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Literate Life Expectancy for Females of Assam and Selected States of India: A District Level Analysis of the 2001 Census Data

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Literate Life Expectancy (LLE), computed by using life table method, is based on age-specific mortality rates and age-specific proportions of literate. It is proved to be an innovative, objective and useful indicator of sustainable social development and quality of life. LLE is the aggregate average number of years that a person lives under literate state. Living under literate conditions has many positive effects on social, economic, political and environmental aspects. Through this study an attempt has been made to compare and contrast the LLEs at district level for females of Assam and some selected states including West Bengal, Kerala, Gujarat, Rajasthan and Uttar Pradesh. With the district level analysis of LLE for females we are particularly interested in finding those social differentials which are overlooked at the national level analysis. The outcome of the study at district level was rather meaningful as we observed a gloomy picture regarding the social development of females living in different districts under study. We found a difference of almost 60 years of LLE at birth for females between the first and last ranked districts of the states included in this analysis. We also observed that high LLEs at birth were concentrated around the districts of Kerala.

Keywords*: literate life expectancy, female, India*

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Introduction

Literate Life Expectancy (LLE) was developed by Lutz (1995) at International Institute for Applied System Analysis (IIASA) as a simplified single indicator of human capital. It is based on readily available data on age-specific mortality rates and age-specific proportions literate and computed by using life table method. The indicator does not give multidimensional information on human capital but it is more appropriate for direct inter-country comparisons. LLE is proved to be an innovative, objective and useful indicator of sustainable social development and quality of life. It can be projected into the future, based on population and education projections (Lutz, 1995; Lutz & Goujon, 2004). Under this approach, literacy is treated as an attribute attached to the person-years in the life table. The LLE indicator is interpreted as the "average number of years a person lives in a literate state," i.e., able to read and write under current mortality and literacy conditions (Lutz, 1995; Medina, 1996). Higher literate life expectancy indicates not only development but also social improvement and quality of life in a very comprehensive and sensitive manner (Nair, Chandran & Aliyar, 2000).

As suggested by Lutz (1995) this indicator has several advantages over other indicators of social and educational development like literacy rate by sex and age-standardized literacy rate. It is not an abstract index on a relative scale and can be expressed in terms of individual years of life. The indicator can also be used for different subpopulations, such as differentiation by sex or place of residence. Depending upon the availability of data, further breakdowns can be made. This ability to describe within-country differentials is another great advantage of LLE. Maximum or minimum assumption or adjustment is not required for its interpretation as done in the case of abstract indices on a relative scale.

This innovative indicator is based on clearly observable and measurable non-material individual characteristics and combines in one number the two basic aspects of social development, namely, life expectancy and literacy. Life expectancy is one of the most comprehensive indicators of quality of life while literacy is the indicator of empowerment. Both in developed and developing countries these two factors are directly influenced by government policies and programs on health and education. However literacy is defined differently by different data sources.

Medina (1996) used the LLE to assess the social development in Mexico at the national, regional and state levels and ascertained that education and health boosts

social development. Huang and Nanjo (1998) in China, Nair, Chandran and Aliyar, (2000) in India, Khan and Asaduzzaman (2007) in Bangladesh, and Chattopadhyay and Sinha (2010) in India also used this indicator to measure social development aspect. But district level studies using literate life expectancy are very limited. District is the basic territorial unit of administration in India. At this level the common men come into direct contact with the administration (www.indianetzone.com). The development of districts is reflected in the overall progress of the nation. In developing countries like India, social development is not possible without considering equity conditions which are reflected at micro level.

Several social scientists recognized India as strongly patrilineal society and there are several stereotypes in the Indian society. A popular stereotype is the strong preference for male child (Nath & Land, 1994). So, analysis of social development of females at district level using LLE is more meaningful because this analysis not only highlights the females' social conditions within and among the states but it also allows to disentangle many social differences that are more difficult to find and overlooked at the national level analysis.

The objective of this paper is of twofold: (1) to compare and contrast the literate life expectancies (LLEs) for female in districts of Assam State in the Northeast and those of other states from different zones, namely, Rajasthan from the North, Kerala from the South, West Bengal from the East, Gujarat from the West, Uttar Pradesh from the Central; and (2) to assess the level of social development for females of Assam State at the district level.

Data and Methodology

Assam is situated in the extreme North-East of India. Therefore, it is justified to compare the nature of social development at the district level for the women of this state with those of different states of India from North, South, East, West and central zones. For this purpose, Rajasthan from the North, Uttar Pradesh from the Central, West Bengal from the East, Kerala from the South and Gujarat from the West are selected in the study. From UNDP report 2006, it was found that Gender Development Index (GDI) for Assam, Rajasthan and Uttar Pradesh had scores below the all-India average (0.590), whereas Kerala, Gujarat and West Bengal had GDI above all-India average. According to the 2001 Census, India had 593 districts. Out of these, 182 districts from the selected states are included for the present analysis.

The basic data required for this study are district level ordinary female life tables and the age specific proportions literate of females (PL_x). The district level life tables for female are taken from a study by Choudhury and Sarma (2011). Choudhury and Sarma (2011) generated one parameter model life tables for the major states and their districts in India where life expectancy at birth (e_0^0) was the only input. The e_0^0 for the districts can be estimated by the regression method using the estimated infant mortality rates of the districts and proportion of persons above 65 years of age (Choudhury and Sarma, 2012). Thus the life tables for the districts of the major states can be obtained from the estimated e_0^0. The age specific female literacy data are collected from 2001 Population Census Reports of Assam, Kerala, West Bengal, Gujarat, Rajasthan and Uttar Pradesh.

The estimation of the LLE is performed without any complex mathematical operation in a life table which is used for summarizing the mortality experience of a population. The only new element is the weighted number of person-years at each age by the age-specific proportions literate, i.e.,

PL_x = Age-specific female proportions literate (for age group x)

LL_x = Literate person-years lived for age group x (female)

In the life table, the L_x column is multiplied by PL_x to generate the LL_x column. The formula of the literate life expectancy indicator and notations in the model life table are as follow:

$(L_x)\ (PL_x) = LL_x$

L_x = Total number of person-years living in age group x (female)

Like in a regular life table, literate life expectancy (Le^o_x) (for female) is calculated by dividing the cumulative literate person years LT_x by the l_x column, i.e.,

$$Le_x^0 = \frac{LT_x}{l_x}$$

Where, $LT_x = \Sigma LL_x$

Le^0_x = female literate life expectancy at age x

LT_x = cumulative literate person-years (female)

l_x = number of survivors at age x (female)

Results and Discussion

Our results and discussion are divided into three parts. First, we attempt to rank the districts of the individual states according to their female LLE at birth and underline the remarkable differences among females of the districts within the states. From the ranks we consider only the maximum and minimum values of LLE at birth and their LLE differentials. Second, we also calculate the average and standard deviation of LLE at birth for individual state to study the nature of central tendency and dispersion. These are presented in Table 1. For further comparison, we construct box plots, the results of which are presented in Figure 1. Third, we prepare a frequency distribution table of LLE at birth for female of the 182 districts ranging from below 10 to above 65 years and chart the remarkable differences of development of females among different districts of the states. We believe that this micro-level analysis is appropriate for revealing the relevant issues of development of females in the 21st century.

In our analysis, we found that LLE differentials of females at district level within and across the states are rather meaningful, which clearly demonstrates Lutz's (1995) idea discussed above.

Difference within the states

Table 1 reveals that, among 23 districts of Assam, females of Jorhat district had highest LLE at birth (33.1 years) while females of Dhubri district had the lowest LLE at birth (16.8 years). This suggests the LLE differential of 16.3 years between the two extremes. It means that females of Jorhat district had the possibility to live 16.3 years longer in a literate state than the females of Dhubri district. However, LLE at birth is the expectation of a child to live under literate conditions. Living under literate conditions has many positive consequences for social, economic, environmental and political espects of life (Medina, 1996). The average and standard deviation of LLE at birth for the 23 districts of Assam were 24.3 years and 4.5 years respectively.

Among 25 districts of Gujarat, females of Navsari district had 37.5 years of LLE at birth (highest), while in Dohad district females had only 11.5 years (lowest) with about 26.0 years of LLE differentials. Average LLE at birth of this districts was 26.8 years with standard deviation of 6.7 years. In Kerala, females of Pathanamthitta district reached highest 65.3 years of LLE at birth while those in Kasaragod district had LLE at birth of 42.4 years, the lowest in the state. This resulted in 22.8 years of

LLE differentials. The average LLE at birth for the 14 districts of Kerala was 53.9 years with standard deviation of 7.3 years. Among 32 districts of Rajasthan, the highest LLE at birth was found among females of Kota district (27.1 years) and the lowest (10.1 years) was among the females of Jalor district, with 17.0 years of LLE differentials. The average and standard deviation of LLE at birth in this state were 17.2 years and 4.4 years respectively. Among 70 districts of Uttar Pradesh, females of Kanpur Nagar had the highest LLE at birth (30.9 years) and those in Budaun district showed the lowest LLE at birth of only 5.0 years, with LLE differential of 25.9 years. The average LLE at birth of all districts in this state was 17.0 years and standard deviation was 8.3 years. Finally, in West Bengal, females of Kolkata district had the highest LLE at birth (45.9 years), while in Uttar Dinajpur district the women had only 15.1 years with LLE differentials of 30.7 years. The average and standard deviation of LLE at birth was 27.9 and 8.3 years respectively.

From Table 1 it is also observed that, among 182 districts from all selected states in this study, females from Pathanamthitta district of Kerala had the highest LLE at birth (65.3 years) and those from Budaun district of Uttar Pradesh who had the lowest LLE (5.0 years). The gap in LLE at birth between these two district is 60.2 years. Among other things, this seems to indicate a marked difference in social development for females living in different districts of the states under this study. Such a pronounced difference may also be found among females in different districts of the nation.

Table 1: Districts with minimum and maximum LLE at birth for females in Assam and selected states along with LLE differentials, average and standard deviation

State	No. of districts	Districts with		For LLE at Birth		
		Minimum LLE at birth	Maximum LLE at birth	*LLE differential	average	Standard Deviation
Assam	23	Dhubri 16.8	Jorhat 33.1	16.3	24.3	4.5
Gujarat	25	Dohad 11.5	Navsari 37.5	26.0	26.8	6.7
Kerala	14	Kasaragod 42.4	Pathanamthitta 65.3	22.8	53.9	7.3
Rajasthan	32	Jalor 10.1	Kota 27.1	17.0	17.2	4.4

Table 1 (Continue)

State	No. of districts	Districts with		For LLE at Birth		
		Minimum LLE at birth	Maximum LLE at birth	*LLE differential	average	Standard Deviation
Uttar Pradesh	70	Budaun 5.0	Kanpur Nagar 30.9	25.9	17.0	4.9
West Bengal	18	Uttar Dinajpur 15.1	Kolkata 45.9	30.7	27.9	8.3
Total	182	Budaun 5.0	Pathanamthitta 65.3	60.2	23.2	11.4

*LLE Differential = Range

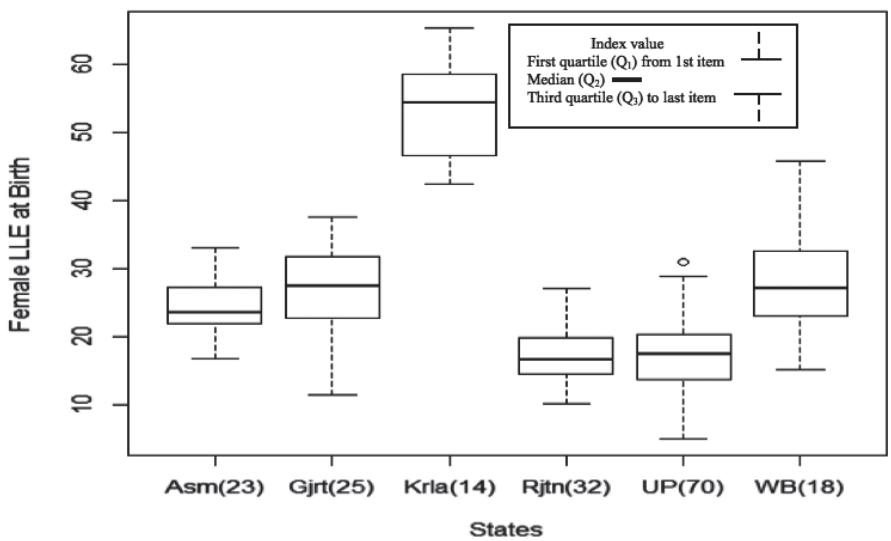
Difference across the States

To study the distributions of female LLE at birth at district level for the states under study, we summarize all the data in boxplots and present these in Figure 1. A boxplot, also known as a box-and-whiskers plot, is a good way to summarized large amount of data. It displays the range and distribution of data along a number line. To construct a boxplot, first quartile (Q_1), median (Q_2), third quartile (Q_3), and lower and upper Extremes of the ordered data set are needed. The distance between the points in the boxplot tells us about the distribution of data in the quartiles. A shorter distance, as observed in Q_2 in boxplots of Gujarat, Q_1 in boxplots of Kerala, Rajasthan and West Bengal, means that the quartile data are bunched together. A longer distance, as in Q_1 in boxplots of Gujarat, Q_2 in Kerala, Rajasthan and West Bengal, means that the quartile data are spread out. The lower and upper extremes are always the first and the last items in an ordered set of data.

For comparison purpose, we summarized the data from Figure 1 and present them in Table 2. From Figure 1 and Table 2 we can easily see the median years of LLE at birth for each state. Females in districts of Kerala (median 54.3 years) appear to be the best among all females under study with respect to LLE at birth. Females of Kerala have the highest (65.3 years) and females of Uttar Pradesh have the lowest (5.0 years) LLE at birth. If we observe the data set in terms of Inter Quartile Range (IQR), we will find that the higher the value of IQR, the more spread out the LLE at birth are. It indicates higher social inequality among the females within the state. In Table 2, the figures within brackets in the last column indicate the rank in terms

of IQR. It is observed that females of Kerala occupied first position with IQR of 10.9 years, females of Assam occupied fifth position (IQR=5.3 years) and those of Rajasthan occupied last position (IQR= 5.1 years) in terms of social inequality. Finally, on the basis of boxplot results, it can be said that the states with higher LLE too are not free from social inequality as more intra-state disparities in LLE exists within these states compared to the states with low LLE. Consequently, the females of all the districts, irrespective of the state to which they belong, should receive equal opportunity for sustainable development.

Figure 1: The boxplot showing distribution of the LLE at birth for females from the districts within each state.



Note: In Figure: Asm(23) = Assam with 23 districts; Gjrt(25) = Gujarat with 25 districts; Krla(14) = Kerala with 14 districts; Rjtn(32) = Rajasthan with 32 districts; UP(70) = Uttar Pradesh with 70 districts; and WB(18) = West Bengal with 18 districts

Table 2: Summary of data from the Boxplot (Figure 1, p.95)

States	Minimum	First quartile	Median	Third quartile	Maximum	Inter quartile range (Rank)
Assam	16.7	21.9	23.6	27.2	33.1	5.3 (5)
Gujarat	11.5	22.7	27.4	31.8	37.5	9.1 (2)
Kerala	42.4	47.6	54.3	58.5	65.3	10.9 (1)
Rajasthan	10.1	14.6	16.6	19.7	27.1	5.1 (6)
Uttar Pradesh	5.0	13.6	17.4	20.2	30.9	6.6 (4)
West Bengal	15.1	23.4	27.1	32.2	45.9	8.8 (3)

Table 3 presents the frequency distribution of LLE at birth of females from 182 districts under study which range from below 10 years to above 65 years. From the Table, a dismal picture has emerged. That is, about 2.8 percent of all the districts have LLE at birth below 10 years. These are five districts from Uttar Pradesh. It is observed that, nearly two-thirds (65.4 percent) of the districts have LLE at birth between 10.0-24.9 years, while about one-forth (23.6 percent) have between 25.0-39.9 years of LLE at birth. These are 162 districts from all the states under study, except Kerala. Note that only five districts, two from Gujarat and three from West Bengal (accounting for 2.8 percent), have LLE at birth between 35.0-39.9 years. Only 4.4 percent of the districts have LLE at birth between 40.0-54.9 years. Out of eight districts in this group seven districts are from Kerala, while only one district is from West Bengal. Only 3.3 percent of all the districts belong to the group with LLE at birth of 55.0-64.9 years. These are six districts from Kerala. Only one district (0.6 percent) from Kerala has LLE at birth above 65 years.

Since independence in 1947, India has experienced major inter- and intra-regional disparities in social development of females. For example, according to 2001 census female literacy rate for Assam, West Bengal, Kerala, Gujarat, Rajasthan and Uttar Pradesh were 56.0, 60.2, 87.9, 58.6, 44.3 and 43.0 respectively. These disparities are reflected in the present study. In all the cases LLE for all age groups of females from the districts of Kerala are in an advantageous position. Kerala's development has been cited as an example for developing countries highlighting the role of public policies in attaining high social development despite low per capita income (Center for Development studies, 2005).

Table 3: Frequency distribution of LLE for districts of the selected states (female)

LLE at birth	Frequency		Number of districts					
	Total	%	Assam	Gujarat	Kerala	Rajasthan	UP	WB
Below 10	5	2.8	0	0	0	0	5	0
10-14.9	33	18.1	0	2	0	10	21	0
15-19.9	49	26.9	4	2	0	14	26	3
20-24.9	37	20.3	9	5	0	6	13	4
25-29.9	24	13.2	7	7	0	2	4	4
30-34.9	14	7.7	3	7	0	0	1	3
35-39.9	5	2.8	0	2	0	0	0	3
40-44.9	3	1.7	0	0	2	0	0	1
45-49.9	2	1.1	0	0	2	0	0	0
50-54.9	3	1.7	0	0	3	0	0	0
55-59.9	4	2.2	0	0	4	0	0	0
60-64.9	2	1.1	0	0	2	0	0	0
above 65	1	0.6	0	0	1	0	0	0
Total	182	100.0	23	25	14	32	70	18

Conclusion

The use of Literate Life Expectancy (LLE) indicator proved to be an innovative method for measuring social development. Since this indicator is based on clearly observable individual characteristics, it highlights the areas which are in need of more education and social development for females. Public policies and programs focusing on improving female literacy, health and social status will result in increase not only of their life expectancy but their literate life expectancy at the macro level as well.

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