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INDIRECT ESTIMATES OF FERTILITY AND MORTALITY AT THE DISTRICT LEVEL, 1981

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CONTENTS

	Page
Foreword	v
List of Exhibits, Tables and Maps	vii
Introduction	1
Methodology	4
Fertility Estimates	4
Brass P/F Ratio Technique	5
Rele Method	6
Palmore Method	8
Gunasekaran-Palmore Method	10
Mortality Estimates	12
Results, Fertility	13
Comparison of the Four Indirect Estimation Techniques	13
Regional and Intra-State Fertility Differentials	32
Results, Mortality	39
Discussion and Conclusions	49
Acknowledgements	50
References	51
Appendix I. District Level Fertility Estimates, 1981	53
Appendix II. District Level Estimates of the Infant Mortality Rate and Life Expectancy at Birth, 1981	69

FOREWORD

Under the agreement on Family Planning Communications and Marketing between the Government of India and the United States of America through the Agency for International Development (USAID), the Demographic Analysis component had been assigned to the Office of the Registrar General, India to execute. Activities under the component included training, workshops, conferences and research activities in collaboration with the East-West Center, Honolulu, Hawaii and the U.S. Bureau of Census, Washington, D.C.

The present study is an outcome of the collaborative research between the Program on Population, East-West Center and the Office of the Registrar General, India.

I thank the authors for the efforts put in by them and hope that this work will be of interest to the data users. I also thank the United States Agency for International Development and Program on Population, East-West Center for making the research work possible.

New Delhi,
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A.R. Nanda
Registrar General, India

List of Exhibits, Tables, and Maps

Exhibit, Table, or Map		Page
Exhibit 1.	General Form for the Rele Method Equations	6
Exhibit 2.	Equation Used by the Palmore Method	9
Exhibit 3.	The Gunasekaran - Palmore Method Equation	10
Table 1.	Comparison of Total Fertility Rate Estimates for the Major States of India, 1981	14
Table 2.	Distribution of Direction of District-Level Differences between TFR Estimates for all India (except Assam), 1981	15
Table 3.	Distribution of Direction of Differences between TFR Estimates for the Major States of India (except Assam), 1981	17
Table 4.	Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for all India (except Assam), 1981	21
Table 5.	Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for all India (except Assam and Smaller States), 1981	22
Table 6.	Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for Major States of India, 1981	24
Table 7.	Distribution of Districts by the Level of Average Total Fertility Rate, India, 1981	33
Table 8.	Distribution of Districts by their Level of Average Total Fertility Rate for Major States of India, 1981	34
Table 9.	Intra-State Variability in Total Fertility Rates, Major States of India, 1981	36
Map 1.	District-Level Total Fertility Rates, India, 1981	38

List of Exhibits, Tables, and Maps (continued)

Exhibit, Table, or Map		Page
Table 10.	Distribution of Districts by the Level of the Infant Mortality Rate, India, 1981	39
Table 11.	Distribution of Districts by their Level of Infant Mortality Rate for Major States of India, 1981	40
Table 12.	Intra-State Variability in the Infant Mortality Rate, Major States of India, 1981	42
Map 2.	District-Level Infant Mortality Rates, India, 1981	43
Table 13.	Distribution of Districts by the Level of Expectation of Life at Birth, India, 1981	45
Map 3.	District-Level Life Expectancies at Birth, India, 1981	46
Table 14.	Distribution of Districts by their Level of Expectation of Life at Birth for Major States of India, 1981	47
Table 15.	Intra-State Variability in Life Expectancy at Birth, Major States of India, 1981	48

Introduction

Reliable vital statistics at the district level are essential for meaningful decentralized population planning in India. Although India's civil registration system is a century old, the vital statistics generated from it are, unfortunately, unreliable and suffer from significant under-registration of both births and deaths.

Recognizing the need for accurate information on fertility and mortality, the Government of India initiated a large scale demographic sample survey on a pilot basis in 1964-1965. By 1969-1970, this survey had become a regular feature of India's statistical system. Popularly known as the Sample Registration System (SRS), this demographic sample survey is based on a dual recording system and provides reliable estimates of fertility and mortality at the national and state levels separately for rural and urban areas (see Swamy *et al.* 1992 for a description of the system and the most recent evaluation of the SRS). The sample size for the SRS, however, is too small to provide reliable estimates at the district level for even such crude fertility and mortality measures as the crude birth rate (CBR) and crude death rate (CDR).

Since many government plans are implemented at the district level, the demand for district level data is extraordinary. In particular, the demand has been high for the Office of the Registrar General (ORG) India, the agency responsible for carrying out the SRS, to provide estimates for aggregates below the state level. Increasing the sample size for the SRS is one obvious solution, but pursuing this solution would be very costly, both in funding and in

2–12/RGI/ND/94

trained people. Instead, the ORG's initial solution was to enlarge the scope of the 1981 Population Census by asking additional questions on fertility and mortality.

The 1981 Census included two questions on fertility: the number of births during the last one year, asked for all currently married women; and the number of children ever born (CEB), asked for all ever-married women. All ever married women were also asked a question on the number of children surviving at the time of census. Together, responses to the questions on the number of children ever born and the number of children surviving provide mortality information. Undoubtedly these data suffer from misreporting due to recall lapses, but they nevertheless provide some basis for estimating fertility and mortality levels for the states and districts of India. By applying two indirect techniques (the Brass P/F ratio method and Brass's method for estimating infant and childhood mortality) to these data, the ORG has generated estimates of district-level fertility and child mortality, which are already available in two highly useful publications (Natarajan and Singh 1988; Natarajan and Puri 1988).

The present paper provides additional estimates of the 1981 fertility and mortality levels at the district level. Three additional estimation techniques were applied to estimate total fertility rates (TFRs) and one new method was used to provide estimates of the infant mortality rate (IMR) and life expectancy at birth (e_0). These new estimates were calculated because relying on any one set of estimation techniques is probably unwise when dealing with small administrative units. Further, the Brass P/F ratio method is known to overestimate fertility levels under certain conditions, as documented later in this report.

The total fertility rate (TFR) and the two most important mortality indicators, the infant mortality rate (IMR) and the expectation of life at birth (e_0), are estimated for each state and district in India. Three different sets of TFR estimates are provided in addition to Brass P/F ratio estimates. These are regression estimates of fertility produced by applying the Palmore, Gunasekaran-Palmore, and Rele methods. The district-level estimates of IMR and e_0 are derived from the child mortality (q_2) estimates by interpolating corresponding q_1 and e_0 values from the South Asian Model Life Tables and adjusting them for SRS levels of IMR and e_0 for 1981. This paper also attempts to assess the validity and reliability of different fertility estimation techniques. The district-level TFR estimates from the Brass, Palmore, Gunasekaran-Palmore, and Rele methods are compared for this purpose. Finally, on the basis of these estimates, regional variations in fertility are discussed. For discussing fertility differentials, an average of the three regression estimates of the TFR is used. These average TFR estimates turn out to be satisfactorily consistent with the corresponding SRS estimates for the major states of India. This gives us considerable confidence in our fertility estimates. Similarly, mortality differentials are also discussed by analyzing regional variations in the IMR and e_0 levels.

A brief description of the various estimation methods is presented in the following section and the results are discussed in subsequent sections. District-level estimated total fertility rates are given in Appendix I. Estimates of the infant mortality rate (IMR) and expectation of life at birth (e_0) are given in Appendix II. Several tables and maps were also

prepared and are presented in the text to help in comparing the various fertility estimation methods and discussing regional differentials in fertility and mortality.

Methodology

Fertility Estimates

Several methods are available for indirectly estimating fertility rates. Among the most commonly used methods are: (1) the Brass P/F Ratio technique (Brass 1975), (2) the Own-Children method (Cho, Retherford, and Choe 1986), and (3) several regression methods (*e.g.*, Bogue and Palmore 1964; Rele 1967; Palmore 1978; Gunasekaran and Palmore 1984; and Rele 1967 and 1987). In this report, the Brass (1975), Palmore (1978), Gunasekaran-Palmore (1984), and Rele (1967, 1987) methods are used to arrive at district-level fertility estimates for India. Each of these methods is carefully described in the sources cited above and all of them have been used frequently to estimate fertility for other countries (*e. g.*, Cho 1964; Pacheco and Engracia 1985; Palmore 1978; Palmore *et al.* 1993; Palmore, Mamas, and Arifiyatno 1993; Palmore, Sarmiento, and Gultiano 1991; and United Nations Economic and Social Commission for Asia and the Pacific 1988) as well as for India (*e. g.*, Gunasekaran and Palmore 1984; Rao, Rele, and Palmore 1987; and Rele 1987). Consequently, we provide only a brief review of each method in the following paragraphs. Our discussion of the Rele, Palmore, and

Gunasekaran-Palmore methods closely follows the explanation provided in Swamy *et al.* 1992 and Palmore *et al.* 1993.

Brass P/F Ratio Technique

The Brass fertility estimation technique adjusts the age pattern of fertility derived from information on births during the last one year by the average parity of women in the age groups 20-24 and 25-29. The 1981 census of India collected information on both the number of births during the last one year (asked of all currently married women) and the number of children ever born (asked of women who had ever been married by the time of the census). Births during the last one year provide the age pattern of fertility under the assumption that births to widowed and divorced women during the last one year were very few. The age pattern of fertility thus obtained is corrected for under-reporting using P/F ratios for the 20-24 and 25-29 age groups, where P stands for the average parity of women in a particular age group and F stands for the average parity equivalent determined by cumulating the period fertility rates obtained above.

Natarajan and Singh (1988) have already calculated district-level fertility estimates using the Brass P/F ratio technique. For the purposes of this report we have simply duplicated their estimates. For additional details about the methodology used to provide these estimates, please refer to Natarajan and Singh 1988.

Rele Method

Rele's method derives from stable population theory (Rele 1967). It postulates a linear relationship between child woman ratios (*e.g.*, the ratio of children ages 0-4 to women ages 15-49) and the Gross Reproduction Rate (GRR), which can easily be converted into the total fertility rate. The Rele method uses a family of equations instead of a single equation, with the equations all having the general form presented in Exhibit 1. One example is the Rele equation used when the life expectancy at birth is 60:

$$\mathbf{GRR = -0.0182 + 3.6628\ CWR,}$$

where CWR stands for the child woman ratio. The complete family of equations can be found in Rele 1967 and Hanenberg 1983. The TFR is calculated by multiplying the GRR by 2.05.

Exhibit 1. General Form for the Rele Method Equations

$$GRR = a_n + b_n CWR$$

where GRR = the gross reproduction rate;
CWR = the child-women ratio (expressed per woman); and
n = the level of mortality, expressed in a life expectancy at birth

The major advantage of Rele's method is its simplicity: it requires only an estimate of the overall level of mortality and knowing the age and sex structure of the population. The child woman ratio is calculated from the age and sex composition. Given a rough estimate of the expectation of life at birth, this ratio can then be converted into an estimate of the TFR.

Like most reverse survival methods, the Rele technique is sensitive to differential under-enumeration of children and adult women. In particular, inaccurate counts of children ages 0-4 can cause under-estimates of fertility using this method. Rele recognized this problem himself, of course, and proposed a refinement of his method (Rele 1987). The method we used is somewhat different from his 1987 refinement but also attempts to correct for inaccurate counts of young children.

We calculated four child woman ratios from the 1981 census:

$$C_{0\text{-}4}/W_{15\text{-}44}$$

$$C_{5\ 9}/W_{20\text{-}49}$$

$$C_{0\text{-}4}/W_{15\text{-}49}$$

$$C_{5\ 9}/W_{20\text{-}54}$$

Then, using the district-level expectation of life at birth estimates estimated for this study and given in Appendix II, four GRR values were estimated for each district. Corresponding TFR estimates were then obtained by multiplying the GRR values by 2.05.

In India, the 0-4 age group is often seriously under-enumerated mainly due to the under-reporting of infants and age misreporting. The 5-9 age group, conversely, is often over-

estimated mainly due to age misreporting. The corresponding CWRs, and in turn TFR values, are under-estimated for the CWRs with the 0-4 age group in the numerator, and over-estimated for the 5-9 age group CWRs. To correct for this problem, we calculated two sets of modified TFR values as follows:

$$TFR_1 = [TFR_{CWR(0\text{-}4/15\text{-}44)} + TFR_{CWR(5\text{-}9/20\text{-}49)}]/2$$

$$TFR_2 = [TFR_{CWR(0\text{-}4/15\text{-}49)} + TFR_{CWR(5\text{-}9/20\text{-}54)}]/2$$

Since the 15-49 age group of women is the preferred denominator for estimating fertility in India, we chose TFR_2 as the modified Rele estimates. The Rele estimates based on the 0-4 age group CWRs refer to the average fertility rate for the five years prior to the census and the estimates using the 5-9 age group CWRs refer to the average fertility rate for the period 5-9 years before the census. Hence, the modified Rele estimates used in this report refer to about five years prior to 1981, an average for the ten years prior to the 1981 Census.

Palmore Method

The Palmore method is a modification of a technique first introduced by Bogue and Palmore in 1964. Like Rele's method, it also postulates a linear relationship between the child woman ratio, a mortality measurement, and the TFR. Unlike Rele's method, however, the Palmore method was derived empirically using census and vital registration data from countries where both data sources were sufficiently complete and accurate. The Palmore method also adds indicators to take into account differentials in marriage patterns. If marital

status data are available, the equation used to derive the Palmore method estimates is the one presented in Exhibit 2.

Exhibit 2. Equation Used by the Palmore Method

$$TFR = 12\ 0405 + 13\ 5277\,IMR + 11\ 1042\,CWR_0 - 176\ 4889\,CP_0 - 6\ 4698\,PEM$$

where IMR = the infant mortality rate;
CWR_0 = the ratio of children ages 0-4 to 1000 women ages 15-49 years;
CP_0 = the percentage of the total population ages 0-4; and
PEM = the percentage of women ages 20-24 who have ever been married

This method requires more data than Rele's method, but the data required are usually available from censuses or surveys in their regular tabulation programs. Also, instead of using the expectation of life at birth like Rele's method, the Palmore method employs the infant mortality rate.

This method suffers from the same sensitivity as the Rele method to data quality, particularly counts of infants and children. Whereas the Rele method tends to underestimate fertility, the Palmore method tends to overestimate when the infant mortality rate has been declining rapidly.

Gunasekaran-Palmore Method

The Gunasekaran-Palmore method is also a regression method, but it uses moments of the entire female age distribution instead of the child woman ratio. The method assumes that the moments of an age frequency distribution serve as indicators of the nature of the relationship between fertility and the age distribution and, therefore, the level of fertility. Like the Palmore method, the equation was empirically derived. The Gunasekaran-Palmore model is summarized in Exhibit 3. To calculate the TFR, the GRR is multiplied by 2.05.

Exhibit 3. The Gunasekaran - Palmore Method Equation

$$\log GRR = 9.65566 - 0.37613045 \log e_0^f + 6.08957\, CVAG - 0.56680627 \log K_3 - 0.74030 \log \beta_2$$

where GRR = the gross reproduction rate;
e_0^f = life expectancy at birth for females;
CVAG = σ / μ_1, where CVAG is the coefficient of variation of the female age distribution (not, as typically, expressed as a percentage), σ being the standard deviation and μ_1 the mean of the female age distribution;
K_3 = μ_3, the third cumulant (or moment) about the mean; and
β_2 = $(K_4 / \sigma^4) + 3$, a measure of the peakedness of the distribution, where $K_4 = \mu_4 - 3\sigma^4$ is the fourth cumulant.

The method is applicable despite suspected data errors in the age group 0-4 (a condition widely encountered in developing country data). There is no assumption of population stability but the method probably works better if there have not been very rapid fluctuations in fertility.

In summary, the Palmore, Rele, and Gunasekaran-Palmore methods are all regression techniques that rely on commonly available census or survey tabulations, whereas the Brass P/F ratio technique requires additional fertility questions. The Palmore and Rele equations rely on child woman ratios, with adjustments for mortality. The Palmore equation also adjusts for nuptiality patterns in the population. When the number of children ages 0-4 is severely over- or under-counted, both the Palmore and Rele estimates will reflect the inaccurate counts. The Gunasekaran-Palmore method, based on the whole age distribution of the female population, was designed in an attempt to get around this problem, but depending on the age distribution so much relies on relatively accurate age data.

The Palmore and Gunasekaran-Palmore methods yield estimates of fertility that are roughly an average for the five years prior to the date of the census, 2.5 years before the census. The Brass method provides an estimate for the year prior to the census. The modified Rele method estimates rates that are an average for the ten years prior to the census.

The fertility estimates for the states and districts of India from the Brass technique and three regression methods (Palmore, Gunasekaran-Palmore, and Rele) are presented in Appendix I. For the purposes of discussing fertility differentials in India, an average of the

three regression estimates is calculated and reported in Appendix I along with the above estimates.

Mortality Estimates

The infant mortality rate (IMR) and the expectation of life at birth (e_0) were also estimated for each district. As mentioned previously, the 1981 census collected information on the number of children ever born (CEB) and the number of children surviving (CS) from all ever married women. From these data, the ORG estimated various child mortality indicators (q_1, q_2, and q_5) at the district level using the Brass method (see Natarajan and Puri 1988). Since q_1 values from the Brass method are often not reliable, we used q_2 as our input variable to arrive at new estimates of the infant mortality rate and the expectation of life at birth.

Using the q_2 values derived from the 1981 census, corresponding q_1 and e_0 values at the district level were estimated by interpolation from the South Asian Model Life Tables. To assure that our district-level IMR and e_0 estimates were consistent with the SRS estimates, the estimates of q_1 and e_0 obtained from the model life tables were adjusted to SRS levels for the major states. For smaller states and union territories, we could not make this adjustment because the SRS does not provide estimates for those areas. The adjustment for the major states of India was carried out by inflating or deflating the state-level IMR and e_0 model life table estimates to the corresponding SRS estimates and changing the district level estimates

by the proportion for the state as a whole. In other words, we assumed that the level of under- or over-estimation of IMR and e_0 values with respect to SRS estimates was constant for all districts within the state. These IMR and e_0 estimates are presented in Appendix II.

Results, Fertility

Comparison of the Four Indirect Estimation Techniques

Part of our rationale for calculating new fertility estimates was based on the knowledge that the Brass P/F ratio technique tends to overestimate fertility under certain conditions. This part of our rationale seems to be born out by the empirical results. Tables 1 - 6 summarize the comparisons we made between the four indirect estimation techniques.

For every state except Bihar, the Brass TFR estimates for 1981 exceed the adjusted SRS figures (see Table 1). Further, the Brass TFR estimates exceed the Palmore and Gunasekaran-Palmore method estimates for most states. Even the Rele method estimates, which refer to an average for the past ten years while the Brass techniques estimates are for the one year before the census, are higher for only five states.

Table 2 summarizes the results of subtracting the TFR estimates using the various methods from each other. The first column (labeled B-P), for example, shows the difference when the Palmore method estimate is subtracted from the Brass method estimate. At the

Table 1. Comparison of Total Fertility Rate Estimates for the Major States of India, 1981

State	SRS Adj.	Brass	Palmore	Gunasekaran-Palmore	Rele	Average TFR
INDIA	4.6	4.9	4.8	4.7	4.8	4.8
Andhra Pradesh	4.2	4.3	4.1	4.4	4.5	4.3
Bihar*	5.7	5.2	5.3	5.5	5.6	5.5
Gujarat	4.3	4.7	4.6	4.2	4.5	4.4
Haryana	5.1	5.4	5.3	5.0	5.4	5.2
Himachal Pradesh	3.9	4.7	4.2	4.4	4.7	4.4
Jammu & Kashmir*	4.5	5.6	4.6	4.7	5.1	4.8
Karnataka	4.0	4.7	4.2	4.4	4.7	4.4
Kerala	2.9	3.3	2.8	3.1	3.3	3.1
Madhya Pradesh	5.2	5.3	5.7	5.4	5.4	5.5
Maharashtra	3.7	4.3	4.1	4.2	4.4	4.2
Orissa*	4.3	4.8	4.8	4.6	4.8	4.7
Punjab	4.1	4.9	4.3	3.9	4.3	4.2
Rajasthan	5.5	6.1	5.6	5.5	5.6	5.6
Tamil Nadu	3.5	3.9	3.6	3.6	3.8	3.7
Uttar Pradesh	5.9	5.9	6.0	5.7	5.8	5.8
West Bengal*	4.2	4.3	4.2	4.3	4.7	4.4

* SRS estimates could not be adjusted for Bihar, Jammu & Kashmir, Orissa, and West Bengal because the correction factors from the 1980-81 SRS Intensive Inquiry are not available for these states. Average TFR is the mean of the Palmore, Gunasekaran-Palmore, and Rele estimates.

district level, the Brass estimates are higher for two-thirds of the districts as compared with the Palmore method, seventy-two percent of the districts as compared with the Gunasekaran-Palmore method estimates, and sixty-one percent of the districts as compared with the Rele

Table 2. Distribution of Direction of District-Level Differences between TFR Estimates for all India (except Assam), 1981

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Sign	Pair of Methods					
	B-P Number	B-G Number	B-R Number	P-G Number	P-R Number	G-R Number
Negative	134	114	156	171	245	319
Positive	268	288	246	231	157	83
Total	402	402	402	402	402	402

method estimates. In general, the Brass method estimates are the highest, the Rele method estimates second highest, the Palmore method estimates second lowest, and the Gunasekaran-Palmore method estimates lowest. Since fertility in India is declining, the Brass method estimates should be the lowest and the Rele methods highest because the Brass method estimates are for the year just before the census whereas the Rele estimates are an average for the previous ten years. This leads to the conclusion that the Brass method estimates are probably not valid and, in fact, over-estimate the TFR for most districts.

In Table 3, this conclusion is further substantiated. The Brass method estimates are higher than the Palmore method estimates for most of the districts in every state except Madhya Pradesh and Uttar Pradesh. The reason these two states may be exceptions is because fertility may not have been declining as quickly there. When comparing the Brass method estimates with the Gunasekaran-Palmore method estimates, again we find the Brass estimates higher for most districts in all states except three: Andhra Pradesh, Bihar, and Maharashtra. Compared with the Rele method estimates, the Brass method estimates are not so consistently higher for the districts in each state. This is understandable since even if the Brass method estimates are over-estimates, the Rele method estimates refer to an earlier time period when fertility was higher.

The comparison of the Gunasekaran-Palmore method estimates and the Rele method estimates (in the last column of Table 3) gives the depiction one would expect. The Rele estimates are consistently higher for most districts in all of the major states. This is what we would expect because the Rele method is estimating for an earlier time period -- at least two and a half years before the time period for the Gunasekaran-Palmore estimates. Comparing the Palmore method estimates and the Rele method estimates gives a similar picture, with the Rele estimates being higher, again confirming the expected pattern of results. Finally, the comparison of the Palmore and Gunasekaran-Palmore estimates shows an inconclusive pattern: sometimes one method is higher and sometimes the other. This is also

Table 3. Distribution of Direction of Differences between TFR Estimates for the Major States of India (except Assam), 1981

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Sign	Pair of Methods					
	B-P Number	B-G Number	B-R Number	P-G Number	P-R Number	G-R Number
Andhra Pradesh						
Negative	7	16	18	23	23	20
Positive	16	7	5	0	0	3
Total	23	23	23	23	23	23
Bihar						
Negative	13	25	25	30	29	18
Positive	18	6	6	1	2	13
Total	31	31	31	31	31	31
Gujarat						
Negative	6	2	6	1	7	18
Positive	13	17	13	18	12	1
Total	19	19	19	19	19	19
Haryana						
Negative	4	2	5	0	9	12
Positive	8	10	7	12	3	0
Total	12	12	12	12	12	12

4—12/RGI/ND/94

Table 3. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Sign	Pair of Methods					
	B-P Number	B-G Number	B-R Number	P-G Number	P-R Number	G-R Number
Himachal Pradesh						
Negative	0	1	5	9	10	11
Positive	12	11	7	3	2	1
Total	12	12	12	12	12	12
Jammu & Kashmir						
Negative	0	0	0	10	12	12
Positive	14	14	14	4	2	2
Total	14	14	14	14	14	14
Karnataka						
Negative	0	4	10	18	19	19
Positive	19	15	9	1	0	0
Total	19	19	19	19	19	19
Kerala						
Negative	0	3	7	12	12	12
Positive	12	9	5	0	0	0
Total	12	12	12	12	12	12

Table 3. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Sign	Pair of Methods					
	B-P Number	B-G Number	B-R Number	P-G Number	P-R Number	G-R Number
Madhya Pradesh						
Negative	39	19	18	2	5	23
Positive	6	26	27	43	40	22
Total	45	45	45	45	45	45
Maharashtra						
Negative	10	15	19	25	26	20
Positive	16	11	7	1	0	6
Total	26	26	26	26	26	26
Orissa						
Negative	6	6	7	3	9	12
Positive	7	7	6	10	4	1
Total	13	13	13	13	13	13
Punjab						
Negative	0	0	0	0	6	12
Positive	12	12	12	12	6	0
Total	12	12	12	12	12	12

Table 3. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Sign	Pair of Methods					
	B-P Number	B-G Number	B-R Number	P-G Number	P-R Number	G-R Number
Rajasthan						
Negative	2	1	2	11	14	15
Positive	24	25	24	15	12	11
Total	26	26	26	26	26	26
Tamil Nadu						
Negative	1	1	3	8	12	12
Positive	15	15	13	8	4	4
Total	16	16	16	16	16	16
Uttar Pradesh						
Negative	34	12	17	4	11	43
Positive	22	44	39	52	45	13
Total	56	56	56	56	56	56
West Bengal						
Negative	1	4	11	10	16	16
Positive	15	12	5	6	0	0
Total	16	16	16	16	16	16

to be expected, since this indicates no consistent bias one way or the other and both of these two methods are estimating for the same time period (2.5 years before the 1981 census).

Up to this point, we have shown only the direction of the differences in the estimates originating from the four indirect estimation techniques. The magnitude of the differences is also important. As can be seen in Table 4, for example, the Brass method

Table 4. Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for all India (except Assam), 1981

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< =0.2	122	30.3	121	30.1	141	35.1	162	40.3	162	40.3	217	54.0
0.4	110	27.4	109	27.1	123	30.6	141	35.1	107	26.6	129	32.1
0.6	78	19.4	53	13.2	67	16.7	73	18.2	89	22.1	50	12.4
0.8	35	8.7	47	11.7	33	8.2	18	4.5	37	9.2	6	1.5
1.0	26	6.5	25	6.2	15	3.7	7	1.7	7	1.7	0	0.0
>1.0	31	7.7	47	11.7	23	5.7	1	0.2	0	0.0	0	0.0
Total	**402**	**100**	**402**	**100**	**402**	**100**	**402**	**100**	**402**	**100**	**402**	**100**

estimates are more than 0.4 different from the other three estimates in more than a third of the districts (the first three percentage columns in Table 4). The three regression method estimates agree better. In fact, there are only six comparisons of the Rele method and the Gunasekaran-Palmore method with differences greater than 0.6 -- less than two percent!

The fit between the three regression method estimates becomes even better if we exclude smaller states and union territories (see Table 5). To cite just one example, the

Table 5. Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for all India (except Assam and Smaller States), 1981

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< =0.2	114	32.4	115	32.7	132	37.5	148	42.0	138	39.2	203	57.7
0.4	104	29.5	107	30.4	120	34.1	128	36.4	93	26.4	112	31.8
0.6	71	20.2	46	13.1	59	16.8	61	17.3	82	23.3	36	10.2
0.8	30	8.5	45	12.8	24	6.8	13	3.7	35	9.9	1	0.3
1.0	17	4.8	20	5.7	12	3.4	2	0.6	4	1.1	0	0.0
>1.0	16	4.5	19	5.4	5	1.4	0	0.0	0	0.0	0	0.0
Total	**352**	**100**	**352**	**100**	**352**	**100**	**352**	**100**	**352**	**100**	**352**	**100**

agreement between the Gunasekaran-Palmore and Rele method estimates is outstanding: close to ninety percent of the differences are 0.4 or smaller. The Palmore and Gunasekaran-Palmore estimates also diverge relatively little, with close to eighty percent of the differences being 0.4 or smaller. The agreement among the three regression estimates for the larger states is partly due to the fact that these methods tend to work better for larger aggregates, perhaps due to the usually smaller impact of migration on the age distribution of areas with larger populations, for example. The improvement in fits noticed when relating the results presented in Table 5 as compared to those in Table 4 also partly results from the fact that we were unable to adjust the IMR and e_0 values to SRS levels for the smaller states and union territories because the SRS does not have the adjustment figures for these areas.

Even in Table 5, the likelihood that the Brass method is over-estimating the total fertility rates is substantiated. The Brass estimates agree best with the Rele estimates, with about two-thirds of the differences being 0.4 or less. But the Rele estimates are supposed to refer to a time period some four or more years before the time referent for the Brass estimates, hence this agreement indicates over-estimation by the Brass technique.

The comparisons summarized in Table 6, which presents the same comparisons as those in Tables 4 and 5 but for each state separately, confirm our previous statements. In general, the fit between the Brass estimates and the three regression method estimates is better in states where we suspect that fertility has not been declining as rapidly as in other states.

Table 6. Distribution of Absolute Differences between TFR Estimates from Different Estimation Methods for Major States of India, 1981

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Andhra Pradesh												
< =0.2	11	47.8	9	39.1	8	34.8	10	43.5	3	13.0	17	73.9
0.4	7	30.4	12	52.2	11	47.8	10	43.5	7	30.4	6	26.1
0.6	4	17.4	2	8.7	4	17.4	3	13.0	9	39.1	0	0.0
0.8	0	0.0	0	0.0	0	0.0	0	0.0	4	17.4	0	0.0
1.0	1	4.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	23	100	23	100	23	100	23	100	23	100	23	100
Bihar												
< =0.2	16	51.6	12	38.7	11	35.5	10	32.3	11	35.5	25	80.6
0.4	9	29.0	10	32.3	8	25.8	15	48.4	10	32.3	5	16.1
0.6	4	12.9	4	12.9	8	25.8	6	19.4	10	32.3	1	3.2
0.8	1	3.2	3	9.7	3	9.7	0	0.0	0	0.0	0	0.0
1.0	0	0.0	1	3.2	0	0.00	0	0.0	0	0.0	0	0.0
>1.0	1	3.2	1	3.2	1	3.2	0	0.0	0	0.0	0	0.0
Total	31	100	31	100	31	100	31	100	31	100	31	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Gujarat												
< =0.2	5	26.3	3	15.8	4	21.1	4	21.1	8	42.1	6	31.6
0.4	7	36.8	1	5.3	8	42.1	6	31.6	7	36.8	10	52.6
0.6	3	15.8	5	26.3	3	15.8	6	31.6	4	21.1	3	15.8
0.8	2	10.5	6	31.6	4	21.1	2	10.5	0	0.0	0	0.0
1.0	2	10.5	2	10.5	0	0.0	1	5.3	0	0.0	0	0.0
> 1.0	0	0.0	2	10.5	0	0.0	0	0.0	0	0.0	0	0.0
Total	19	100	19	100	19	100	19	100	19	100	19	100
Haryana												
< =0.2	4	33.3	2	16.7	5	41.7	2	16.7	8	66.7	2	16.7
0.4	4	33.3	3	25.0	5	41.7	9	75.0	4	33.3	5	41.7
0.6	3	25.0	2	16.7	2	16.7	1	8.3	0	0.0	5	41.7
0.8	1	8.3	3	25.0	0	0	0	0.0	0	0.0	0	0.0
1.0	0	0.0	2	16.7	0	0	0	0.0	0	0.0	0	0.0
> 1.0	0	0.0	0	0.0	0	0	0	0.0	0	0.0	0	0.0
Total	12	100	12	100	12	100	12	100	12	100	12	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Himachal Pradesh												
< =0.2	2	16.7	5	41.7	6	50.0	6	50.0	3	25.0	3	25.0
0.4	6	50.0	3	25.0	4	33.3	5	41.7	3	25.0	9	75.0
0.6	1	8.3	1	8.3	2	16.7	1	8.3	3	25.0	0	0.0
0.8	1	8.3	3	25.0	0	0.0	0	0.0	2	16.7	0	0.0
1.0	0	0.0	0	0.0	0	0.0	0	0.0	1	8.3	0	0.0
>1.0	2	16.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	100	12	100	12	100	12	100	12	100	12	100
Jammu & Kashmir												
< =0.2	0	0.0	0	0.0	3	21.4	11	78.6	0	0.0	1	7.1
0.4	0	0.0	1	7.1	3	21.4	3	21.4	5	35.7	8	57.1
0.6	2	14.3	3	21.4	3	21.4	0	0.0	7	50.0	4	28.6
0.8	4	28.6	3	21.4	0	0.0	0	0.0	1	7.1	1	7.1
1.0	3	21.4	2	14.3	3	21.4	0	0.0	1	7.1	0	0.0
>1.0	5	35.7	5	35.7	2	14.3	0	0.0	0	0.0	0	0.0
Total	14	100	14	100	14	100	14	100	14	100	14	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Karnataka												
< =0.2	2	10.5	6	31.6	11	57.9	7	36.8	0	0.0	7	36.8
0.4	7	36.8	8	42.1	5	26.3	10	52.6	4	21.1	9	47.4
0.6	4	21.1	2	10.5	1	5.3	2	10.5	12	63.2	3	15.8
0.8	3	15.8	1	5.3	1	5.3	0	0.0	3	15.8	0	0.0
1.0	1	5.3	1	5.3	0	0.0	0	0.0	0	0.0	0	0.0
> 1.0	2	10.5	1	5.3	1	5.3	0	0.0	0	0.0	0	0.0
Total	19	100	19	100	19	100	19	100	19	100	19	100
Kerala												
< =0.2	0	0.0	6	50.0	5	41.7	2	16.7	0	0.0	4	33.3
0.4	4	33.3	2	16.7	4	33.3	7	58.3	0	0.0	6	50.0
0.6	4	33.3	0	0.0	3	25.0	3	25.0	7	58.3	2	16.7
0.8	0	0.0	2	16.7	0	0.0	0	0.0	5	41.7	0	0.0
1.0	0	0.0	1	8.3	0	0.0	0	0.0	0	0.0	0	0.0
> 1.0	4	33.3	1	8.3	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	100	12	100	12	100	12	100	12	100	12	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Madhya Pradesh												
< =0.2	10	22.2	19	42.2	18	40.0	13	28.9	19	42.2	36	80.0
0.4	17	37.8	18	40.0	16	35.6	11	24.4	5	11.1	8	17.8
0.6	15	33.3	3	6.7	9	20.0	16	35.6	12	26.7	1	2.2
0.8	3	6.7	3	6.7	1	2.2	5	11.1	9	20.0	0	0.0
1.0	0	0.0	2	4.4	0	0.0	0	0.0	0	0.0	0	0.0
> 1.0	0	0.0	0	0.0	1	2.2	0	0.0	0	0.0	0	0.0
Total	45	100	45	100	45	100	45	100	45	100	45	100
Maharashtra												
< =0.2	14	53.8	12	46.2	10	38.5	16	61.5	12	46.2	21	80.8
0.4	8	30.8	10	38.5	9	34.6	9	34.6	8	30.8	4	15.4
0.6	3	11.5	3	11.5	5	19.2	1	3.8	5	19.2	1	3.8
0.8	0	0.0	1	3.8	2	7.7	0	0.0	1	3.8	0	0.0
1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 1.0	1	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	26	100	26	100	26	100	26	100	26	100	26	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Orissa												
< =0.2	9	69.2	6	46.2	5	38.5	6	46.2	10	76.9	7	53.8
0.4	4	30.8	3	23.1	5	38.5	7	53.8	3	23.1	5	38.5
0.6	0	0.0	4	30.8	2	15.4	0	0.0	0	0.0	1	7.7
0.8	0	0.0	0	0.0	1	7.7	0	0.0	0	0.0	0	0.0
1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	13	100	13	100	13	100	13	100	13	100	13	100
Punjab												
< =0.2	0	0.0	0	0.0	0	0.0	0	0.0	12	100	0	0.0
0.4	2	16.7	0	0.0	1	8.3	9	75.0	0	0.0	10	83.3
0.6	1	8.3	0	0.0	1	8.3	3	25.0	0	0.0	2	16.7
0.8	4	33.3	2	16.7	5	41.7	0	0.0	0	0.0	0	0.0
1.0	4	33.3	2	16.7	5	41.7	0	0.0	0	0.0	0	0.0
> 1.0	1	8.3	8	66.7	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	100	12	100	12	100	12	100	12	100	12	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rajasthan												
< =0.2	6	23.1	3	11.5	5	19.2	22	84.6	18	69.2	21	80.8
0.4	6	23.1	9	34.6	8	30.8	4	15.4	7	26.9	4	15.4
0.6	3	11.5	3	11.5	6	23.1	0	0.0	1	3.8	1	3.8
0.8	7	26.9	7	26.9	5	19.2	0	0.0	0	0.0	0	0.0
1.0	4	15.4	4	15.4	2	7.7	0	0.0	0	0.0	0	0.0
> 1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	26	100	26	100	26	100	26	100	26	100	26	100
Tamil Nadu												
< =0.2	5	31.3	4	25.0	10	62.5	15	93.8	9	56.3	10	62.5
0.4	4	25.0	6	37.5	3	18.8	1	6.3	6	37.5	5	31.3
0.6	5	31.3	4	25.0	1	6.3	0	0.0	1	6.3	1	6.3
0.8	1	6.3	0	0.0	1	6.3	0	0.0	0	0.0	0	0.0
1.0	1	6.3	2	12.5	1	6.3	0	0.0	0	0.0	0	0.0
> 1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	16	100	16	100	16	100	16	100	16	100	16	100

Table 6. (continued)

(B: Brass, P: Palmore, G: Gunasekaran-Palmore, R: Rele)

Difference	Pair of Methods											
	B-P		B-G		B-R		P-G		P-R		G-R	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Uttar pradesh												
< =0.2	25	45.0	22	39.0	22	39.3	15	27.0	24	43.0	40	71.0
0.4	16	28.6	16	28.6	25	44.6	17	30.4	19	33.9	14	25.0
0.6	13	23.2	7	12.5	7	12.5	17	30.4	7	12.5	2	3.6
0.8	1	1.8	9	16.1	1	1.8	6	10.7	5	8.9	0	0.0
1.0	1	1.8	1	1.8	1	1.8	1	1.8	1	1.8	0	0.0
> 1.0	0	0.0	1	1.8	0	0.0	0	0.0	0	0.0	0	0.0
Total	56	100	56	100	56	100	56	100	56	100	56	100
West Bengal												
< =0.2	5	31.3	6	37.5	9	56.3	9	56.3	1	6.3	3	18.8
0.4	3	18.8	5	31.3	5	31.3	5	31.3	5	31.3	4	25.0
0.6	6	37.5	3	18.8	2	12.5	2	12.5	4	25.0	9	56.3
0.8	2	12.5	2	12.5	0	0.0	0	0.0	5	31.3	0	0.0
1.0	0	0.0	0	0.0	0	0.0	0	0.0	1	6.3	0	0.0
> 1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	16	100	16	100	16	100	16	100	16	100	16	100

In addition, the Palmore and Gunasekaran-Palmore estimates agree better with the Rele estimates in the states with relatively little fertility decline before 1981. The Palmore and Gunasekaran-Palmore method estimates tend to agree better in states that we believe have undergone more fertility change prior to 1981. For the most part, then, what we are seeing is relatively close agreement between the methods regardless of the referent time period when fertility has not changed very much but agreement between the Palmore and Gunasekaran-Palmore methods in areas with fertility decline before 1981. Since the Palmore and Gunasekaran-Palmore methods refer to the same time period, this is what we should expect.

Regional and Intra-State Fertility Differentials

Having summarized the differences between the results of the four fertility estimation methods, we now move on to an overview of the fertility situation in India shortly before 1981. For this purpose, we use an average of the three regression method estimates of the total fertility rate. In other words, we averaged the estimates from the Rele, Palmore, and Gunasekaran-Palmore methods. We did this partially to simplify our description but also in the belief that any one method's estimate might be misleading and that "averaging out" errors might be advisable. We did not include the Brass method estimates in our averages because, as shown above, we believe the Brass method estimates are too high. Tables 7 - 9 and Map 1 present selected important results.

The first striking result in the district-level total fertility rates is the proportion of India's districts with very high fertility (see Table 7). Close to eighty-four percent of the districts had a total fertility rate of 4.0 or more. More than forty-five percent of the districts

Table 7. Distribution of Districts by the Level of Average Total Fertility Rate, India, 1981

Total Fertility Rate (TFR)	Number of Districts	Percentage
2.5 and under	1	0.2
2.5 - 3.0	11	2.7
3.0 - 3.5	16	4.0
3.5 - 4.0	37	9.2
4.0 - 4.5	73	18.2
4.5 - 5.0	81	20.1
5.0 - 5.5	73	18.2
5.5 - 6.0	70	17.4
6.0 - 6.5	27	6.7
6.5 - 7.0	13	3.2
7.0 and above	0	0.0
Total	**402**	**100.0**

had a total fertilty rate greater than 5.0. Only one district had a total fertility rate less than 2.5 and only twelve had total fertility rates less than 3.0.

As shown in Tables 8 and 9, the second important result is the very wide variation in the

Table 8. Distribution of Districts by Their Level of Average Total Fertility Rate for Major States of India, 1981

State	Number of Districts with Average TFR				
	< = 3	3 - 4	4 - 5	5 - 6	> 6
Andhra Pradesh	0	4	17	2	0
Bihar	0	0	1	27	3
Gujarat	0	3	13	3	0
Haryana	0	0	3	9	0
Himachal Pradesh	0	1	11	0	0
Jammu & Kashmir	0	1	5	8	0
Karnataka	0	4	15	0	0
Kerala	6	5	1	0	0
Madhya Pradesh	0	0	9	22	14
Maharashtra	0	7	17	2	0
Orissa	0	0	11	2	0
Punjab	0	3	9	0	0
Rajasthan	0	0	2	20	4
Tamil Nadu	3	10	3	0	0
Uttar Pradesh	0	0	8	29	19
West Bengal	1	2	9	4	0

total fertility rates: a range in total fertility rates of more than four children! While the variation is particularly high when considering India as a whole, it is also remarkable how much variation was evident in the districts within each state.

For Bihar, Haryana, Jammu and Kashmir, Madhya Pradesh, Rajasthan, and Uttar Pradesh, the distribution of district-level total fertility rates is clearly skewed toward higher rates. Kerala and Tamil Nadu, on the other hand, are two states with most district-level fertility estimates skewed towards lower rates. The remaining states are in between these two extremes (Table 8).

The within state variations in district-level fertility are highly divergent. The coefficients of variation are highest in Kerala and West Bengal (see Table 9), with Kerala having a district-level range in TFRs from 2.5 to 4.2 and West Bengal having a range of 2.4 to 5.5. Tamil Nadu and Maharashtra also show substantial variation. In general, the intra-state variability in TFRs seems to be higher in states that probably underwent fertility declines before 1981. The variation in district-level total fertility rates is less for states with high levels of fertility overall. Examples of this phenomenon are Bihar, with a range of TFRs from 4.4 to 6.4; Haryana with a range of TFRs from 4.4 to 5.9; Orissa with a range of TFRs from 4.1 to 5.4; and Rajasthan with a range of TFRs from 4.8 to 6.5.

For the whole country (except Assam), the range in district-level TFRs is from a low of 2.4 for Calcutta to a high of 6.8, shared by the Tikamgarh and Chhatarpur districts in Madhya Pradesh and the Bijnor, Maradabad, and Rampur districts in Uttar Pradesh. This

Table 9. Intra-State Variability in Total Fertility Rates, Major States of India, 1981

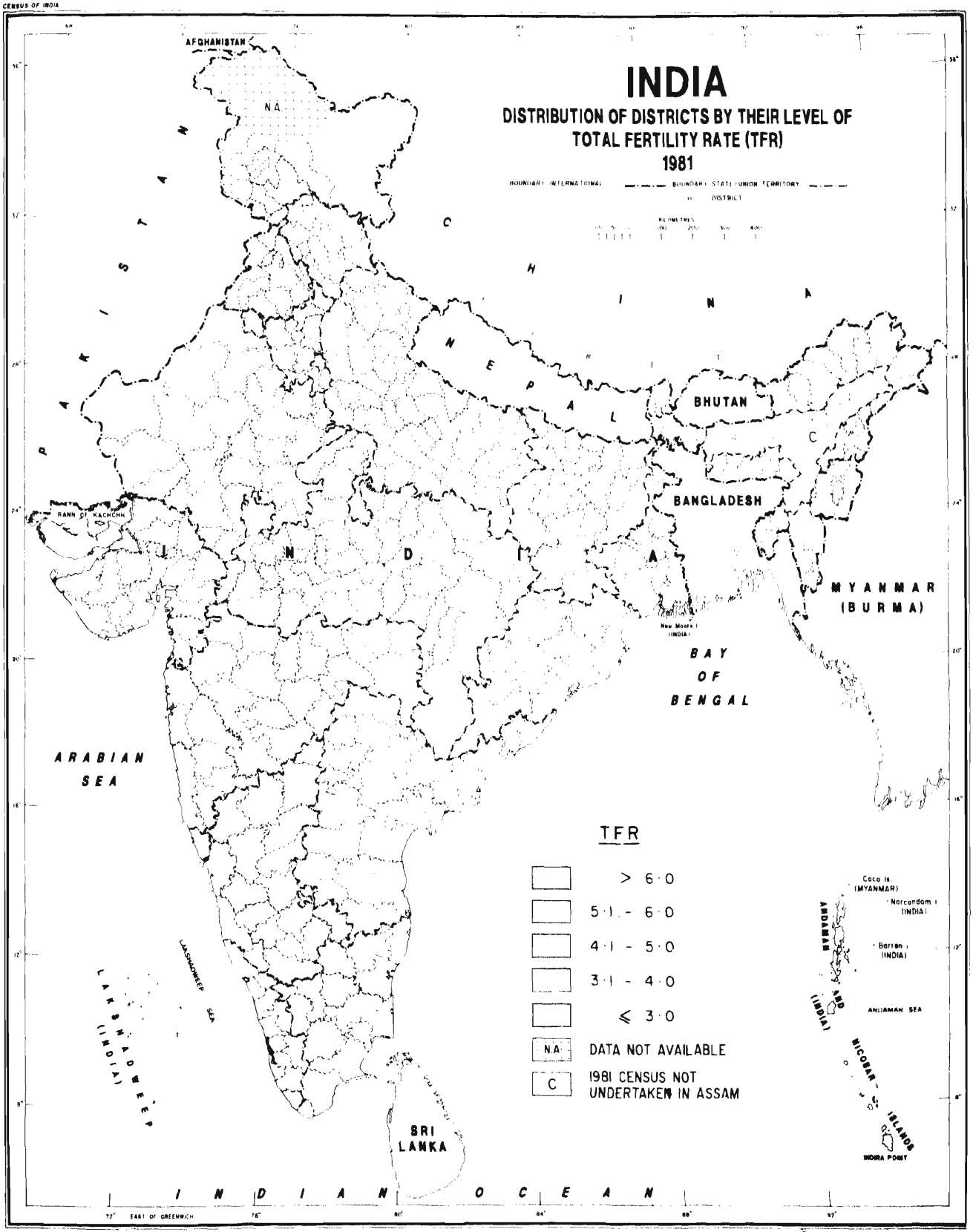
State	Total Fertility Rate				
	TFR	Min.	Max.	S.D.	C.V.
Andhra Pradesh	4.3	3.7	5.1	0.4	9.8
Bihar	5.5	4.4	6.4	0.4	6.8
Gujarat	4.4	4.0	5.6	0.4	10.1
Haryana	5.2	4.4	5.9	0.4	7.2
Himachal Pradesh	4.4	3.7	4.9	0.3	7.2
Jammu & Kashmir	4.8	3.7	5.8	0.5	10.7
Karnataka	4.4	3.5	5.0	0.5	10.3
Kerala	3.1	2.5	4.2	0.5	17.6
Madhya Pradesh	5.5	4.3	6.8	0.7	12.0
Maharashtra	4.2	3.2	5.4	0.5	13.0
Orissa	4.7	4.1	5.4	0.3	7.3
Punjab	4.2	3.6	4.7	0.3	6.3
Rajasthan	5.6	4.8	6.5	0.4	7.1
Tamil Nadu	3.7	2.8	4.5	0.5	14.1
Uttar Pradesh	5.8	4.2	6.8	0.6	10.3
West Bengal	4.4	2.4	5.5	0.7	17.0

Note: Coefficient of Variation (C.V.) is calculated with respect to our state level TFR estimates rather than the mean of TFRs for districts in each state.

overall fertility pattern, described in the tables and paragraphs above, is perhaps best summarized in a map (Map 1).

Just before 1981, the districts with total fertility rates of 5.0 and above were clearly concentrated in Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh, and Bihar. The districts with lower fertility rates are mostly coastal areas in Maharashtra, Karnataka, Kerala, Tamil Nadu, and Andhra Pradesh. Most of the districts in the north-eastern states of Nagaland and Manipur also have relatively low TFRs. TFRs in the middle range are found in districts located in the northern states of Jammu and Kashmir, Punjab, Himachal Pradesh; the western state Gujarat; the eastern states of West Bengal and Orissa; and hinterland districts of Maharashtra, Andhra Pradesh, and Karnataka. Most of the districts of Mizoram and Tripura also fall into this middle category.

Studying the map will provide few surprises for the keen observer of Indian fertility patterns when it comes to assessing the overall pattern by state, but the variation within states and the pockets of either high or low fertility in each state stand out more when looking at the map than when looking at a rather less visually appealing table. The few districts with very high fertility in Maharashtra, Andhra Pradesh, and Orissa clearly stand out. The pockets of lower fertility in Himachal Pradesh, Jammu and Kashmir, Gujarat, and West Bengal also catch the eye. Likewise, the difference in fertility of the coastal and hinterland districts in the southern states is notable.



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Results, Mortality

Tables 10 - 15 summarize our new district-level mortality estimates. As one might expect, mortality conditions in India are highly variable too. The district-level infant mortality rates vary from under 30 to over 200! With an IMR of 60 as the national goal for the year 2000, it is remarkable that only 46 districts out of 402 had achieved that level by 1981 (Table 10). In

Table 10. Distribution of Districts by the Level of the Infant Mortality Rate, India, 1981

Infant Mortality Rate (IMR)	Number of Districts	Percentage
20 and under	0	0.0
20 - 40	13	3.2
40 - 60	33	8.2
60 - 80	61	15.2
80 - 100	90	22.4
100 - 120	64	15.9
120 - 140	62	15.4
140 - 160	48	11.9
160 - 180	22	5.5
180 - 200	6	1.5
200 and above	3	0.7
Total	**402**	**100.0**

fact, more than one third of the districts had IMRs greater than 120.

Districts in Bihar, Gujarat, Madhya Pradesh, Orissa, and Uttar Pradesh tended to have higher infant mortality rates than most states (Table 11). At the other extreme, districts in

Table 11. Distribution of Districts by Their Level of Infant Mortality Rate for Major States of India, 1981

State	Number of Districts with IMR				
	< = 40	40 - 80	80 - 120	120 - 160	> 160
Andhra Pradesh	1	5	16	1	0
Bihar	0	1	16	14	0
Gujarat	0	0	8	11	0
Haryana	0	0	11	1	0
Himachal Pradesh	0	8	4	0	0
Jammu & Kashmir	0	9	4	1	0
Karnataka	0	18	1	0	0
Kerala	8	4	0	0	0
Madhya Pradesh	0	0	3	32	10
Maharashtra	0	9	17	0	0
Orissa	0	0	3	10	0
Punjab	0	5	7	0	0
Rajasthan	0	3	16	7	0
Tamil Nadu	0	4	12	0	0
Uttar Pradesh	0	0	8	29	19
West Bengal	0	7	7	2	0

Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Punjab, and West Bengal had lower infant mortality rates. Among these states, Kerala clearly stands out as having the lowest IMRs.

As was true for fertility rates, there is substantial intra-state variation in infant mortality rates (Table 12). Within state variability in IMR levels is highest in Jammu and Kashmir, with a coefficient of variation of 30.5. In that state, the district-level IMRs range from a low of 44 in Srinagar district to a high of 142 in Kargil district. Kerala, West Bengal, Maharashtra, and Himachal Pradesh also have relatively high levels of variability. Again as was true for fertility rates, it appears that within state variability in IMRs is usually greater in states where the IMR appears to have been declining more rapidly prior to 1981.

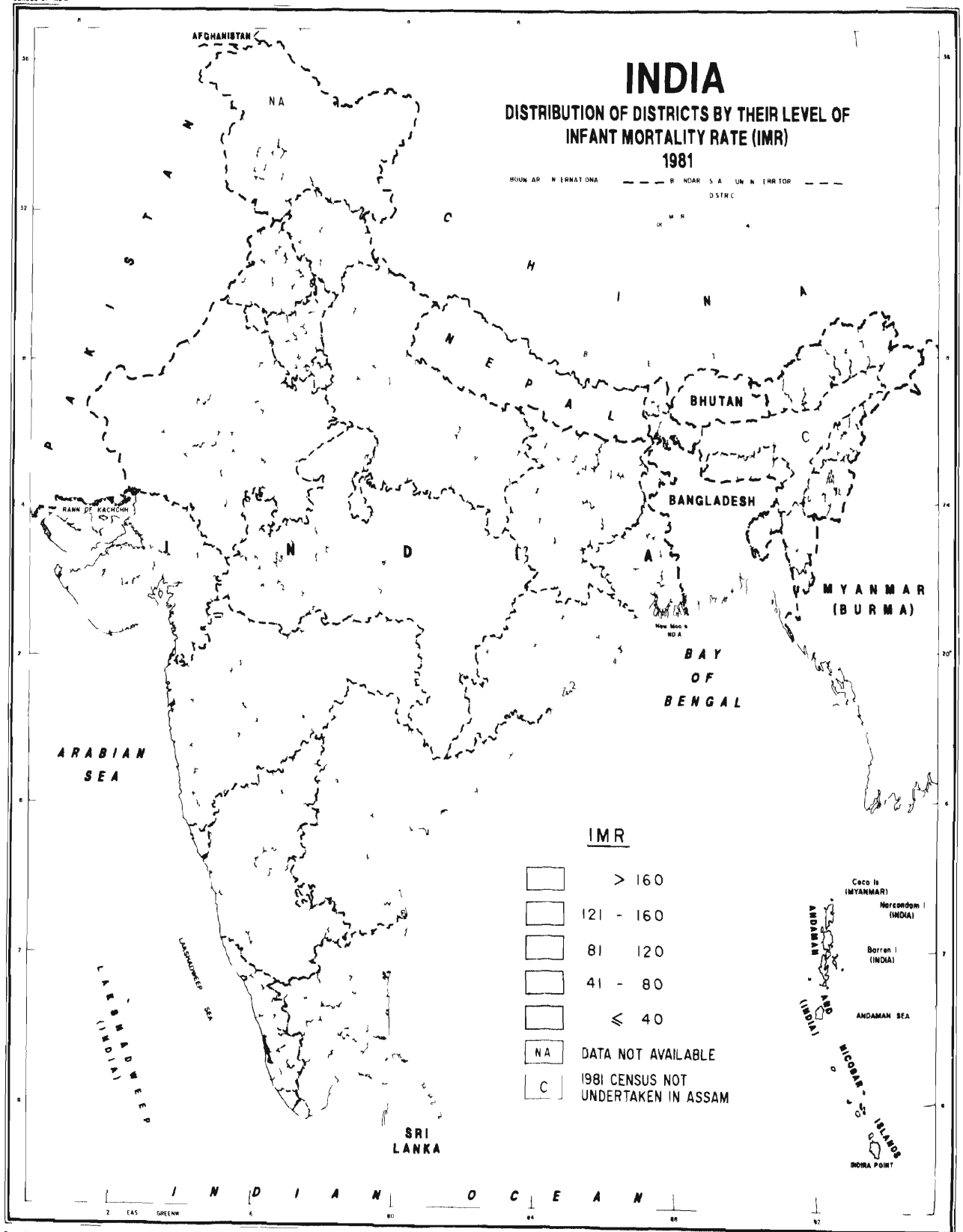
The districts with IMRs over 120 are mostly located in Uttar Pradesh, Madhya Pradesh, Bihar, and Orissa (see Map 2). Surprisingly, there are also many districts in Gujarat with high IMRs. Perhaps equally surprising is that relatively few districts in Rajasthan have IMRs over 120. All of the districts with IMRs greater than 160 are found in Uttar Pradesh and Madhya Pradesh except for East Kameng and Upper Subansiri districts in Arunachal Pradesh.

Kerala has the lowest levels of infant mortality in the country. Western Maharashtra, Karnataka, Nagaland, Manipur, Mizoram also have relatively low infant mortality, as do many districts in Jammu and Kashmir, Himachal Pradesh, Punjab, Rajasthan, Arunachal Pradesh, and Western Bengal.

Table 12. Intra-state Variability in the Infant Mortality Rate Major States of India, 1981

State	Infant Mortality Rate				
	TFR	Min.	Max.	S.D.	C.V.
Andhra Pradesh	86.0	29.7	123.5	18.2	21.1
Bihar	118.0	67.9	150.7	16.2	13.8
Gujarat	116.0	88.8	145.3	18.3	15.8
Haryana	101.0	80.2	122.0	12.0	11.9
Himachal Pradesh	71.0	51.4	105.4	16.0	22.5
Jammu & Kashmir	72.0	43.7	141.9	21.9	30.5
Karnataka	69.0	40.2	86.9	9.9	14.4
Kerala	37.0	25.6	57.4	9.7	26.2
Madhya Pradesh	142.0	80.3	181.6	21.9	15.4
Maharashtra	79.0	48.8	115.5	18.5	23.5
Orissa	135.0	104.2	156.9	17.7	13.1
Punjab	81.0	70.0	91.8	6.0	7.4
Rajasthan	108.0	57.4	142.5	21.4	19.8
Tamil Nadu	91.0	53.9	110.7	15.5	17.0
Uttar Pradesh	150.0	85.0	212.5	25.8	17.2
West Bengal	91.0	45.7	127.2	23.0	25.2

Note: Coefficient of Variation (C.V.) is calculated with respect to our state level IMR estimates rather than the mean of IMRs for districts in each state.



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For the country as a whole, the infant mortality rate ranged from a low of 26 for Kottayam district in Kerala to a high of 212 for Hardoi district in Uttar Pradesh. The few districts with IMRs less than 40 are Hyderabad district in Andhra Pradesh; Cannanore, Kozhikod., Trichur, Ernakulam, Kottayam, Alleppey, Quilon, and Trivendrum districts in Kerala; Manipur South and Manipur Central districts in Manipur; and Wokha district in Nagaland. At the other extreme, the districts with an IMR over 200 were Badaun and Hardoi districts in Uttar Pradesh, and East Kameng in Arunachal Pradesh.

Turning now to our other mortality estimate, the life expectancy at birth, we found that about one third of all the districts in India in 1981 had a life expectancy at birth less than 50 years and only eleven districts had an e_0 greater than 70 years (Table 13). Roughly half of the districts had an e_0 between 50 and 60 years. For the country as a whole, the 1981 district-level life expectancy at birth ranged from 38.2 years for Hardoi district in Uttar Pradesh to 75.0 years for Manipur Central district in Manipur.

The districts with expectations of life less than 50 years are mostly in Uttar Pradesh, Madhya Pradesh, Bihar, and Orissa (see Map 3). The areas with relatively high life expectancy are the entire states of Kerala, Punjab, Nagaland, Manipur, and Mizoram, and the districts in western Rajasthan and western Maharashtra. From both the map and Table 14, one can see wide variability in the e_0 values.

Table 13. Distribution of Districts by the Level of Expectation of Life at Birth, India, 1981		
Expectation of Life at Birth (e_0)	**Number of Districts**	**Percentage**
40 and under	4	1.0
40 - 45	21	5.2
45 - 50	97	24.1
50 - 55	88	21.9
55 - 60	103	25.6
60 - 65	56	13.9
65 - 70	22	5.5
70 - 75	10	2.5
75 and above	1	0.2
Total	402	100.0

The districts with higher mortality rates (lower e_0 values) are generally found in Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, West Bengal, Rajasthan, and Tamil Nadu. Districts in Bihar, Orissa, and Uttar Pradesh have the lowest e_0 values. To give an example from just one of these states: twenty-nine of the thirty-one districts in Bihar had 1981 life expectancies less than 50. At the other extreme, all of the districts in Kerala and Punjab have life expectancies over 60 (Table 14).

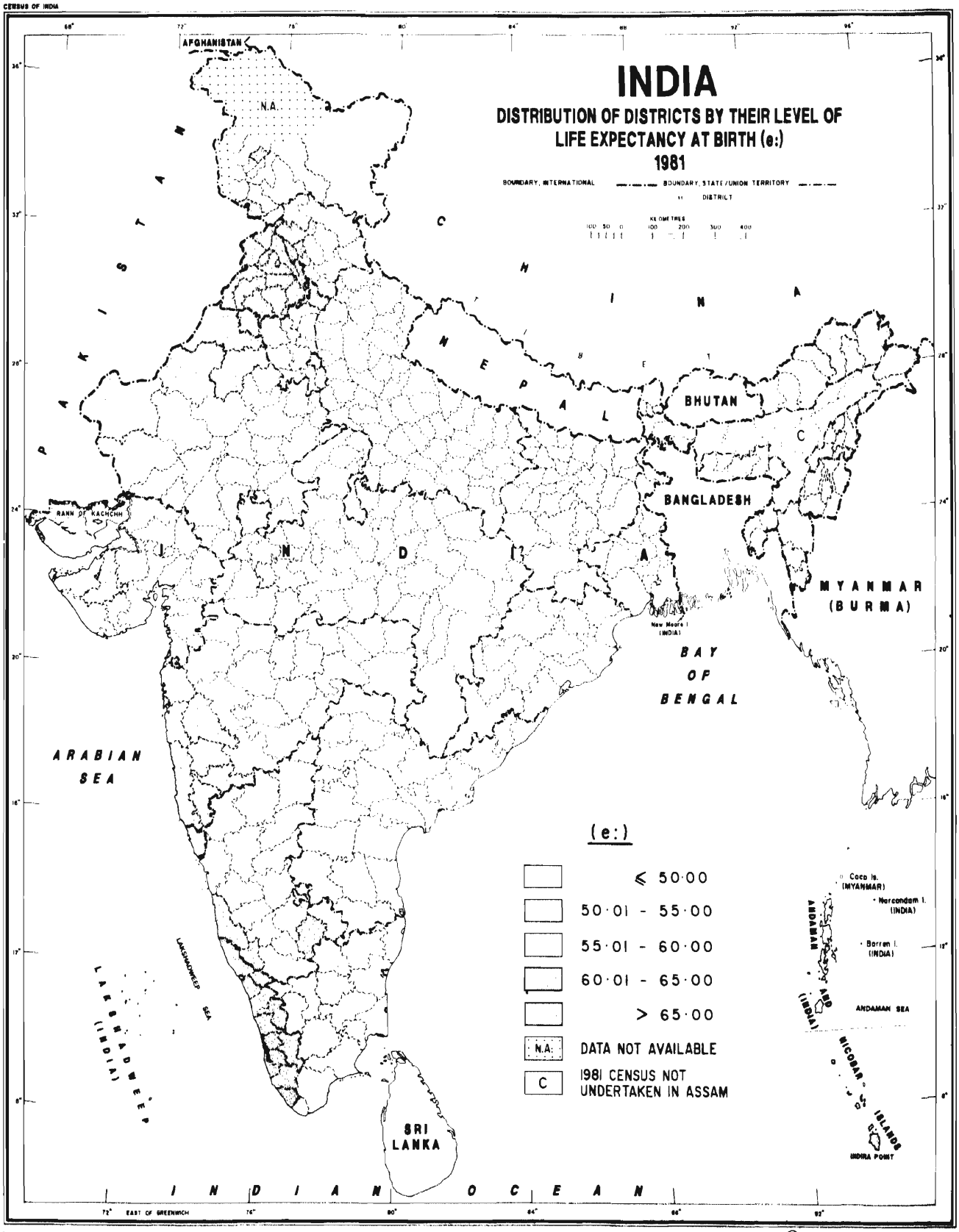

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Table 14. Distribution of Districts by Their Level of Expectation of Life at Birth for Major States of India, 1981

State	Number of Districts with e_0				
	< = 50	50 - 55	55 - 60	60 - 65	> 65
Andhra Pradesh	3	5	14	0	1
Bihar	29	2	0	0	0
Gujarat	0	1	17	1	0
Haryana	0	2	9	1	0
Himachal Pradesh	1	3	4	4	0
Jammu & Kashmir	1	1	10	2	0
Karnataka	0	1	15	2	1
Kerala	0	0	0	3	9
Madhya Pradesh	25	17	2	1	0
Maharashtra	3	6	10	6	1
Orissa	8	2	3	0	0
Punjab	0	0	0	12	0
Rajasthan	6	11	5	3	1
Tamil Nadu	0	11	4	1	0
Uttar Pradesh	41	13	2	0	0
West Bengal	2	10	3	1	0

The intra-state variability in the district e_0 levels is highest in Rajasthan, where the district-level life expectancies at birth range from 45.4 years for Tonk district to 65.1 years for

Bikaner district (Table 15). Relatively high within state variability is also found in Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir, Maharashtra, and Madhya Pradesh.

Table 15. Intra-State Variability in Life Expectancy at Birth, Major States of India, 1981

State	Life Expectancy at Birth (e_0)				
	e_0	Min.	Max.	S.D.	C.V.
Andhra Pradesh	55.0	47.7	67.8	3.7	6.6
Bihar	46.5	42.2	53.6	1.8	3.9
Gujarat	56.1	51.8	60.2	2.0	3.7
Haryana	55.8	51.5	60.2	2.7	4.8
Himachal Pradesh	56.7	46.8	62.7	4.8	8.5
Jammu & Kashmir	57.7	42.8	64.6	4.7	8.2
Karnataka	57.7	53.2	65.6	2.4	4.1
Kerala	67.3	61.2	71.2	3.1	4.6
Madhya Pradesh	49.7	42.9	61.3	4.0	8.1
Maharashtra	57.8	48.9	65.8	4.7	8.2
Orissa	49.8	46.2	56.1	3.6	7.1
Punjab	61.7	60.4	64.2	1.0	1.7
Rajasthan	53.0	45.4	65.1	5.2	9.9
Tamil Nadu	53.6	53.0	60.8	2.2	4.0
Uttar Pradesh	47.0	38.2	57.1	4.3	9.2
West Bengal	51.7	45.6	60.3	3.7	7.1

Note: Coefficient of Variation (C.V.) is calculated with respect to our state level e_0 estimates rather than the mean of e_0 values for districts in each state.

The lowest intra-state variability is observed in Punjab where all of the districts have life expectancies between 60 and 65 years.

Discussion and Conclusions

The main result from this work is the series of new fertility and mortality estimates for each district, presented in Appendices I and II. While useful in their own right, these numbers will become even more useful after a similar study is completed when the appropriate 1991 Census data become available.

The new district-level estimates presented in this report are almost certainly more valid than the Brass method estimates published earlier for the reasons enumerated earlier in this report. Nevertheless, these new estimates should also be interpreted and used with some caution. They are, after all, *estimates* rather than actual fertility and mortality rates resulting from the combination of complete and reliable vital registration of births and deaths and good census data.

The district-level fertility estimates should be viewed with particular caution under the following four conditions:

> if migration into or out of the district was particularly heavy in the five to ten years before the 1981 Census (because heavy migration affects the age and sex distribution of the district's population);

- if the age and sex distribution data for the district is especially inaccurate because of under-enumeration of particular age groups or females or males, age mis-statement, or other reasons;

- if the district has cultural norms that make it uncommonly likely to under-report children ages 0-4; and

- if the mortality estimates for the district are inaccurate, since all three regression methods use a mortality indicator as an input variable;

The district-level mortality estimates are, of course, most likely to be wrong if there were reporting errors in the 1981 Census on the special questions on children ever born and children surviving.

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APPENDIX I

District Level Fertility Estimates, 1981

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	INDIA	4.9	4.8	4.7	4.8	4.8
	ANDHRA PRADESH	4.3	4.1	4.4	4.5	4.3
1	SRIKAKULAM	4.1	4.4	4.6	4.5	4.5
2	VIJAYNAGARAM	4.0	4.2	4.4	4.2	4.3
3	VISHAKHAPATANAM	4.0	3.8	4.1	4.2	4.0
4	EAST GODAVARI	3.8	3.8	4.2	4.2	4.1
5	WEST GODAVARI	3.9	3.8	4.1	4.3	4.1
6	KRISHNA	4.3	3.8	3.9	4.2	4.0
7	GUNTUR	4.1	3.6	3.8	4.1	3.8
8	PRAKASAM	4.6	4.2	4.4	4.5	4.3
9	NELLORE	3.9	3.5	3.8	4.0	3.8
10	CHITTOOR	4.0	4.0	4.1	4.2	4.1
11	CUDDAPAH	4.5	4.0	4.2	4.4	4.2
12	ANANTPUR	4.9	4.9	5.0	5.2	5.0
13	KURNOOL	5.0	4.7	4.8	5.0	4.8
14	MAHBUBNAGAR	4.9	5.0	5.3	5.2	5.1
15	RANGAREDDY	4.8	4.7	4.8	5.1	4.9
16	HYDERABAD	4.2	3.4	3.7	4.1	3.7
17	MEDAK	4.6	4.4	4.7	4.9	4.6
18	NIZAMABAD	4.1	3.9	4.3	4.5	4.2
19	ADILABAD	4.6	4.5	4.9	5.0	4.8
20	KARIMNAGAR	4.1	3.7	4.2	4.4	4.1
21	WARANGAL	4.6	4.6	4.9	5.0	4.9
22	KHAMMAM	4.7	4.6	4.9	5.2	4.9
23	NALGONDA	4.5	4.6	4.8	4.9	4.8

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	BIHAR	5.2	5.3	5.5	5.6	5.5
1	PATNA	5.4	5.3	5.4	5.6	5.4
2	NALANDA	5.4	5.5	5.7	5.8	5.7
3	NAWADA	5.7	5.2	5.5	5.6	5.4
4	GAYA	5.7	5.5	5.8	5.7	5.6
5	AURANGABAD	5.6	5.5	5.7	5.7	5.6
6	ROHTAS	5.3	5.2	5.4	5.6	5.4
7	BHOJPUR	5.1	5.2	5.3	5.6	5.4
8	SARAN	5.1	4.9	5.4	5.5	5.3
9	SIWAN	5.2	5.0	5.5	5.6	5.4
10	GOPALGANJ	5.3	5.1	5.6	5.6	5.4
11	PASCHIM CHAMPARAN	5.2	5.5	5.8	5.6	5.7
12	PURAB CHAMPARAN	4.9	5.3	5.6	5.5	5.5
13	SITAMARHI	5.0	5.4	5.5	5.3	5.4
14	MUZAFFARPUR	5.3	5.1	5.3	5.2	5.2
15	VAISHALI	5.3	5.4	5.6	5.6	5.5
16	BEGUSARAI	5.6	5.4	5.5	5.6	5.5
17	SAMASTIPUR	5.4	5.4	5.5	5.4	5.4
18	DARBHANGA	5.4	4.8	5.2	5.3	5.1
19	MADHUBANI	4.8	4.7	5.2	5.3	5.0
20	SAHARSA	5.8	5.4	5.5	5.6	5.5
21	PURNIA	5.5	6.1	6.3	6.3	6.2
22	KATHIHAR	5.7	6.1	6.1	6.2	6.1
23	MUNGER	5.7	5.5	5.8	5.7	5.7
24	BHAGALPUR	5.5	5.8	6.2	5.9	6.0
25	SANTHAL PARGANA	3.9	5.0	5.3	5.2	5.2
26	DHANBAD	4.6	4.7	5.0	5.3	5.0
27	GIRIDIH	5.1	5.1	5.5	5.6	5.4
28	HAZARIBAG	5.5	5.5	6.0	5.9	5.8
29	PALAMU	5.7	6.3	6.7	6.2	6.4
30	RANCHI	5.0	4.8	5.1	5.1	5.0
31	SINGHBHUM	4.3	4.3	4.4	4.7	4.4

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	GUJARAT	4.7	4.6	4.2	4.5	4.4
1	JAMNAGAR	5.2	4.5	4.2	4.6	4.4
2	RAJKOT	4.7	4.2	3.9	4.3	4.2
3	SURENDRANAGAR	5.3	5.2	4.6	4.8	4.9
4	BHAVNAGAR	5.2	4.8	4.6	4.9	4.8
5	AMRELI	5.4	4.8	4.6	5.0	4.8
6	JUNAGARH	5.3	4.5	4.2	4.7	4.4
7	KACHCHH	5.3	5.0	4.4	4.6	4.7
8	BANAS KANTHA	5.9	5.9	5.4	5.4	5.6
9	SABAR KANTHA	4.8	4.7	4.4	4.5	4.5
10	MAHESANA	4.9	4.6	4.0	4.3	4.3
11	GANDHINAGAR	4.3	4.7	3.9	4.3	4.3
12	AHMEDABAD	4.3	4.2	3.6	4.1	4.0
13	KHEDA	4.5	4.7	4.0	4.2	4.3
14	PANCH MAHALS	5.4	5.2	4.9	5.0	5.0
15	VADODARA	3.7	4.4	3.8	4.1	4.1
16	BHARUCH	4.5	4.3	4.3	4.5	4.4
17	SURAT	3.9	4.2	3.7	4.1	4.0
18	VALSAD	4.0	4.0	3.8	4.0	4.0
19	THE DANGS	4.7	5.6	5.3	5.1	5.4

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	HARYANA	5.4	5.3	5.0	5.4	5.2
1	AMBALA	5.0	4.3	4.2	4.6	4.4
2	KURUKSHETRA	5.5	5.0	4.6	5.2	5.0
3	KARNAL	5.6	5.3	5.0	5.3	5.2
4	JIND	5.7	5.5	5.2	5.7	5.4
5	SONIPAT	5.3	4.9	4.6	5.0	4.8
6	ROHTAK	5.4	5.3	5.1	5.2	5.2
7	FARIDABAD	5.2	5.5	5.1	5.5	5.3
8	GURGAON	5.3	5.7	5.4	5.8	5.6
9	MAHENDRAGARH	5.1	5.4	5.3	5.4	5.4
10	BHIWANI	5.9	5.9	5.7	6.0	5.9
11	HISAR	5.4	5.2	4.9	5.4	5.2
12	SIRSA	5.4	5.1	4.8	5.3	5.1
	HIMACHAL PRADESH	4.7	4.2	4.4	4.7	4.4
1	CHAMBA	4.9	4.5	4.6	4.8	4.6
2	KANGRA	4.8	3.8	4.2	4.5	4.1
3	HAMIRPUR	4.3	3.6	4.2	4.4	4.1
4	UNA	4.9	3.8	4.2	4.5	4.2
5	BILASPUR	4.5	4.1	4.4	4.7	4.4
6	MANDI	4.6	4.4	4.7	4.9	4.7
7	KULU	4.9	4.5	4.6	4.8	4.7
8	LAHUL & SPITI	4.2	3.8	3.6	3.7	3.7
9	SIMLA	4.7	4.3	4.3	4.5	4.4
10	SOLAN	4.6	4.3	4.4	4.7	4.5
11	SIRMAUR	4.9	4.8	4.8	5.1	4.9
12	KINNAUR	4.9	4.7	4.7	4.6	4.7

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	JAMMU & KASHMIR	5.6	4.6	4.7	5.1	4.8
1	ANANTNAG	5.7	4.7	4.9	5.2	5.0
2	PULWAMA	5.5	4.8	5.2	5.4	5.1
3	SRINAGAR	5.0	3.3	3.6	4.2	3.7
4	BADGAM	5.4	4.6	4.9	5.2	4.9
5	BARAMULA	5.6	4.9	4.9	5.3	5.0
6	KUPWARA	5.6	5.1	5.0	5.4	5.2
7	KARGIL	6.2	4.9	4.8	4.6	4.8
8	LADAKH	5.4	4.4	4.3	4.2	4.3
9	DODA	6.0	5.0	5.1	5.5	5.2
10	UDHAMPUR	5.9	5.4	5.4	5.7	5.5
11	KATHUA	6.2	4.8	4.9	5.3	5.0
12	JAMMU	5.6	4.1	4.2	4.8	4.4
13	RAJAURI	6.4	5.6	5.7	6.1	5.8
14	PUNCH	6.0	5.1	5.1	5.5	5.2
	KARNATAKA	4.7	4.2	4.4	4.7	4.4
1	BANGALORE	4.1	3.7	3.8	4.3	3.9
2	BELGAUM	4.4	4.2	4.4	4.6	4.4
3	BELLARY	5.0	4.7	4.9	5.2	5.0
4	BIDAR	5.1	4.7	5.0	5.2	5.0
5	BIJAPUR	5.0	4.8	5.0	5.0	4.9
6	CHIKMANGALUR	4.6	3.8	3.8	4.3	4.0
7	CHITRADURGA	4.9	4.5	4.7	5.0	4.7
8	DAKSHIN KANNAD	4.8	3.1	3.5	3.8	3.5
9	DHARWAD	5.0	4.5	4.6	4.8	4.6
10	GULBARGA	4.8	4.7	5.0	5.1	4.9
11	HASSAN	4.6	4.0	4.2	4.5	4.2
12	KODAGU	3.8	3.4	3.4	3.8	3.5
13	KOLAR	4.6	4.2	4.6	4.8	4.5
14	MANDYA	4.5	4.4	4.8	5.0	4.7
15	MYSORE	4.4	4.0	4.2	4.5	4.2
16	RAICHUR	5.2	4.6	5.0	5.0	4.8
17	SHIMOGA	4.8	4.1	4.3	4.8	4.4
18	TUMKUR	4.5	4.1	4.3	4.5	4.3
19	UTTAR KANNAD	4.9	3.9	4.0	4.3	4.0

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	KERALA	3.3	2.8	3.1	3.3	3.0
1	CANNANORE	4.2	3.2	3.6	3.8	3.5
2	KOZHIKODE	3.4	2.9	3.3	3.6	3.3
3	MALAPPURAM	5.0	3.9	4.2	4.5	4.2
4	PALGHAT	4.2	3.1	3.5	3.7	3.5
5	TRICHUR	2.7	2.3	2.8	2.9	2.7
6	ERNAKULAM	2.7	2.3	2.6	2.8	2.6
7	IDUKKI	3.3	2.9	3.0	3.6	3.2
8	KOTTAYAM	2.7	2.2	2.6	2.8	2.5
9	ALLEPPEY	2.7	2.3	2.7	2.8	2.6
10	QUILON	3.1	2.5	2.9	3.1	2.8
11	TRIVENDRUM	2.5	2 3	2.6	2.8	2.6
12	WAYNAD	4.9	3.7	3.8	4.3	3.9

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	MADHYA PRADESH	5.3	5.7	5.4	5.4	5.5
1	MORENA	6.8	6.7	6.2	6.3	6.4
2	BHIND	6.1	6.3	5.8	5.8	6.0
3	GWALIOR	5.8	5.6	5.0	5.3	5.3
4	DATIA	6.1	6.6	6.1	6.0	6.2
5	SHIVPURI	6.4	7.1	6.6	6.3	6.7
6	GUNA	6.3	6.7	6.4	6.3	6.5
7	TIKAMGARH	7.6	7.2	6.8	6.4	6.8
8	CHHATARPUR	6.8	7.2	6.8	6.4	6.8
9	PANNA	6.7	6.6	6.0	5.9	6.2
10	SAGAR	6.4	6.8	6.1	6.0	6.3
11	DAMOH	6.2	6.7	6.1	6.0	6.3
12	SATNA	5.9	6.2	5.7	5.6	5.8
13	REWA	5.8	5.9	5.6	5.6	5.7
14	SAHDOL	4.9	5.4	5.1	5.3	5.3
15	SIDHI	5.7	6.0	5.8	6.0	5.9
16	MANDSAUR	5.3	5.5	5.2	5.4	5.4
17	RATLAM	5.3	5.4	5.0	5.2	5.2
18	UJJAIN	5.3	5.3	5.0	5.1	5.1
19	SHAJAPUR	5.7	6.1	5.6	5.7	5.8
20	DEWAS	5.5	6.0	5.6	5.8	5.8
21	JHABUA	6.3	6.4	6.4	6.2	6.3
22	DHAR	5.7	6.0	6.0	6.0	6.0
23	INDORE	4.5	4.4	4.2	4.4	4.4
24	WEST NIMAR	5.9	6.4	6.2	6.2	6.3
25	EAST NIMAR	5.7	6.1	5.6	5.6	5.8
26	RAJGARH	5.7	6.0	5.6	5.6	5.7
27	VIDISHA	6.5	6.9	6.3	6.3	6.5
28	BHOPAL	5.1	4.8	4.3	4.8	4.6
29	SEHORE	6.2	6.6	6.1	6.0	6.2
30	RAISEN	6.4	6.8	6.3	6.3	6.5
31	BETUL	6.0	6.2	5.7	5.6	5.8
32	HOSHANGABAD	6.0	6.2	5.5	5.5	5.8
33	JABALPUR	5.3	5.6	5.0	5.2	5.2
34	NARSIMHPUR	5.5	6.2	5.9	5.7	5.9
35	MANDLA	4.5	4.9	4.8	5.0	4.9
36	CHHINDWARA	5.2	5.7	5.5	5.5	5.6
37	SEONI	5.0	5.6	5.5	5.4	5.5
38	BALAGHAT	4.6	4.9	4.8	4.8	4.9
39	SURGUJA	4.4	4.7	4.4	4.7	4.6
40	BILASPUR	4.7	5.3	5.1	5.1	5.2

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	MADHYA PRADESH (continued)					
41	RAIGARH	3.8	4.3	4.2	4.3	4.3
42	RAJNANDGAON	5.0	5.4	5.2	5.3	5.3
43	DURG	4.5	5.0	4.7	4.9	4.9
44	RAIPUR	4.7	5.0	4.9	4.9	5.0
45	BASTAR	4.7	4.8	4.6	4.8	4.7
	MAHARASHTRA	4.3	4.1	4.2	4.4	4.2
1	GREATER BOMBAY	3.4	3.3	3.0	3.4	3.2
2	THANE	3.9	3.8	3.9	4.2	4.0
3	RAIGARH	4.4	4.1	4.4	4.4	4.3
4	RATNAGIRI	4.0	3.0	3.5	3.5	3.3
5	NASIK	4.7	4.4	4.5	4.6	4.5
6	DHULE	4.8	4.6	4.8	4.8	4.7
7	JALGAON	4.8	4.4	4.5	4.5	4.5
8	AHAMADNAGAR	3.8	4.0	4.3	4.4	4.2
9	PUNE	3.6	3.6	3.8	4.0	3.8
10	SATARA	3.8	3.6	3.9	4.0	3.8
11	SANGLI	3.5	3.5	3.8	4.0	3.8
12	SOLAPUR	4.2	4.1	4.3	4.5	4.3
13	KOLHAPUR	3.5	3.1	3.5	3.8	3.5
14	AURANGABAD	4.6	4.7	4.8	4.9	4.8
15	PARBHANI	4.3	4.8	5.0	5.1	5.0
16	BID	4.3	4.5	4.8	4.8	4.7
17	NANDED	5.0	5.3	5.4	5.6	5.4
18	OSMANABAD	4.6	4.8	4.9	4.9	4.9
19	BULDANA	4.6	4.7	4.8	4.8	4.8
20	AKOLA	4.7	4.7	4.8	4.8	4.8
21	AMARAVATI	4.8	4.6	4.6	4.7	4.6
22	YAVATMAL	5.0	5.1	5.2	5.3	5.2
23	WARDHA	4.6	4.4	4.5	4.6	4.5
24	NAGPUR	4.6	4.2	4.2	4.3	4.2
25	BHANDARA	4.5	4.4	4.6	4.6	4.5
26	CHANDRAPUR	4.8	4.7	4.8	4.9	4.8

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	MANIPUR	5.2	3.8	3.8	4.1	3.9
1	MANIPUR NORTH	5.0	3.0	2.9	3.3	3.1
2	MANIPUR WEST	5.0	4.1	3.7	4.2	4.0
3	MANIPUR SOUTH	6.3	3.8	3.6	4.2	3.9
4	TENGNOUPAL	5.1	3.1	2.7	3.1	3.0
5	MANIPUR CENTRAL	5.4	4.1	4.2	4.4	4.2
6	MANIPUR EAST	5.1	3.7	3.4	3.7	3.6
	MEGHALAYA	6.0	5.0	4.6	5.0	4.9
1	JAINTIA HILLS	7.2	5.9	5.6	5.7	5.7
2	EAST KHASI HILLS	5.6	4.5	4.2	4.6	4.4
3	WEST KHASI HILLS	7.4	5.6	5.2	5.6	5.5
4	EAST GARO HILLS	5.9	5.2	4.6	5.1	5.0
5	WEST GARO HILLS	5.5	4.9	4.4	4.9	4.8

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	NAGALAND	5.6	4.2	3.7	4.2	4.0
1	KOHIMA	5.8	4.8	4.1	4.7	4.6
2	PHEK	5.6	3.3	2.8	3.2	3.1
3	WOKHA	5.4	3.6	3.5	4.0	3.7
4	ZUNHEBOTO	6.3	4.1	3.8	4.1	4.0
5	MOKOKCHUNG	9.1	3.9	3.7	4.0	3.9
6	TUENSANG	6.1	4.0	3.6	4.0	3.9
7	MON	4.2	4.4	4.0	4.1	4.2
	ORISSA	4.8	4.8	4.6	4.8	4.8
1	SAMBALPUR	4.3	4.3	4.5	4.3	4.4
2	SUNDERGARH	4.7	4.7	4.4	4.8	4.6
3	KENDUJHAR	4.9	4.9	4.5	4.9	4.7
4	MAYURBHANJ	3.9	4.0	4.0	4.4	4.1
5	BALESHWAR	5.8	5.5	5.2	5.5	5.4
6	CUTTACK	5.3	5.1	4.7	4.9	4.9
7	DHENKANAL	5.0	5.4	5.2	5.4	5.3
8	PHULBANI	4.7	4.8	4.5	4.7	4.7
9	BALANGIR	4.5	4.6	4.6	4.8	4.7
10	KALAHANDI	4.4	4.7	4.8	5.1	4.9
11	KORAPUT	4.3	4.3	4.3	4.6	4.4
12	GANJAM	5.2	5.0	4.8	5.0	5.0
13	PURI	5.1	4.9	4.7	4.8	4.8
	PUNJAB	4.9	4.3	3.9	4.3	4.2
1	GURDASPUR	5.5	4.5	4.2	4.5	4.4
2	AMRITSAR	5.3	4.5	4.2	4.5	4.4
3	FIROZPUR	5.2	4.9	4.5	4.8	4.7
4	LUDHIANA	4.6	3.7	3.4	3.8	3.6
5	JALANDHAR	4.7	3.9	3.7	4.1	3.9
6	KAPURTHALA	5.0	4.2	3.8	4.3	4.1
7	HOSHIARPUR	5.0	4.1	3.8	4.1	4.0
8	RUPNAGAR	4.8	4.1	3.9	4.1	4.0
9	PATIALA	5.1	4.3	3.8	4.3	4.1
10	SANGARUR	5.0	4.3	3.8	4.1	4.1
11	BATHINDA	4.8	4.5	4.1	4.4	4.3
12	FARIDKOT	4.9	4.4	3.9	4.3	4.2

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	RAJASTHAN	6.1	5.6	5.5	5.6	5.6
1	GANGANAGAR	5.7	5.7	5.4	5.8	5.6
2	BIKANER	6.0	5.3	5.2	5.5	5.4
3	CHURU	6.1	5.4	5.5	5.7	5.5
4	JHUNJHUNUN	5.9	5.4	5.5	5.7	5.5
5	ALWAR	6.4	6.1	6.0	6.2	6.1
6	BHARATPUR	7.0	6.6	6.4	6.5	6.5
7	SAWAI MADHOPUR	6.7	6.0	6.1	6.0	6.1
8	JAIPUR	6.2	5.5	5.5	5.6	5.5
9	SIKAR	6.2	5.4	5.6	5.6	5.5
10	AJMER	5.5	4.8	4.7	4.8	4.8
11	TONK	6.5	5.7	5.5	5.6	5.6
12	JAISALMER	5.5	5.9	5.5	5.5	5.7
13	JODHPUR	6.1	5.2	5.2	5.3	5.2
14	NAGAUR	6.1	5.1	5.2	5.3	5.2
15	PALI	6.0	5.9	5.8	5.6	5.8
16	BARMER	6.2	6.2	6.0	5.8	6.0
17	JALOR	6.5	6.6	6.5	6.2	6.4
18	SIROHI	5.8	5.7	5.6	5.5	5.6
19	BHILWARA	5.3	5.0	4.9	4.9	4.9
20	UDAIPUR	5.6	5.2	5.3	5.3	5.3
21	CHITTAURGARH	5.4	5.3	5.2	5.2	5.2
22	DUNGARPUR	6.1	5.1	5.3	5.4	5.3
23	BANSWARA	6.1	5.7	5.9	5.9	5.9
24	BUNDI	5.9	5.5	5.4	5.5	5.5
25	KOTA	6.3	5.5	5.5	5.5	5.5
26	JHALAWAR	6.1	5.7	5.9	5.7	5.8
	SIKKIM	5.8	5.4	4.6	5.1	5.0
1	NORTH SIKKIM	6.4	6.5	5.4	5.8	5.9
2	EAST SIKKIM	5.5	5.0	4.3	4.9	4.7
3	SOUTH SIKKIM	5.8	5.6	4.9	5.1	5.2
4	WEST SIKKIM	5.9	5.4	4.9	5.0	5.1

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	TAMIL NADU	3.9	3.6	3.6	3.8	3.7
1	MADRAS	3.3	2.8	2.9	3.3	3.0
2	CHENGALPATTU	4.0	3.9	3.9	4.1	4.0
3	NORTH ARCOT	4.5	4.4	4.5	4.3	4.4
4	SOUTH ARCOT	4.4	4.3	4.3	4.2	4.2
5	DHARAMPURI	4.3	4.3	4.4	4.6	4.5
6	SALEM	3.4	2.9	3.0	3.3	3.0
7	PERIYAR	2.9	2.8	2.7	2.9	2.8
8	COIMBATORE	3.2	2.8	2.8	3.1	2.9
9	NILGIRI	3.6	3.2	3.0	3.5	3.3
10	MADURAI	4.0	3.7	3.7	3.8	3.7
11	TIRUCHIRAPALLI	3.6	3.4	3.4	3.5	3.4
12	THANJAVUR	3.7	3.3	3.4	3.6	3.4
13	PUDUKOTTAI	4.3	3.8	4.1	4.0	3.9
14	RAMANATHPURAM	4.5	4.0	4.0	3.9	4.0
15	TIRUNELVELI	4.7	4.0	3.8	3.9	3.9
16	KANYAKUMARI	4.4	3.5	3.4	3.7	3.5
	TRIPURA	5.2	4.4	4.1	4.6	4.4
1	WEST TRIPURA	5.1	4.5	4.0	4.6	4.3
2	NORTH TRIPURA	5.3	4.7	4.2	4.7	4.5
3	SOUTH TRIPURA	5.4	4.4	4.2	4.6	4.4

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	UTTAR PRADESH	5.9	6.0	5.7	5.8	5.8
1	UTTAR KASHI	4.6	4.9	4.6	4.6	4.7
2	CHAMOLI	5.0	4.5	4.4	4.5	4.5
3	TEHRI GARHWAL	5.7	4.9	4.9	4.8	4.9
4	DEHRADUN	4.7	4.2	4.0	4.4	4.2
5	GARHWAL	5.3	4.8	4.9	5.0	4.9
6	PITHORAGARH	4.7	4.7	4.7	4.6	4.7
7	ALMORA	4.9	4.5	4.7	4.7	4.7
8	NAINITAL	5.9	5.8	5.4	5.8	5.7
9	SAHARANPUR	6.1	5.8	5.4	5.7	5.6
10	MUZAFFARNAGAR	6.2	5.9	5.6	6.0	5.8
11	BIJNOR	6.9	7.1	6.6	6.7	6.8
12	MEERUT	6.2	6.0	5.6	5.8	5.8
13	GHAZIABAD	6.1	6.0	5.5	5.7	5.7
14	BULANDSHAHAR	6.6	6.5	6.0	6.2	6.2
15	MORADABAD	6.8	7.2	6.5	6.7	6.8
16	RAMPUR	7.2	7.1	6.5	6.7	6.8
17	BADAUN	6.7	7.2	6.4	6.4	6.6
18	BAREILLY	6.4	6.9	6.4	6.5	6.6
19	PILIBHIT	6.3	7.0	6.7	6.6	6.7
20	SHAHJAHANPUR	6.5	6.9	6.2	6.2	6.5
21	ALIGARH	6.5	6.3	5.8	6.0	6.0
22	MATHURA	6.3	6.2	5.8	5.9	6.0
23	AGRA	6.3	5.8	5.3	5.6	5.6
24	ETAH	6.4	6.4	5.8	6.0	6.1
25	MAINPURI	6.2	6.1	5.5	5.8	5.8
26	FARUKHABAD	6.2	6.3	6.0	6.1	6.1
27	ETAWAH	6.0	6.2	5.9	6.0	6.0
28	KANPUR	5.5	5.1	4.9	5.2	5.1
29	FATEHPUR	5.9	6.2	5.9	5.9	6.0
30	ALLAHABAD	5.8	6.0	5.7	5.8	5.8
31	JALAUN	5.6	5.9	5.5	5.6	5.7
32	JHANSI	5.6	5.9	5.5	5.6	5.7
33	LALITPUR	6.5	6.9	6.4	6.2	6.5
34	HAMIRPUR	5.8	6.2	5.8	5.9	5.9
35	BANDA	6.1	6.2	6.0	6.1	6.1
36	KHERI	5.9	6.2	6.0	6.0	6.1
37	SITAPUR	6.2	6.3	5.9	5.9	6.0
38	HARDOI	6.6	7.1	6.5	6.3	6.6
39	UNNAO	5.8	5.9	5.5	5.6	5.7
40	LUCKNOW	5.2	4.8	4.4	4.6	4.6

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	UTTAR PRADESH (continued)					
41	RAE BARELI	6.0	6.1	5.6	5.6	5.8
42	BAHRAICH	5.9	6.4	6.0	5.8	6.1
43	GONDA	5.8	6.4	5.7	5.6	5.9
44	BARABANKI	5.3	5.8	5.4	5.5	5.6
45	FAIZABAD	5.4	5.5	5.2	5.3	5.4
46	SULTANPUR	5.8	5.9	5.5	5.5	5.6
47	PRATAPGARH	5.8	5.7	5.5	5.5	5.5
48	BASTI	6.0	6.4	5.7	5.7	5.9
49	GORAKHPUR	5.8	5.9	5.6	5.6	5.7
50	DEORIA	5.8	5.9	5.9	5.8	5.9
51	AZAMGARH	5.8	5.5	5.5	5.6	5.6
52	JAUNPUR	5.9	5.8	5.7	5.8	5.7
53	BALLIA	5.0	4.9	5.2	5.4	5.2
54	GHAZIPUR	5.3	5.5	5.5	5.6	5.5
55	VARANASI	5.4	5.7	5.6	5.7	5.6
56	MIRZAPUR	5.6	6.0	5.9	6.0	5.9
	WEST BENGAL	4.3	4.2	4.3	4.7	4.4
1	KOCH BIHAR	5.1	5.5	5.3	5.7	5.5
2	JALPAIGURI	4.7	4.6	4.4	4.9	4.6
3	DARJILING	4.2	3.7	3.6	4.2	3.8
4	WEST DINAJPUR	5.2	5.0	5.0	5.3	5.1
5	MALDAH	5.7	5.2	5.0	5.6	5.3
6	MURSHIDABAD	5.5	5.3	5.3	5.5	5.4
7	NADIA	5.1	4.7	4.8	5.1	4.9
8	24 PARGANAS	4.4	4.3	4.2	4.7	4.4
9	CALCUTTA	2.7	2.2	2.2	2.6	2.4
10	HAORA	4.6	3.8	4.0	4.4	4.1
11	HUGLI	4.2	3.5	3.7	4.2	3.8
12	MEDINIPUR	4.9	4.4	4.7	5.1	4.7
13	BANKURA	4.1	3.6	4.1	4.4	4.0
14	PURULIA	4.1	3.9	4.4	4.6	4.3
15	BARDDHAMAN	4.2	3.8	4.0	4.4	4.1
16	BIRBHUM	4.4	4.3	4.5	4.7	4.5

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	A. & N. ISLANDS	4.9	5.3	4.5	5.2	5.0
1	ANDAMANS	5.1	5.4	4.5	5.3	5.1
2	NICOBARS	4.9	5.1	4.3	4.9	4.8
	ARUNACHAL PRADESH	5.7	5.7	5.2	5.2	5.4
1	WEST KAMENG	5.7	6.0	5.1	5.2	5.4
2	EAST KAMENG	5.1	5.6	5.2	4.7	5.2
3	LOWER SUBANSIRI	5.2	5.5	5.2	5.1	5.3
4	UPPER SUBANSIRI	6.2	5.7	5.2	4.9	5.3
5	WEST SIANG	6.0	5.7	5.6	5.3	5.6
6	EAST SIANG	5.1	5.0	5.0	4.9	5.0
7	DIBANG VALLY	5.3	6.1	5.1	5.3	5.5
8	LOHIT	6.0	6.0	5.4	5.6	5.7
9	TIRAP	7.0	6.0	5.4	5.6	5.7
	CHANDIGARH	3.5	3.6	2.9	3.7	3.4
	D. & N. HAVELI	5.5	5.1	5.0	5.0	5.0
	DELHI	4.2	4.0	3.5	4.0	3.9
	GOA, DAMAN & DIU	6.8	3.3	3.2	3.5	3.3
1	GOA	4.0	3.1	3.0	3.4	3.2
2	DAMAN	7.4	4.2	4.4	4.8	4.5
3	DIU	5.7	4.7	4.7	4.9	4.8
	LAKSHADWEEP	5.7	4.9	4.7	4.9	4.8
	MIZORAM	5.8	4.8	4.4	4.8	4.7
1	AIZWAL	5.7	4.7	4.5	4.8	4.6
2	LUNGLEI	5.7	4.9	4.4	4.8	4.7
3	CHHIMTUIPUI	6.1	5.2	4.3	4.7	4.7

APPENDIX I (continued)

S.N.	STATE/ DISTRICT	BRASS	PALMORE	GUNSEK. PALMORE	RELE	AVERAGE TFR
	PONDICHERRY	4.0	3.5	3.6	3.8	3.6
1	PONDICHERRY DT.	4.0	3.7	3.7	3.9	3.7
2	KARAIKAL	3.9	3.3	3.4	3.5	3.4
3	MAHE	3.6	2.6	3.1	3.2	3.0
4	YANAM	3.7	3.8	3.8	4.0	3.9

APPENDIX II

District Level Estimates of Infant Mortality Rate and Life Expectancy at Birth, 1981

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	INDIA	110	53.85
	ANDHRA PRADESH	86	55.02
1	SRIKAKULAM	113	49.72
2	VIJAYNAGARAM	123	47.69
3	VISHAKHAPATANAM	87	54.87
4	EAST GODAVARI	77	56.85
5	WEST GODAVARI	80	56.23
6	KRISHNA	83	55.62
7	GUNTUR	77	56.85
8	PRAKASAM	86	55.02
9	NELLORE	76	57.16
10	CHITTOOR	96	54.74
11	CUDDAPAH	93	55.47
12	ANANTPUR	115	49.31
13	KURNOOL	100	54.92
14	MAHBUBNAGAR	100	54.92
15	RANGAREDDY	80	56.23
16	HYDERABAD	30	67.79
17	MEDAK	85	55.17
18	NIZAMABAD	70	58.27
19	ADILABAD	88	55.46
20	KARIMNAGAR	73	57.79
21	WARANGAL	93	55.33
22	KHAMMAM	82	55.92
23	NALGONDA	96	54.89

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	BIHAR	118	46.50
1	PATNA	116	47.53
2	NALANDA	126	47.04
3	NAWADA	126	47.04
4	GAYA	129	47.32
5	AURANGABAD	124	47.29
6	ROHTAS	108	47.78
7	BHOJPUR	110	47.53
8	SARAN	94	49.79
9	SIWAN	89	50.48
10	GOPALGANJ	104	48.44
11	PASCHIM CHAMPARAN	127	47.69
12	PURAB CHAMPARAN	108	47.78
13	SITAMARHI	133	47.60
14	MUZAFFARPUR	116	47.53
15	VAISHALI	109	47.66
16	BEGUSARAI	120	47.79
17	SAMASTIPUR	126	47.04
18	DARBHANGA	115	47.65
19	MADHUBANI	106	48.18
20	SAHARSA	134	47.48
21	PURNIA	151	42.25
22	KATHIHAR	144	43.07
23	MUNGER	126	47.04
24	BHAGALPUR	122	47.54
25	SANTHAL PARGANA	123	47.41
26	DHANBAD	68	53.56
27	GIRIDIH	104	48.44
28	HAZARIBAG	110	47.53
29	PALAMU	134	47.48
30	RANCHI	114	47.78
31	SINGHBHUM	100	48.98

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	GUJARAT	116	56.06
1	JAMNAGAR	101	58.25
2	RAJKOT	89	60.22
3	SURENDRANAGAR	132	55.47
4	BHAVNAGAR	92	59.71
5	AMRELI	98	58.73
6	JUNAGARH	99	58.57
7	KACHCHH	124	55.75
8	BANAS KANTHA	132	55.47
9	SABAR KANTHA	125	55.60
10	MAHESANA	141	55.98
11	GANDHINAGAR	125	55.60
12	AHMEDABAD	109	57.14
13	KHEDA	144	55.55
14	PANCH MAHALS	120	55.45
15	VADODARA	129	55.91
16	BHARUCH	145	51.79
17	SURAT	96	59.06
18	VALSAD	95	59.22
19	THE DANGS	127	55.30
	HARYANA	101	55.75
1	AMBALA	80	60.17
2	KURUKSHETRA	93	58.40
3	KARNAL	100	58.77
4	JIND	118	52.19
5	SONIPAT	93	58.40
6	ROHTAK	101	58.62
7	FARIDABAD	98	58.27
8	GURGAON	122	51.47
9	MAHENDRAGARH	104	58.96
10	BHIWANI	91	58.72
11	HISAR	93	58.40
12	SIRSA	82	59.68

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	HIMACHAL PRADESH	71	56.66
1	CHAMBA	76	55.14
2	KANGRA	59	60.34
3	HAMIRPUR	51	62.70
4	UNA	59	60.34
5	BILASPUR	59	60.34
6	MANDI	63	59.19
7	KULU	89	51.31
8	LAHUL & SPITI	62	59.36
9	SIMLA	90	51.02
10	SOLAN	73	59.92
11	SIRMAUR	85	52.61
12	KINNAUR	105	46.85
	JAMMU & KASHMIR	72	57.69
1	ANANTNAG	88	56.01
2	PULWAMA	76	56.76
3	SRINAGAR	44	64.57
4	BADGAM	69	58.33
5	BARAMULA	87	56.16
6	KUPWARA	99	51.58
7	KARGIL	142	42.80
8	LADAKH	91	56.19
9	DODA	78	56.29
10	UDHAMPUR	74	57.22
11	KATHUA	69	58.33
12	JAMMU	58	60.97
13	RAJAURI	66	59.14
14	PUNCH	75	56.91

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	KARNATAKA	69	57.71
1	BANGALORE	54	61.64
2	BELGAUM	67	58.35
3	BELLARY	87	53.17
4	BIDAR	70	57.40
5	BIJAPUR	80	57.75
6	CHIKMANGALUR	70	57.56
7	CHITRADURGA	75	57.09
8	DAKSHIN KANNAD	40	65.63
9	DHARWAD	75	57.09
10	GULBARGA	71	57.09
11	HASSAN	67	58.35
12	KODAGU	57	60.97
13	KOLAR	65	58.67
14	MANDYA	69	57.71
15	MYSORE	66	58.51
16	RAICHUR	77	57.57
17	SHIMOGA	69	57.71
18	TUMKUR	74	57.25
19	UTTAR KANNAD	62	59.64
	KERALA	37	67.33
1	CANNANORE	35	67.94
2	KOZHIKODE	36	67.53
3	MALAPPURAM	44	65.03
4	PALGHAT	48	63.94
5	TRICHUR	31	69.40
6	ERNAKULAM	29	70.06
7	IDUKKI	50	63.40
8	KOTTAYAM	26	71.21
9	ALLEPPEY	29	70.06
10	QUILON	31	69.19
11	TRIVENDRUM	31	69.40
12	WAYNAD	57	61.16

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	MADHYA PRADESH	142	49.74
1	MORENA	143	49.60
2	BHIND	139	50.30
3	GWALIOR	133	51.43
4	DATIA	176	43.83
5	SHIVPURI	178	43.57
6	GUNA	157	47.13
7	TIKAMGARH	182	42.93
8	CHHATARPUR	175	43.96
9	PANNA	175	44.09
10	SAGAR	160	46.59
11	DAMOH	173	44.35
12	SATNA	175	43.96
13	REWA	155	47.54
14	SAHDOL	155	47.40
15	SIDHI	147	48.77
16	MANDSAUR	140	50.16
17	RATLAM	141	49.88
18	UJJAIN	121	53.46
19	SHAJAPUR	160	46.59
20	DEWAS	121	53.60
21	JHABUA	133	51.29
22	DHAR	123	53.16
23	INDORE	80	61.29
24	WEST NIMAR	129	52.15
25	EAST NIMAR	154	47.67
26	RAJGARH	164	45.93
27	VIDISHA	158	46.86
28	BHOPAL	91	59.14
29	SEHORE	170	44.87
30	RAISEN	152	47.95
31	BETUL	148	48.63
32	HOSHANGABAD	164	45.93
33	JABALPUR	151	48.08
34	NARSIMHPUR	151	48.08
35	MANDLA	131	51.72
36	CHHINDWARA	131	51.72
37	SEONI	133	51.29
38	BALAGHAT	133	51.29
39	SURGUJA	126	52.58
40	BILASPUR	133	51.43

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	MADHYA PRADESH (continued)		
41	RAIGARH	130	51.86
42	RAJNANDGAON	147	48.91
43	DURG	128	52.29
44	RAIPUR	132	51.57
45	BASTAR	117	58.13
	MAHARASHTRA	79	57.76
1	GREATER BOMBAY	49	65.76
2	THANE	59	62.88
3	RAIGARH	85	59.25
4	RATNAGIRI	57	63.40
5	NASIK	83	58.75
6	DHULE	89	59.15
7	JALGAON	87	59.60
8	AHAMADNAGAR	74	59.04
9	PUNE	59	63.05
10	SATARA	66	61.17
11	SANGLI	58	63.23
12	SOLAPUR	74	59.04
13	KOLHAPUR	57	63.40
14	AURANGABAD	86	58.94
15	PARBHANI	102	52.18
16	BID	84	59.41
17	NANDED	97	53.20
18	OSMANABAD	88	59.45
19	BULDANA	96	53.50
20	AKOLA	94	53.94
21	AMARAVATI	95	53.79
22	YAVATMAL	112	49.76
23	WARDHA	101	52.47
24	NAGPUR	85	59.10
25	BHANDARA	113	49.48
26	CHANDRAPUR	116	48.92

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	MANIPUR*	35	74.03
1	MANIPUR NORTH	42	71.97
2	MANIPUR WEST	56	68.28
3	MANIPUR SOUTH	38	73.10
4	TENGNOUPAL	62	66.94
5	MANIPUR CENTRAL	32	75.01
6	MANIPUR EAST	45	71.11
	MEGHALAYA*	83	61.97
1	JAINTIA HILLS	86	61.13
2	EAST KHASI HILLS	59	67.70
3	WEST KHASI HILLS	55	68.67
4	EAST GARO HILLS	106	56.63
5	WEST GARO HILLS	108	56.32
	NAGALAND*	64	65.29
1	KOHIMA	60	67.32
2	PHEK	46	70.90
3	WOKHA	38	73.10
4	ZUNHEBOTO	78	62.99
5	MOKOKCHUNG	45	71.33
6	TUENSANG	80	62.48
7	MON	96	61.84

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	ORISSA	135	49.84
1	SAMBALPUR	109	56.10
2	SUNDERGARH	110	55.95
3	KENDUJHAR	141	48.88
4	MAYURBHANJ	104	56.08
5	BALESHWAR	154	46 60
6	CUTTACK	148	47.67
7	DHENKANAL	153	46.87
8	PHULBANI	157	46.21
9	BALANGIR	125	51.52
10	KALAHANDI	135	49.84
11	KORAPUT	128	50.96
12	GANJAM	149	47 53
13	PURI	146	48.07
	PUNJAB	81	61.74
1	GURDASPUR	83	61.40
2	AMRITSAR	78	62.42
3	FIROZPUR	79	62.08
4	LUDHIANA	70	64.17
5	JALANDHAR	79	62 25
6	KAPURTHALA	92	60.40
7	HOSHIARPUR	85	60.91
8	RUPNAGAR	76	62.94
9	PATIALA	83	61.40
10	SANGARUR	92	60.40
11	BATHINDA	84	61.07
12	FARIDKOT	82	61.57

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	RAJASTHAN	108	52.98
1	GANGANAGAR	77	60.26
2	BIKANER	57	65.09
3	CHURU	74	60.92
4	JHUNJHUNUN	84	59.45
5	ALWAR	122	49.96
6	BHARATPUR	140	45.96
7	SAWAI MADHOPUR	134	47.32
8	JAIPUR	105	53.72
9	SIKAR	88	59.47
10	AJMER	116	51.09
11	TONK	143	45.43
12	JAISALMER	81	60.25
13	JODHPUR	80	59.44
14	NAGAUR	88	59.63
15	PALI	120	50.24
16	BARMER	95	59.87
17	JALOR	100	54.76
18	SIROHI	113	51.81
19	BHILWARA	130	48.14
20	UDAIPUR	113	51.96
21	CHITTAURGARH	125	49.11
22	DUNGARPUR	103	54.02
23	BANSWARA	101	54.61
24	BUNDI	118	50.66
25	KOTA	103	54.02
26	JHALAWAR	115	51.38
	SIKKIM*	92	59.81
1	NORTH SIKKIM	131	51.38
2	EAST SIKKIM	76	63.51
3	SOUTH SIKKIM	103	61.41
4	WEST SIKKIM	100	61.04

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	TAMIL NADU	91	53.61
1	MADRAS	54	60.78
2	CHENGALPATTU	90	53.76
3	NORTH ARCOT	108	53.23
4	SOUTH ARCOT	110	53.68
5	DHARAMPURI	87	54.35
6	SALEM	79	55.86
7	PERIYAR	84	54.94
8	COIMBATORE	81	55.55
9	NILGIRI	93	53.32
10	MADURAI	94	53.03
11	TIRUCHIRAPALLI	92	53.46
12	THANJAVUR	85	54.79
13	PUDUKOTTAI	75	56.63
14	RAMANATHPURAM	103	53.20
15	TIRUNELVELI	111	53.55
16	KANYAKUMARI	62	59.06
	TRIPURA*	104	57.10
1	WEST TRIPURA	115	54.64
2	NORTH TRIPURA	110	55.86
3	SOUTH TRIPURA	95	61.16

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	UTTAR PRADESH	150	46.98
1	UTTAR KASHI	132	49.64
2	CHAMOLI	116	53.88
3	TEHRI GARHWAL	126	53.21
4	DEHRADUN	85	57.08
5	GARHWAL	109	53.15
6	PITHORAGARH	117	53.74
7	ALMORA	101	54.47
8	NAINITAL	117	53.74
9	SAHARANPUR	121	53.03
10	MUZAFFARNAGAR	138	48.69
11	BIJNOR	161	45.30
12	MEERUT	134	49.37
13	GHAZIABAD	129	53.53
14	BULANDSHAHAR	154	46.46
15	MORADABAD	162	45.17
16	RAMPUR	159	45.68
17	BADAUN	202	39.55
18	BAREILLY	161	45.30
19	PILIBHIT	160	45.56
20	SHAHJAHANPUR	188	41.58
21	ALIGARH	159	45.68
22	MATHURA	146	47.50
23	AGRA	140	48.43
24	ETAH	180	42.67
25	MAINPURI	161	45.43
26	FARUKHABAD	156	46.07
27	ETAWAH	150	46.98
28	KANPUR	115	53.16
29	FATEHPUR	163	45.05
30	ALLAHABAD	146	47.50
31	JALAUN	153	46.59
32	JHANSI	146	47.50
33	LALITPUR	175	43.29
34	HAMIRPUR	162	45.17
35	BANDA	143	48.03
36	KHERI	147	47.37
37	SITAPUR	167	44.54
38	HARDOI	212	38.15
39	UNNAO	166	44.67
40	LUCKNOW	124	53.49

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	UTTAR PRADESH (continued)		
41	RAE BARELI	184	42.06
42	BAHRAICH	165	44.79
43	GONDA	186	41.82
44	BARABANKI	161	45.43
45	FAIZABAD	147	47.37
46	SULTANPUR	169	44.16
47	PRATAPGARH	155	46.20
48	BASTI	189	41.34
49	GORAKHPUR	151	46.85
50	DEORIA	134	49.37
51	AZAMGARH	124	53.49
52	JAUNPUR	140	48.43
53	BALLIA	95	55.37
54	GHAZIPUR	126	53.21
55	VARANASI	127	53.07
56	MIRZAPUR	134	49.37
	WEST BENGAL	91	51.72
1	KOCH BIHAR	127	45.60
2	JALPAIGURI	102	51.46
3	DARJILING	76	54.34
4	WEST DINAJPUR	113	51.26
5	MALDAH	125	45.98
6	MURSHIDABAD	111	51.65
7	NADIA	97	51.58
8	24 PARGANAS	91	51.72
9	CALCUTTA	46	60.26
10	HAORA	61	57.15
11	HUGLI	62	56.99
12	MEDINIPUR	100	51.03
13	BANKURA	71	55.40
14	PURULIA	80	53.74
15	BARDDHAMAN	74	54.79
16	BIRBHUM	98	51.30

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	A. & N. ISLANDS*	68	65.47
1	ANDAMANS	66	65.83
2	NICOBARS	84	61.63
	ARUNACHAL PRADESH*	118	54.03
1	WEST KAMENG	113	55.09
2	EAST KAMENG	205	36.79
3	LOWER SUBANSIRI	142	49.08
4	UPPER SUBANSIRI	192	39.12
5	WEST SIANG	98	61.36
6	EAST SIANG	76	63.51
7	DIBANG VALLY	89	61.47
8	LOHIT	88	61.80
9	TIRAP	103	57.26
	CHANDIGARH*	53	69.06
	D. & N. HAVELI*	102	61.57
	DELHI*	68	65.47
	GOA, DAMAN & DIU*	65	66.13
1	GOA	56	68.28
2	DAMAN	59	67.70
3	DIU	83	61.80
	LAKSHADWEEP*	117	54.33

APPENDIX II (continued)

S.N.	STATE/ DISTRICT	INFANT MORTALITY RATE	LIFE EXPECTANCY AT BIRTH
	MIZORAM*	68	65.33
1	AIZWAL	58	67.89
2	LUNGLEI	70	64.93
3	CHHIMTUIPUI	102	61.57
	PONDICHERRY*	68	65.47
1	PONDICHERRY DT.	68	65.29
2	KARAIKAL	74	64.04
3	MAHE	40	72.64
4	YANAM	83	61.97

IMR and e_0 estimates for major states are same as SRS estimates because for major states estimates derived from the South Asian Model Life Tables have been adjusted for SRS levels. For smaller states and union territories the IMR and e_0 estimates could not be adjusted to SRS levels due to the non-availability of corresponding SRS estimates.

7—12/RGI/ND/94

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