

LITERATE LIFE EXPECTANCY UNDER DYNAMIC SET UP WITH APPLICATIONS TO INDIAN DATA

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Abstract

Literacy enhances an individual's quality of life by creating an environment to develop one's personal skills and thereby provides wider social and economic benefits for a community to flourish. To measure human quality of life literate life expectancy (LLE) was introduced by Lutz (1995), which combines both life expectancy and literacy. Further, the concept of dynamic life table arises when the assumption of a constant mortality probability of a cohort of period life table is altered to the observed rates of change of mortality probabilities of that cohort. Here we proposed an indicator called 'dynamic literate life expectancy' that will measure the average years lived by a population in a literate state with the continuous changes in mortality. An application of this indicator is shown for Indian data for the year 2011 when the probabilities of death changes over the previous 10 years. The paper highlighted the significant differences between LLE under dynamic and usual procedure for various states, where Kerala performs exceptionally well in terms of LLE for both sexes. Also, the quality of life for males is found to be better than females in terms of dynamic LLE.

Keywords: Dynamic literate life expectancy; India.

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1. Introduction

Literacy is the basic building block and a crucial element in the development of education in society ^[10]. According to census of India (2011), an individual of age seven years and above can be considered as literate if he/she can read and write with understanding in any language. Literacy is one of the key components in advancing the Human Development index (HDI), as it directly influences the per capita income, standard of living and eventually the life expectancy ^[27]. Literacy and educational attainment are two of the most commonly used indicators for a global comparative analysis ^[1]. However, instead of literacy skills and years of completed education, Literate life expectancy (LLE) is taken as a simplified single indicator. The Literate life expectancy (LLE) was first developed by Wolfgang Lutz in 1995^{[1], [3], [13], [14]} as an indicator to access the socio economic well being and quality of life. The LLE indicator is interpreted as the average number of years a person lives in a literate state, that is able to read and write under current mortality and literacy conditions ^{[3], [12], [14], [18]}. The indicator not only gives the information on human capital but also suitable for direct inter-country comparisons ^[3].

The LLE indicator requires age specific mortality rates and the corresponding age specific proportion of literates and is computed by using life table method. Moreover, the period life table is based on the mortality experience of a population during a short period of time, usually a year, or three years or an intercensal period, in which the mortality rates have remained considerably the same ^[26]. The information given by a period life table attempts to show what would happen to a cohort if it were subjected for all of its life to the mortality conditions of that period ^[20]. As a consequence, the mortality data for period tables are not acquainted for further changes and thus the possibility for future mortality improvement are not incorporated in the tables ^{[23], [24]}. However, Denton and Spencer^[5] showed an alternative approach of period life table, named as 'dynamic' extension, that contradicts the assumption of constant mortality of period life table and unambiguously allow for the likelihood of further changes in mortality rates. In continuation with the work of Denton and Spencer ^[5], Sharma et al.,^[24] have also examined the mortality changes of India and some of its major states by using dynamic life table.

Increases in life expectancy have been attributed to improvements in sanitation and access to clean water, medical advances, including childhood vaccines, and massive increases in

agricultural production^[16]. Additionally, the technological advancements, health care, education, working conditions and also the socio economic infrastructure have significantly influence the life expectancy^[14]. Intuitively, literacy plays an important role in determining the human health as it is directly associated with the quality of life lived by a person. Higher education levels among a population had a positive impact on life expectancy^[16] as literacy decreases mortality levels by increasing awareness about the need and right to use public facilities, including medical facilities^[17]. The study made by Hummer and Hernandez^[8] for United States also reveals that the people with higher education levels have lower mortality rates than those with less education, which is true for every age, gender and other subgroups of the population. The LLE is that indicator which brings out the implications of human life by combining together the mortality and literacy levels of a population. Further, several works have been done in the field of LLE all over the globe^[4]. The existing literature^{[1], [3], [7], [11], [14], [18]} showed that the LLE indicator has been used explicitly to measure country's social well being and development. All these prior works have been done by considering only two indicators, life expectancy and literacy, with the assumption that the mortality experience of a population will remain constant. However, there are substantial evidences which suggest that both in developed and developing countries mortality rates are declining^{[2], [19], [29]} together with an improvement in literacy rates, but no studies have been made so far which would incorporate the corresponding changes in mortality and literacy levels in computing the LLE indicator. Therefore an attempt can be made to measure the dynamic LLE where both the mortality and literacy rates continue to change over the years. As mortality rates have been gradually declining, it is evident that one of the major reasons for this decline is literacy. As such, if we compute dynamic LLE by considering simultaneous changes in mortality and literacy then the resultant indicator would expect to give an absurd value, which might not be acceptable in real situation. Consequently, to compute dynamic LLE one can consider only the changing mortality scenario prevailing in a population and the current level of literacy. The dynamic literate life expectancies could be used to represent the expected number of years to be lived by a person in a literate state if there is a continuous change in observed rates of mortality provided that the current situation of literacy remains same.

Illiteracy, being one of the core obstacles in the growth of a developing country like India, is associated mainly with infant and young adult mortality. As without education people are more

likely to be vulnerable to health related problems. Besides, the increasing literacy rates of India from meager 43.57% in 1981 to 74.04 % in 2011 census year has a relative contribution to the decline in mortality rates of the country. Shetty and Shetty^[25] have showed that in India female literacy has a definite bearing on infant mortality as the improvement in literacy status of women would tremendously bring down the infant mortality rate due to increased awareness in maternal and child health and hygiene. Although the requirement of dynamic life table is particularly important for analyzing the changes in mortality rates for India^[24], one can also have a thought to measure the life expectancy under dynamic scenario with an addition to the literacy factor. Thus, in the present paper, an attempt has been made to develop literate life expectancy under dynamic consideration in order to portray the affects of literacy on mortality in India. An application of this indicator, called ‘dynamic literate life expectancy’, is then illustrated for India and its major states for the census year 2011 based on the rates of change of the probabilities of death over the previous ten years i.e., 2001. Also, in order to access the quality of life in terms of literacy for any two specific ages, we measure the temporary literate life expectancies under dynamic consideration. However, the purpose of measuring the temporary literate life expectancies is to be acquainted with the literacy situation of Indian states in different phases of life.

2. Development of literate life expectancy under dynamic set up:

For constructing the dynamic life table as per the method given by Denton and Spencer^[5] we need two period life tables for a particular region. The most recent period could be taken as the reference period. Then the annual rate of change of probabilities of death for any age group x to $x+n$ is calculated by-

$${}_n r_x = \left(\frac{{}_n q_x}{{}_n \bar{q}_x} \right)^{1/t} - 1 \quad (1)$$

where, ${}_n q_x$ is the probability of death for the age group x to $x+n$ in the reference period table and ${}_n \bar{q}_x$ is the corresponding probability in the earlier period table^[5]. Using the rate of change of probabilities of death (given in equation 1), the dynamic probabilities of death is obtained by

$${}_n q_{xy} = {}_n q_y (1 + {}_n r_y)^{y-x}, \quad (2)$$

which gives the probability that a member of the cohort (defined as l_{xx}), who has survived upto the exact age y , will die in the interval y to $y+n$ (where $y > x$).

Here in equation (2), ${}_nq_y$ denotes the probability of death for the age group y to $y+n$ in the reference period, ${}_nr_y$ is the annual rate of change of that probability and is computed by using (1), $y-x$ gives the number of years between the subsequent age and initial age group^[5]. Once the dynamic probabilities of death are obtained, the rest of the columns of the dynamic life table are calculated through the same procedure as in a period life table.

The dynamic literate life expectancy is that indicator which is expected to give the number of years lived on an average by a person in a literate state when mortality changes over the years under consideration. We denote the above mentioned indicator, which is dynamic literate life expectancy, as e_{xx}^{Lt}

Now, to derive the required expression of dynamic literate life expectancy (e_{xx}^{Lt}), we take the sum of the products of L_{xy} (the dynamic analogue of L_x column) and PL_x (the age specific proportion of literates of the reference period) and then divide the summation, which is over y , by the l_{xx} column of the dynamic life table. So we get the following expression:

$$e_{xx}^{Lt} = \frac{\sum_y L_{xy} \cdot PL_x}{l_{xx}} \quad (3)$$

It is worth mentioning that the proposed measure of dynamic literate life expectancy is seemed to be a generalized case of literate life expectancy. In other words, if there is no continuation in the rates of change of probabilities of death, then the dynamic literate life expectancy will reduce to the ordinary literate life expectancy.

Furthermore, the temporary expectation of life between any two ages under dynamic consideration is given by

$${}_i e_{xy} = \frac{T_{xy} - T_{x,y+i}}{l_{xy}} \quad (4)$$

where ${}_i e_{xy}$ is the average number of years that the survivors of l_{xx} cohort, alive at age y will live from age y to $y+i$ and T_{xy} is the number of person years yet to be lived by l_{xx} cohort ^[24]. Extending the idea of dynamic temporary life expectancy, one can also define dynamic temporary literate life expectancies in the similar way. Accordingly, if LT_{xy} gives the number of person years to be lived by l_{xx} cohort in a literate state, then the expression for dynamic temporary literate life expectancies can be given by

$${}_i e_{xy}^{Lt} = \frac{LT_{xy} - LT_{x,y+i}}{l_{xy}} \quad (5)$$

3. Application:

The historical record of Indian demographic data reveals a rapid decline in mortality rates over the years, so the need of dynamic life table is important for India that would incorporate these continuous changes in mortality. Apart from mortality, India's demographic situation in terms of literacy is also rising constantly. The literacy rate of India was only 14% at the time of independence (1947) and now it has increased to 74.04% as per census 2011^[6]. Though the overall literacy rates have been increasing in India, varied rates in literacy can be spotted across the Indian states. According to census 2011, Kerala and Mizoram are the only states which have literacy rate well above the national average and Bihar has the lowest share of literate persons among all the states of India.

The required information regarding the literate population of India and all the major states by its age and sex were obtained from population census of India, which is the main source of literacy data in India, for the year 2011. In order to bring out the implications for maintaining the rates of change of probabilities of death for the reference period ^{[5], [24]}, the dynamic life table is constructed by taking the period 2009-13 (centered at 2011) as reference period and 1999-2003 (centered at 2001) as the previous period. Consequently, the data for these periods have been acquired from Sample Registration System (SRS) based abridged life tables of India.

Literate life expectancy(LLE) at birth for the period 2011 are given in Table 1 for both males and females of India and its major states along with the corresponding values of dynamic literate life expectancy at birth, which are based on the rates at which the probabilities of death have been changing over the previous 10 years, viz., 2001.

Moreover, we have taken the age ranges 5-15 and 15-25 to compute the dynamic temporary life expectancies and dynamic temporary literate life expectancies as the age span 15-29 generally represent the youth population of any country and are likely to determine a country's social and economic growth. The age groups 25-60 as well as 60 and above are also taken to represent the working and old age groups respectively. Accordingly, the dynamic temporary life expectancies and dynamic temporary literate life expectancies are presented in Table 2 for males and Table 3 for females for the age ranges 5-15, 15-25, 25-60 and 60-80.

Table 1: Dynamic and period literate life expectancy at birth for India and its major states, males and females, 2011:

	Males			Females		
	L.L.E at Birth	Dynam ic LLE at Birth	Differen ce	L.L.E at Birth	Dynamic LLE at Birth	Differen ce
India	44.7	47.9	3.2	34.2	36.5	2.3
Andhra Pradesh	40.3	42.7	2.4	31.4	32.1	0.7
Assam	41.1	43.5	2.4	33.0	35.6	2.6
Bihar	38.6	40.2	1.6	23.9	25.0	1.1
Gujarat	48.1	51.2	3.1	38.5	39.3	0.8
Haryana	45.7	44.0	-1.7	33.9	34.0	0.1
Himachal Pradesh	52.2	52.8	0.6	42.3	43.2	0.9
Jammu And Kashmir	42.6	44.8	2.2	27.8	28.0	0.2
Karnataka	46.1	48.1	2.0	37.5	37.7	0.2

Kerala	60.8	66.2	5.4	61.4	65.1	3.7
Madhya Pradesh	40.6	42.8	2.2	28.1	29.4	1.3
Maharashtra	52.4	57.9	5.5	44.5	46.9	2.4
Odisha	44.4	49.3	4.9	32.8	34.5	1.7
Punjab	46.0	46.6	0.6	40.3	41.4	1.1
Rajasthan	41.4	42.1	0.7	24.2	24.9	0.7
Tamil Nadu	50.6	53.9	3.3	42.7	45.3	2.6
Uttar Pradesh	39.9	39.5	-0.4	26.2	27.4	1.2
West Bengal	48.2	51.2	3.0	39.9	41.8	1.9

From table 1, it is found that at national level a man is expected to live about 47.9 years in a literate state in 2011, when mortality rates drop over an interval of 10 years. Meanwhile, a woman will live about 36.5 years in a literate state under dynamic scenario. However, in period life table the LLE at birth for males and females is 44.7 and 34.2 years respectively. The analysis reveals that the highest dynamic LLE at birth is in Kerala with 66.2 years for males and 65.1 years for females. The same is also true in case of usual consideration where Kerala is the state having highest LLE at birth of 60.8 (61.4) years for males (females) among all the other states. This shows that the LLE at birth, under both dynamic and usual consideration, at all India level is not that appreciable as compared to Kerala. Following Kerala, it could also be seen that the dynamic LLE at birth of the states Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Tamil Nadu and West Bengal are well above the national average of 47.9 years for males and 36.5 years for females. In addition to these states, the dynamic LLE at birth for males of the state Odisha and for females of Punjab could be seen performing better than all India level. On the contrary, Andhra Pradesh, Assam, Bihar, Haryana, Jammu and Kashmir, Madhya Pradesh, Rajasthan, and Uttar Pradesh are the states where the LLE at birth under dynamic and usual consideration are below the national average for both sexes. Moreover, the lowest dynamic LLE at birth is observed in males of Uttar Pradesh with 39.5 years and females of Rajasthan with 24.9 years.

The differences in dynamic and period LLE at birth among the major states of India could be seen through table 1. The table depicts that under dynamic scenario, males (females) of India were expected to live about 3.2 (2.3) years more in a literate state than under usual consideration. A look at the above table reveals that the dynamic LLE at birth for males of Kerala, Maharashtra and Odisha produces higher differences of 5.4, 5.5 and 4.9 years respectively with the period LLE at birth. This indicates that during the period of 10 years a person residing in these states are expected to live almost 5 years more if the mortality rates continue to decline over the years. A negative difference of 1.7 years and 0.4 years are observed in the respective states of Haryana and Uttar Pradesh, which shows that the dynamic LLE at birth is higher than the corresponding value under usual consideration. However, the differences in the rest of the states are found to be marginally good for males, in the sense that the dynamic LLE at birth are more or less higher than the usual LLE at birth. Similar differences are also appeared in case of females as were observed among the males. During the period of 10 years, the highest difference between dynamic and period LLE at birth is noted in the state of Kerala (3.7 years) and that of lowest is in Haryana (0.1 years). Apart from Kerala, substantial differences are also visible in the state of Assam, Maharashtra and Tamil-Nadu, all which have a difference of approximately 2 years. Though the dynamic LLE at birth for females in the remaining states are found to be higher than the corresponding values under usual consideration, it is seen that these values are far from satisfactory as compared to Kerala and Maharashtra. This is indicative of the fact that the situation of females in the context of literacy among these states is lagging behind and thus it needs to be improved.

Figure 1: Gender disparity in literate life expectancy at birth under dynamic consideration for India and its major states, 2011.

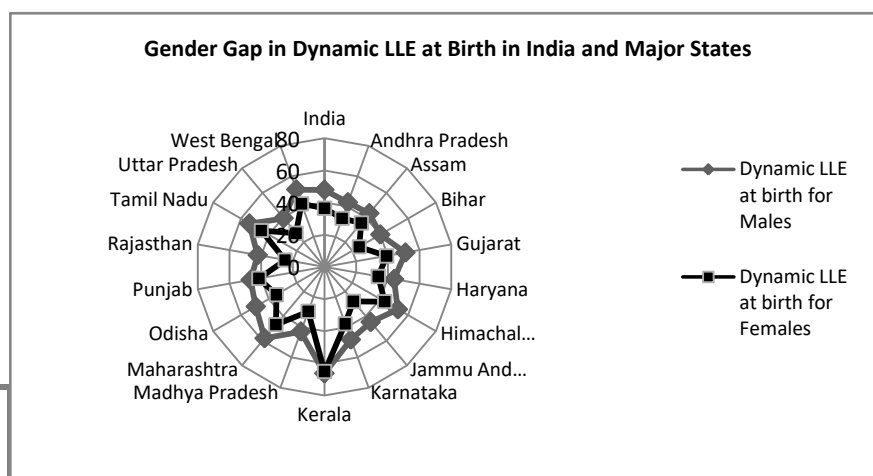
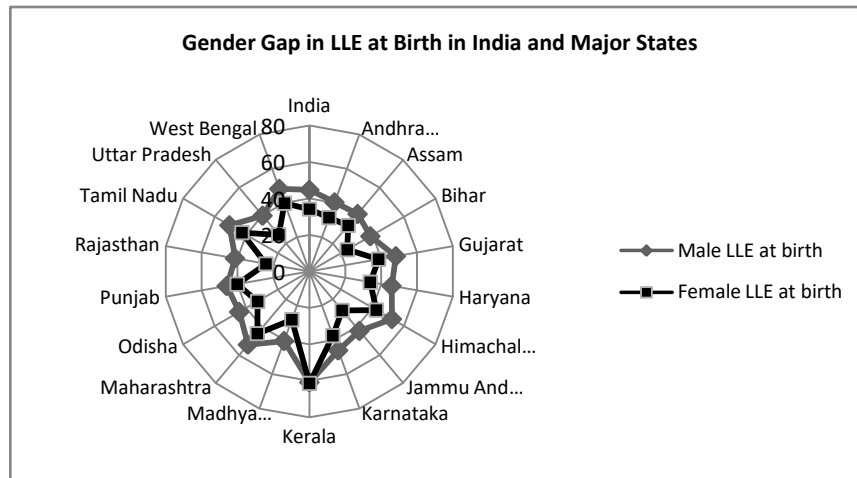


Figure 2: Gender disparity in literate life expectancy at birth under usual consideration for India and its major states, 2011.



Apparently, the male female variation in literacy is inevitable in India and thus it could be seen in LLE at birth for both dynamic and usual consideration. These variations can be helpful to understand the gender gap. Further, the difference between period and dynamic LLE at birth is also found to be highest among males than females in India and across the states under consideration (Table 1). The figure 1 and 2 respectively shows this disparity of LLE at birth among males and females under both dynamic and usual consideration. It is seen from figure 2 that women in India would live in a literate state around 10 years less than their male counterpart. The same has been observed in case of dynamic scenario (figure 1) where the female LLE at birth is almost 11 years lower than their male counterpart. The figures showed that the gender gap is highest in Rajasthan with approximately 17 years for both dynamic and period LLE at birth. The states Jammu-Kashmir and Bihar also show a high level of gender disparity in dynamic LLE at birth (16.8 and 15.2 years). Only the performance of the state Kerala is remarkably well in this regard with a difference of nearly 1 year in dynamic LLE at birth. Subsequently after Kerala, the state whose performance remained better is Punjab with a differential of 5.2 years. On the contrary, the performance of all the other states under consideration is comparatively poorer than Kerala and Punjab, where the states are having a difference of more than 7-8 years in the context of gender disparity (figure1).

Table 2: Dynamic temporary life expectancy with corresponding dynamic temporary literate life expectancy for various age groups expressed as a percentage to maximum possible years, India and its major states, males, 2011:

	Dynamic T. L. E				Dynamic Temporary L.L.E			
	5-15	15-25	25-60	60-80	5-15	15-25	25-60	60-80
India	99.7%	99.6%	95.7%	82.1%	70.4%	89.6%	72.9%	48.6%
Andhra Pradesh	99.8%	99.6%	93.0%	81.6%	73.0%	90.4%	61.6%	36.6%
Assam	99.8%	99.4%	95.3%	75.8%	67.3%	84.6%	69.5%	48.5%
Bihar	99.6%	99.6%	96.6%	76.7%	64.0%	71.2%	61.4%	39.1%
Gujarat	99.7%	99.1%	93.5%	79.9%	73.9%	92.0%	76.8%	53.2%
Haryana	99.8%	99.3%	92.9%	48.4%	73.0%	92.1%	74.7%	27.6%
Himachal Pradesh	99.9%	98.6%	93.9%	84.6%	76.5%	95.6%	83.8%	54.4%
Jammu And Kashmir	99.9%	99.6%	98.4%	90.0%	67.4%	89.2%	69.2%	36.3%
Karnataka	99.7%	99.6%	94.4%	77.8%	74.4%	92.7%	72.7%	46.3%
Kerala	99.9%	99.6%	97.0%	91.8%	77.6%	98.6%	93.8%	80.9%
Madhya Pradesh	99.6%	99.3%	94.9%	77.0%	70.5%	88.3%	68.1%	40.8%
Maharashtra	99.8%	99.8%	97.0%	92.6%	74.1%	94.8%	83.9%	64.6%
Odisha	99.5%	99.6%	95.9%	88.4%	70.7%	90.6%	74.6%	55.8%
Punjab	99.8%	99.6%	93.4%	75.0%	72.5%	90.0%	72.2%	40.1%
Rajasthan	99.6%	99.4%	92.9%	77.0%	70.3%	90.4%	66.3%	35.4%
Tamil Nadu	99.8%	99.4%	94.3%	86.7%	76.6%	96.6%	79.1%	57.0%
Uttar Pradesh	99.6%	99.6%	92.5%	62.5%	67.4%	86.1%	66.1%	32.4%
West Bengal	99.8%	99.7%	96.0%	83.7%	72.1%	88.9%	73.9%	58.7%

Table 3: Dynamic temporary life expectancy with corresponding dynamic temporary literate life expectancy for various age groups expressed as a percentage to maximum possible years, India and its major states, females, 2011:

	Dynamic T. L. E				Dynamic Temporary L.L.E			
	5-15	15-25	25-60	60-80	5-15	15-25	25-60	60-80
India	99.6%	99.7%	98.8%	88.5%	68.9%	81.5%	52.3%	24.8%
Andhra Pradesh	99.8%	99.6%	97.3%	74.7%	72.2%	83.0%	43.1%	18.1%
Assam	99.7%	99.5%	98.0%	87.7%	67.0%	79.2%	53.5%	26.7%
Bihar	99.7%	99.7%	98.2%	83.6%	60.8%	55.6%	34.1%	14.4%
Gujarat	99.7%	99.4%	97.5%	83.2%	72.3%	84.5%	58.6%	29.8%
Haryana	99.7%	99.4%	97.7%	64.7%	70.9%	86.1%	51.4%	14.0%
Himachal Pradesh	99.3%	99.8%	99.2%	94.2%	75.4%	95.6%	70.3%	21.9%
Jammu And Kashmir	99.9%	98.7%	99.2%	81.1%	63.9%	75.1%	38.9%	11.0%
Karnataka	99.8%	99.4%	97.7%	72.1%	73.6%	87.9%	55.9%	21.3%
Kerala	99.9%	99.9%	98.9%	97.3%	77.6%	98.9%	92.5%	70.0%
Madhya Pradesh	99.6%	99.4%	99.0%	82.9%	70.0%	76.9%	41.7%	15.6%
Maharashtra	99.9%	99.8%	99.3%	92.9%	73.6%	91.9%	69.3%	35.0%
Odisha	99.5%	99.7%	96.9%	88.2%	69.5%	80.9%	52.4%	21.0%
Punjab	99.9%	99.6%	98.6%	87.0%	71.6%	88.6%	63.7%	25.1%
Rajasthan	99.7%	99.6%	98.1%	89.8%	65.0%	70.6%	32.1%	12.0%
Tamil Nadu	99.9%	99.6%	98.9%	91.5%	76.5%	94.7%	64.8%	31.4%
Uttar Pradesh	99.6%	99.8%	98.3%	82.4%	65.3%	74.7%	37.7%	14.7%
West Bengal	99.8%	99.7%	98.7%	84.9%	72.4%	85.0%	60.4%	31.0%

From Tables 2 and 3, it is observed that the number of years expected to live by a male or female with continuous change in mortality over the past 10 years is nearly same between the ages 5 and

15, and 15 and 25 for all the states of India. It is seen that the percentage of dynamic temporary L.L.E is approximately 99 percent for the age groups 5-15 and 15-25 for both males and females. The percentage of observed dynamic temporary L.L.E to maximum possible years of 10 years in the age ranges 5-15 and 15-25 was seen highest in Kerala with 77.6% and 99% (approx.) respectively for both sexes. The corresponding figure for the state Bihar was 64 % for males and 60.8% for females in the age range 5-15 while it was 71.2% for males and 55.6% for females in the age range 15-25, thus having the lowest dynamic temporary L.L.E among the states of India.

Further, the dynamic temporary L.L.E between the age 25 and 60 at the national level is about 72.9% for males and only 52.3% for females, indicating relatively a poor situation of females in terms of their literacy. Similarly, for 60-80 years the corresponding value for males is 48.6% and that for females is 24.8%. It is seen that Kerala has the highest percentage of dynamic temporary L.L.E to maximum possible years with 93.8% (92.5%) and 80.9% (70%) for males (females) between ages (25 – 60) and (60 – 80) respectively. There is no doubt that Kerala is the only state which is being compared to the countries in the west. Jaswal^[9] has also mentioned that in comparison to the other states of India and some of the low income countries, the achievements of Kerala in terms of education and health were close to the developed and most of the high income countries. Perhaps, the higher reduction of mortality achieved through a reduction in infant and child mortality was the result of healthcare intervention by the state through effective primary healthcare program like building awareness, vaccination etc. ^[28]. Following Kerala, the state which is seen to be improving in terms of dynamic temporary L.L.E is Maharashtra having about 83.9% (69.3%) and 64.6% (35%) for males (females) respectively for the age group 25-60 and 60-80. It is theorized that better use of health care services and improved understanding of proper hygiene and child care practices are related to literacy ^[15]. Contrary to Kerala and Maharashtra, it can be observed that the other states needs more attention towards their education policy and thus leave room for further improvement.

There is a widening gap of dynamic temporary L.L.E between males and females of India, particularly for the higher ages, that is for (25-60) and (60-80) age groups. At national level, a male female differential of almost 20% and 23.8 % was observed for 25-60 and 60-80 age groups. The variation of dynamic temporary L.L.E among males and females across the states

are clearly observed from the tables 2 and 3. The pattern of variation is somewhat similar to that of dynamic L.L.B (discussed earlier), where the states Kerala and Punjab have lowest gender gap. It is dismaying to note that the situation of females is not at all satisfactory as the quality of life they spend is much lower than males, despite having higher life expectancy. To be specific, the dynamic life expectancy between the two ages (viz., 25-60 and 60-80) is higher for females but the corresponding values of dynamic temporary L.L.E is lower than males.

4. **Conclusion:**

The analysis mainly focuses to bring out the implications on literacy situation of India and its major states along with the mortality scenario by incorporating the rates at which the probabilities of death have been changing over the previous years. As high literacy is inversely related to low IMR and associated with an increase in life expectancy, so we have tried to bring out this scenario through the concept of dynamic literate life expectancy (LLE). With the continuous improvement of mortality, literacy played a major role, as it is observed from dynamic LLE at birth and dynamic temporary literate life expectancies. The result of this indicator reveals that the dynamic LLE at birth are exceptionally well in some states like Kerala and Maharashtra as compared to LLE at birth. The dynamic LLE at birth for other states are also more or less higher as compared to the LLE at birth under usual consideration. The possibility of higher values in dynamic LLE at birth is mainly due to the gradual reduction of mortality rates, which in turn have a significant effect on literate expectation of life at birth. However, a marginal gap of LLE between male and female is still persisting among the Indian states. The study highlights that though mortality is declining with the improvement of literacy, some states like Bihar, Uttar Pradesh, Madhya Pradesh and Jammu and Kashmir needed necessary measures for further improvement of literacy and health status and thereby narrowing the gender gap considerably. Also, a real picture of the literacy scenario could be seen as literacy helps in reducing the mortality conditions. Moreover, the dynamic considerations are the more generalized form of period life table and may be used as an alternate form of the standard period life table procedures.

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References

- [1] Chattopadhyay, A. & Sinha, K. C. (2010). Spatial and gender scenario of literate life expectancy at birth in India. *Asia Pacific Journal of Public Health*, 22 (4), 477-91.
- [2] Chaurasia, A. R. (2010). Mortality transition in India 1970-2005. *Asian Population Studies*, 6 (1), 47-68.
- [3] Choudhury, L., Sarmah, G. R. & Sarma, R. (2013). Literate life expectancy for females of Assam and selected states of India: A district level analysis of 2001 census data. *Journal of Population and Social Studies*, 21 (2), 88-98.
- [4] Choudhury, L. & Sarmah, G. R. (2013). Female literate life expectancy by education level: A district level study for Assam and some selected states of India, 2001. *Journal of Humanities and Social Science*, 11(6), 36-50.
- [5] Denton, F. T. & Spencer, B. G. (2011). A dynamic extension of the period life table. *Demographic Research*. 24 (24), 831-854.
- [6] Desai, V.S. (2012). Importance of literacy in India's economic growth. *International Journal of Economic Research*, 3(2), 112-124.
- [7] Huang, R. & Nanjo, Z. (1998). Measurement of social development in China using the literate life expectancy. *JinkogakuKenkyu*, 22, 25-30.
- [8] Hummer, R.A & Hernandez, E. M (2013). The effect of educational attainment on adult mortality in the United States. *Population Bulletin*. 68(1), 1-16.
- [9] Jaswal, S. (2016). Efficient education sector in Kerala: Lesson to be learnt by other Indian states. *IOSR Journal of Humanities and Social Science*. 21 (10), Ver-2, 57-64.
- [10] Katiyar, S. P. (2016). Gender disparity in literacy in India. *Social Change*, 46 (1), 46-69.
- [11] Khan, H.R & Md.Asaduzzaman. (2007). Literate life expectancy in Bangladesh: A new approach of social indicator. *Journal of Data Science*, 5, 131-142.
- [12] Lutz,W. (1995). Literate life expectancy, Popnet, 26 (winter), 1-5, Laxenburg, Austria: International Institute of Applied System Analysis.

- [13] Lutz, W. & Goujon, A. (2004). Literate Life Expectancy: Charting the Progress in Human Development. In: Lutz, W., W. Sanderson and S. Scherbov. Eds. *The End of World Population Growth in the 21st Century: New Challenges for Human Capital Formation & Sustainable Development* (159-186). London: Earthscan.
- [14] Medina, S. (1996). *Implementing a new indicator of social development in Mexico: Literate life expectancy (LLE)*. Laxenburg-Austria : International Institute of Applied System Analysis.
- [15] Moon, R.Y., Cheng, T.L., Patel, K. M., Baumhaft, K. & Scheidt, P.C. (1988). Parental literacy level and understanding of medical information. *Pediatrics*, 102 (2).
- [16] Mondal, N.I & Shitan, M (2014). Relative importance of demographic, socioeconomic and health factors on life expectancy in low and lower middle income countries. *J. Epidemiol*, 24(2): 117-124.
- [17] Nag, M. (1983). Impact of social and economic development on mortality: comparative study of Kerala and West Bengal. *Economic and Political Weekly*, 18 (19-21), 877-900.
- [18] Nair P.M., Chandran, S.A & Aliyar, S. (2000). Literate life expectancy in India. *Demography India*, 29(1), 117-128.
- [19] Navaneetham K. (1993). Mortality trends in India: An analysis of regional and temporal variations. *Demography India*, 22 (1): 53-63.
- [20] Preston, S. H., Heuveline, P. & Guillet, M. (2001). *Demography: measuring and modelling population processes*. Blackwell publishers Ltd.
- [21] Registrar General of India. (1999-03, 2009-13). *SRS-based Abridged Life Tables of India and the Major States*. New Delhi: Registrar General of India.
- [22] Registrar General of India. (2001, 2011). *Social and Cultural tables: Education level by age and sex for population age 7 and above*. New Delhi: Registrar General of India.
- [23] Richards, H. & M. Donaldson. (2010). *Life and worklife expectancies*. Tucson, Arizona: Lawyers and Judges Publishing Company, Inc.
- [24] Sharma, M., Choudhury, L. & Sarma, R. (2017). Dynamic life tables for India and some of its major states. *Journal of Population and Social Studies*, 25 (04), 343-357.
- [25] Shetty, A. & Shetty, S. (2014). The impact of female literacy in infant mortality rate in Indian states. *Current Pediatric Research*, 18 (1): 49-56.

- [26] Shryock, H.S., Siegel, J.S. & Associates (1980). *The methods and materials of demography*. Washington, DC: United States Government Printing Office..
- [27] Som, K. S. & Mishra, R. P. (2014). Literacy and their differential in West Bengal. *International Journal of Science and Research*, 3 (6).
- [28] Thomas M. B & James K. S. (2014). Changing mortality and human longevity in Kerala: Are they leading to the advanced stages. *Global Health Action*, 7 (1), 22938. doi: 10.3402/gha.v7.22938
- [29] Willekens, F. (2014). Demographic transitions in Europe and the World. Retrieved from Max Plank Institute for Demographic Research website <https://www.demogr.mpg.de/papers/working/wp-2014-004.pdf>