0.04	3.07	6.74	0.25	6.99
PUN	1.80	0.12	1.92	0.09	1.60	1.69	1.92	1.69	3.61
RAJ	1.57	0.31	1.88	1.24	0.98	2.21	2.82	1.28	4.09
TN	3.01	0.86	3.87	1.63	1.33	2.96	4.67	2.17	6.84
UP	2.09	0.98	3.07	2.30	0.58	2.87	4.38	1.57	5.95

TABLE AS : REGIONAL VARIATIONS IN CONTRIBUTION TO MORTALITY
CHANGE IN INDIA (FEMALE): 1970-85

State	1970-75 to 1976-80			1976-80 to 1981-85			1970-75 to 1981-85		
	Due to e(1)	Due to q(1)	Total	Due lo e(1)	Due to q(1)	Total	Due to e(1)	Due to q(1)	Total
AP	4.75	0.11	4.86	4.00	1.68	5.68	8.82	1.72	10.54
ASS	4.76	0.76	5.52	0.89	0.69	1.58	5.68	1.43	7.11
GUJ	3.80	0.58	4.38	4.67	1.49	6.16	8.49	2.05	10.54
HAR	-2.24	-0.81	-3.05	5.80	0.57	6.37	3.60	-0.27	3.32
HP	4.09	-0.16	3.92	5.53	2.52	8.06	9.72	2.26	11.98
JK	-0.19	0.20	0.01	5.96	-0.45	5.51	5.77	-0.25	5.52
KAR	1.19	0.28	1.47	4.55	0.84	5.39	5.74	1.12	6.86
KER	3.43	0.82	4.25	2.89	0.96	3.85	6.33	1.77	8.10
MP.	2.13	0.25	2.38	2.16	1.09	3.25	4.32	1.32	5.63
MAH	2.09	0.54	2.63	4.14	0.94	5.08	6.23	1.49	7.71
ORI	3.34	-0.24	3.10	3.45	1.06	4.52	6.84	0.78	7.62
PUN	3.03	0.38	3.41	1.36	2.08	3.44	4.44	2.41	6.85
RAJ	4.57	0.83	5.41	-0.35	1.21	0.86	4.28	1.99	6.26
TN	3.32	0.57	3.89	3.18	0.81	3.99	6.51	1.37	7.88
UP	3.18	0.12	3.30	3.15	1.50	4.66	6.38	1.57	7.95