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Future Prospects of Adult Mortality in India

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Abstract

In this paper an attempt is made to estimate mortality rate for different age groups with the aim to provide the mortality structures and its future prospect of India by projecting mortality. The special attention has been made on adult mortality. The Lee-Carter model has been used for mortality projection. The study is based on the data of age-specific death rates of India available for age groups. The Data for the study is taken from Sample Registration System 1970-2014, the estimated mortality reveal that the probability of death in future is declining from each group but the rate of declining in child mortality is larger than the rate of decline of mortality in adult age group.

Introduction

For several decades, public health efforts worldwide have focused on developing and implementing disease control programs to improve children's survival in developing countries. Consequently, the methods of calculating the level of child mortality and tendency, surveys are well developed and generally provide good estimates. No doubt, India has observed the same successes story (Krishnan, 1975). After independence, the public health program has focused largely on child and infant survival enhancement and hence this decline mostly credited to the child mortality. This has led to the rapid decline in the infant mortality rate (IMR). According to Sample Registration System (SRS) report (Registrar General for India, 1970-2014), IMR dropped from 129 to 39 per thousand live births during 1970 and 2014 in India. According to the SRS, on one hand, the mortality rate of males children under the age of five has fallen from 24% to 17%, and among females it has declined from 29% to 21% on the other hand, the share of adult (15-59 years) mortality among males increased from 31% to 34%, and between female's share increased from 27% to 28% in India between 2001 and 2010. Adult mortality rate of India increased from 269 deaths per 1000 population in 1970 to 309 deaths per 1000 population in 2014 growing at an average annual rate of 1.72%. The increase in the adult deaths is the daunting situation which should be another domain of consideration of planner as well as government. Subramanian, et al (2007) remarked that increased income inequality has developed a dual burden on mortality in India. Modernization, urbanization, socio-economic progress, improved medical technology and healthcare intervention public lifestyle have pushed India in to the second phase of the epidemiological transition. The disease affects adults and the elderly population becomes common in the second phase of the epidemiological transition (Omran, 2005). More than 60% of 15-69 years of age Indian died as a result of serious non-communicable diseases (NCD) in 2014 (Ram et al, 2015). According to the WHO, 2015 report a global NCD survey gives one fourth Indians face the risk of death for NCD disease before reaching the age of 70. Every fourth person in India over 18 years has increased blood pressure (hypertension) Increased by 10 % between 2010 and 2014 (World Health Organization, 2014). The factor contributing to non-communicable diseases includes bad nutrition, physical inactivity, tobacco and alcohol consumption and atmospheric pollution. The high incidence and prevalence of diseases was largely responsible for the current level of adult mortality in India. Other causes can be attributed to maternal mortality, accidents, crime, political clashes, economic issues, ethno-religious struggles, poverty, etc. Therefore, there is a need for the policy shift from the maternal-child health to the life style related NCD among the adults. Considering above situation the present study was performed with special attention to adult mortality.

Estimation of mortality has a long history of attempts by demographers and actuarial scientists. Traditionally, a parametric curve is used for normalized annual mortality rates. The prominent works in this field are due to DeMoivre (1725), Gompertz (1825), Makeham (1860), and Weibull (1939). However, the works of Alho and Spencer (1985, 1990), Alho (1992), De León, C. J.

G. (1990), McNown and Rogers (1989), Bell and Monsell, (1991) and Lee and Carter (1992) are related to predict mortality by stochastic models.

The proposed method Lee and Carter (1992) became the "most leading statistical model for predicting mortality in demographic literature" (Deaton and Paxson, 2004). It has been used as a reference point for the recent United States Census Bureau forecasts (Hollmann, et al 2000), and two US technical security advisory panels recommended to used (Lee and Miller, 2001). Recently, the Lee-Carter model has become increasingly popular and applied for the long-term prediction of mortality rates for a specific age in many countries. This study examines the suitability of the Lee-Carter model in the Indian context. The objective of the study is also to measure the level and trend of adult mortality by age and sex in India during 1970-2014. Furthermore, the probability of death is estimated for the adult age group (15-60) and also for other age groups to overview the status of mortality in India. Finally, the future prospects of adult mortality have been shown by projecting the probability of dying in the future during 2015-2061.

Materials and Method

The work of Lee and Carter (1992) provided a new method for long-run forecast of the level and age pattern of mortality. This model has been considered as gold standard model for mortality forecasting in recent years (Lee and miller, 2001; Li et al, 2004; Li and Lee, 2005; Li and Chan 2007; Li et al., 2011. etc).

Let $m(x,t)$ denote the death rate for age x in year t. Then according to Lee-Carter model $m(x,t)$ for given t, is defined as

$$\ln m(x,t) = a_x + b_x * k_t + \epsilon_{x,t} \quad (1)$$

Where the coefficienta_x, describes the expected shape of mortality by age or general pattern of mortality by age. k_t, represent the index of mortality level. It is a time trend for the general mortality. It captures the main time trend on the logarithmic scale in mortality rates at all ages. b_x, describes the pattern of deviation from the age profile when the parameter k_t varies. The b_x rate of change in mortality with the change in k_t and $\epsilon_{x,t}$, is the residual term at age x and time t. It reflects the age specific historical influences not capture by the model.

There are three assumptions of the model: Firstly, the model assumes that b_x is invariant (constant) over time for all x. Secondly, it assumes that k_t is fixed over age-group for all t and lastly the disturbances $\epsilon_{x,t}$ are normally distributed with mean 0 and varianceσ^2. The model parameters are estimated by Singular Value Decomposition technique which is given in Lee and Carter (1992) in detail.

To forecast, Lee and Carter assume that $\boldsymbol{b_x}$ remains constant over time and forecast future values of $\boldsymbol{k_t}$ with standard univariate time-series model. After testing several autoregressive integrated moving average (ARIMA) (0, 1, 0) specifications, they find a random walk with drift is most appropriate model for their data. The equation of modelling the value of $\boldsymbol{k_t}$ is

$$k_t = k_{t-1} + \theta + \epsilon_t, \epsilon_t \sim N(0, \sigma_{rw}^2) \quad (2)$$

where θ is known as the drift parameter. The maximum likelihood estimates of the model preceding are as follows:

$$\theta = \frac{k_t - k_1}{t-1} \;\&\; \sigma_{rw}^2 = \frac{1}{t-1}\sum_{t=1}^{t-1}(k_{t+1} - k_t - \theta)^2 \quad (3)$$

With $$var(\theta) = \frac{\sigma_{rw}^2}{t-1} \quad (4)$$

Once these estimates have computed, we obtain a forecast for k_t . After obtaining the value of k_t our next attempt become to prepare life table to get probability of death in different age group. To prepare life table based on ASDR we the MORTPAK software (United Nations. MORTPAK-LITE).

Result and Discussion

The data for the study is taken from Sample Registration System (SRS). SRS generates more reliable estimates of continuous data on age specific death rates (ASDR). Therefore, the present study used this dataset for India. Data is taken for all the years 1970-2014 for males and females separately. On the basis of SRS data the technique of Lee and Carter (1992) as stated in the methodology was

used for estimating a_x, b_x and k_t of equation (1) for both male and female data, and results are presented in tabular form..

Table 1 provides estimates of age-specific estimates of constants a_x and b_x for males and females, along with its future projections, separately. $\exp(a_x)$, describe the general shape across the age of the mortality schedule. Value a_x can be considered as approximate levels of expected mortality. The results show that $a_x$values are quite high for age group 0-4 and then continued to decrease until the age group 10-14 and then increases with age in both sexes. This means that both males and females have an upward trend in mortality on age groups above 14, which implies that a younger age has a lower mortality rate than that older age, which in turn follows J-shaped mortality curve. By comparing both sexes it is noted that for females there is higher mortality than males, up to age 35-39. However, the trend is reversed; it is evident that males in the age range of 40-70 + have a higher mortality rate than their female counterparts. The result is clear show that differential mortality exists and continues to increase with age increase and it is clear that males have a greater risk of mortality as age increases than females.

Values of b_x show the rate of change of the ${}_nm_x$. It is clear from **Table 1** that the b_x shows a declining trend as age increases in general. The decline in the b_x for females is found to be less in comparison to male in the age group 0-14 where the speed of decline for females is higher from the age group starting 15-19 till the age group 44-49. This can be attributed to the reduction of maternal mortality due to a greater canter of general health and special care for females. After age 20 the speed in decline in male mortality is less as comparison to female. It also reveals that, speed in decline among males in age group 25-39 the is much lower as compared to female, it is shows that the male is higher at higher risk mortality.

Table 2 provides the estimated values of mortality index k_t and it capture the main time trend on the logarithmic scale of mortality rates at all ages. From the table 2 it is clear, over the years, both sexes indicate improvement in the overall health situation in India. But the decline in the mortality rate is higher in the case of females than males. The gap in mortality continues to grow as the year increases.

In table 3 an attempt is made to compare the predicted values of mortality from proposed model with the real data of the selected years namely, 1970, 1990 and 2014 to examine the differences in observed and expected ASDR. From this table it can be seen that there is not much difference in the expected and observed values. It indicates the suitability of Lee-Carter model for India. Most of the ages, Lee Carter Model looks very good fit in the Indian context.

For forecasting mortality in the future, Lee Carter model need to forecast the level of mortality index k_t in the future. Table 4 provides the forecast of the mortality index k_t with standard deviation and confidence interval (CI) by using the ARIMA (0, 1, 0) model for both the sexes from period 2015 to 2064. From the tables 4, it is clear that the level of mortality index continue decline in India year by year. The decline in the index of level of mortality is likely to be higher in case of females in the comparison to males. Table also shows that CI in female in much wider as comparison to male.

Table 5(a) and 5(b) provides the forecast ASDR for the year 2015 to 2060 with 5-year interval for male and female, separately. These are obtained by using the estimated value of a_x ,b_x, k_t. From the table it is observed that ASDR is higher for female in comparison of male for lower age group and it has decreasing trend over time. However ASDR of become lower for female than male in higher age group which indicates long survival of women as compared to male in older age group.

Table 6 provides the estimated and projected probability of death for various age groups: 0-5, 15-34, 15-49, 15-59 and 30-69. This has been done by constructing life table using MORTPAK. In each age group the probability of death has declined trend from 2001 to 2061. The probability of death for male adults (${}_{45}q_{15}$) has been observed a decline from 24% in 2001 to 12% in 2061 where as in case of female it is 18% in 2001 to 5% in 2061. This indicates that as per the situation of 2001, one male out of every four males and one female out of every five females of fifteen year old were dying before reaching age sixty however if current trend prevails then one male out of every 8 males and one female out of every 20 females of fifteen year old will die before reaching age sixty in 2061. It indicates the in sex ratio in future.

Probability of dying is consistently higher in the age group 30-69 years as compared to other subcategories, for both male and female. The risk of dying for adult males (45q15) in 2001 is three time higher than male children's (${}_5q_0$) however as per trend in 2061 it will be 31 times higher. On the other hand the risk of dying for adult females (${}_{45}q_{15}$) is observed as two times higher in year 2001 than female children's (${}_5q_0$) and as per projection it will be 17 times higher in 2061. It indicates that among adults, the probability of death is significantly higher in males as compared to females.

Conclusion

This study focused mainly on modelling and forecasting sex specific mortality using Indian data. Mortality was modelled using Lee-Carter's approach (1992). In the above study, it can deduce that the Lee-Carter model fits well with Indian mortality situation. Therefore, based on k_t values, we can forecast the future age pattern of mortality. On the above study, it may be inferred that the Lee-Carter model give a simple but powerful one-parameter family of life table that closely fits the pattern of age and sex specific mortality in the India from 1970 to 2014. During 1970 to 2014, probability of dying has declined across the age group for both male and female. But it remains higher in adult age group. The gender differential in mortality is significant. The probability of death in male is higher than female in all adult age group and future projection also indicates the similar pattern of mortality differentials. Also adults are at higher mortality risk condition as compare to non adults. Hence, need arises to take steps to reduce the level of adult mortality as well as adult mortality differential in India. It is time to think over paying equal attention by policy makers on child mortality as well as adult mortality. So the study indicates the change in paradigm of policies is need of time. This work will be refined and further expanded into future work opportunities incorporating recent death by paying attention to the specific cause of death in the model.

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Appendix

Table 1: Estimated Values of a_x and b_x for males and females for the period 1970-2014

Age Group	Male		Females	
	a_x	b_x	a_x	b_x
0-4	-3.6729	0.1586	-3.5757	0.1062
5-9	-6.1207	0.1659	-5.9606	0.1214
10-14	-6.6498	0.1061	-6.5868	0.0795
15-19	-6.3927	0.0684	-6.1146	0.0689
20-24	-6.0928	0.0497	-5.8447	0.0723
25-29	-5.9644	0.0317	-5.8517	0.0733
30-34	-5.7221	0.0353	-5.8127	0.0744
35-39	-5.4355	0.0333	-5.6871	0.0677
40-44	-5.1051	0.0484	-5.4766	0.0606
45-49	-4.7268	0.0530	-5.1478	0.0571
50-54	-4.3148	0.0580	-4.6983	0.0575

55-59	-3.9128	0.0589	-4.2694	0.0509
60-64	-3.4679	0.0634	-3.7426	0.0517
65-69	-3.0816	0.0483	-3.3223	0.0430
70+	-2.3145	0.0211	-2.4254	0.0156

Table 2: Estimated k_t (Mortality Index) values for India, 1970-2014

Year	Males	Females	Year	Males	Females
1970	4.61543	6.25251	**1993**	-0.78422	-0.40749
1971	4.17205	5.96749	**1994**	-0.71967	-0.7781
1972	5.03861	8.13973	**1995**	-0.64532	-1.00566
1973	4.68079	6.86775	**1996**	-1.12046	-0.8541
1974	3.86844	6.02802	**1997**	-0.95287	-0.84394
1975	4.53397	7.10364	**1998**	-0.88956	-1.29141
1976	4.91795	5.59422	**1999**	-1.15447	-1.5386
1977	3.83903	6.1532	**2000**	-1.63711	-1.86205
1978	3.8096	5.24258	**2001**	-1.46784	-2.32286
1979	2.34759	3.66014	**2002**	-2.29457	-3.02286
1980	2.38413	3.61488	**2003**	-2.78471	-3.91591
1981	2.66701	3.98206	**2004**	-2.77466	-4.72254
1982	1.76014	2.64903	**2005**	-2.68261	-4.16854
1983	1.94766	2.99259	**2006**	-3.11357	-4.82742
1984	2.55725	3.83461	**2007**	-3.12181	-5.30636
1985	2.28366	3.31034	**2008**	-3.46017	-5.87907
1986	1.58051	2.35953	**2009**	-4.21834	-6.72162
1987	1.16368	1.85141	**2010**	-4.27627	-6.60083
1988	1.21651	1.80945	**2011**	-4.80493	-7.97085
1989	0.53108	0.79032	**2012**	-4.79996	-8.41807
1990	0.04812	0.3107	**2013**	-5.98726	-8.48339
1991	0.53863	0.60324	**2014**	-6.98418	-9.40881
1992	0.17276	1.23301			

Table 3: Observed and expected age specific death rates for selected years for India

Age Group	Males						Females					
	1970		1990		2014		1970		1990		2014	
	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.
0-4	51.7	52.8	24.8	25.6	9.3	8.4	55.1	54.4	27.9	28.9	10.6	10.3
5-9	4.6	4.7	2.3	2.2	0.6	0.7	5.0	5.5	2.8	2.7	0.7	0.8
10-14	2.0	2.1	1.4	1.3	0.7	0.6	2.4	2.3	1.4	1.4	0.6	0.7
15-19	2.5	2.3	1.7	1.7	1.1	1.0	3.7	3.4	2.5	2.3	1.0	1.2
20-24	2.9	2.8	2.4	2.3	1.4	1.6	4.6	4.5	3.1	3.0	1.2	1.5
25-29	3.3	3.0	2.5	2.6	1.7	2.1	4.9	4.5	2.8	2.9	1.3	1.4
30-34	4.0	3.9	3.1	3.3	2.3	2.6	5.2	4.8	2.9	3.1	1.5	1.5
35-39	4.7	5.1	3.9	4.4	3.3	3.5	5.7	5.2	3.2	3.5	1.9	1.8
40-44	8.0	7.6	5.7	6.1	4.5	4.3	5.9	6.1	4.4	4.3	2.9	2.4
45-49	11.9	11.3	9.0	8.9	6.1	6.1	8.0	8.3	6.3	5.9	3.8	3.4
50-54	17.9	17.5	13.2	13.4	9.7	8.9	12.9	13.1	9.0	9.3	7.7	5.3
55-59	25.5	26.2	20.9	20.0	14.0	13.2	16.5	19.2	14.4	14.2	10.2	8.7
60-64	42.7	41.8	28.9	31.3	19.9	20.0	31.4	32.7	23.0	24.1	15.6	14.6
65-69	53.6	57.3	47.3	46.0	29.5	32.7	41.5	47.2	37.8	36.6	22.7	24.1
70+	117.1	108.9	91.4	98.9	94.4	85.3	104.0	97.5	79.4	88.9	83.9	76.4

Table 4: Forecasts of mortality index k_t with 95% CI, from ARIMA (0, 1, 0) model for India

Year	Males				Females			
	k_t	SD	LCL	UCL	k_t	SD	LCL	UCL
2015	-7.25	0.27	-7.77	-6.73	-9.76	0.57	-10.88	-8.65
2016	-7.51	0.38	-8.25	-6.77	-10.12	0.80	-11.69	-8.55
2017	-7.78	0.46	-8.68	-6.87	-10.48	0.98	-12.40	-8.55
2018	-8.04	0.53	-9.08	-7.00	-10.83	1.13	-13.05	-8.61
2019	-8.30	0.60	-9.47	-7.14	-11.19	1.27	-13.67	-8.70
2020	-8.57	0.65	-9.84	-7.29	-11.54	1.39	-14.27	-8.82
2021	-8.83	0.70	-10.21	-7.45	-11.90	1.50	-14.84	-8.96
2022	-9.09	0.75	-10.57	-7.62	-12.26	1.60	-15.40	-9.11
2023	-9.36	0.80	-10.92	-7.79	-12.61	1.70	-15.95	-9.28
2024	-9.62	0.84	-11.27	-7.97	-12.97	1.79	-16.48	-9.45
2025	-9.88	0.88	-11.61	-8.15	-13.32	1.88	-17.01	-9.64
2026	-10.15	0.92	-11.96	-8.34	-13.68	1.96	-17.53	-9.83
2027	-10.41	0.96	-12.29	-8.53	-14.04	2.04	-18.04	-10.03
2028	-10.67	1.00	-12.63	-8.72	-14.39	2.12	-18.55	-10.24
2029	-10.94	1.03	-12.96	-8.92	-14.75	2.20	-19.05	-10.45
2030	-11.20	1.06	-13.29	-9.12	-15.10	2.27	-19.55	-10.66
2031	-11.47	1.10	-13.62	-9.31	-15.46	2.34	-20.04	-10.88
2032	-11.73	1.13	-13.94	-9.52	-15.82	2.40	-20.53	-11.10
2033	-11.99	1.16	-14.27	-9.72	-16.17	2.47	-21.01	-11.33
2034	-12.26	1.19	-14.59	-9.92	-16.53	2.53	-21.50	-11.56
2035	-12.52	1.22	-14.91	-10.13	-16.88	2.60	-21.97	-11.79
2036	-12.78	1.25	-15.23	-10.34	-17.24	2.66	-22.45	-12.03
2037	-13.05	1.28	-15.55	-10.55	-17.60	2.72	-22.92	-12.27
2038	-13.31	1.30	-15.87	-10.76	-17.95	2.78	-23.39	-12.51
2039	-13.57	1.33	-16.18	-10.97	-18.31	2.83	-23.86	-12.75
2040	-13.84	1.36	-16.50	-11.18	-18.66	2.89	-24.33	-13.00
2041	-14.10	1.38	-16.81	-11.39	-19.02	2.95	-24.79	-13.25
2042	-14.37	1.41	-17.13	-11.60	-19.38	3.00	-25.25	-13.50
2043	-14.63	1.43	-17.44	-11.82	-19.73	3.05	-25.71	-13.75
2044	-14.89	1.46	-17.75	-12.04	-20.09	3.10	-26.17	-14.00
2045	-15.16	1.48	-18.06	-12.25	-20.44	3.16	-26.63	-14.26
2046	-15.42	1.51	-18.37	-12.47	-20.80	3.21	-27.08	-14.51
2047	-15.68	1.53	-18.68	-12.69	-21.15	3.26	-27.54	-14.77
2048	-15.95	1.55	-18.99	-12.91	-21.51	3.31	-27.99	-15.03
2049	-16.21	1.57	-19.30	-13.12	-21.87	3.35	-28.44	-15.29
2050	-16.47	1.60	-19.61	-13.34	-22.22	3.40	-28.89	-15.56
2051	-16.74	1.62	-19.91	-13.56	-22.58	3.45	-29.34	-15.82
2052	-17.00	1.64	-20.22	-13.79	-22.93	3.49	-29.78	-16.09
2053	-17.27	1.66	-20.52	-14.01	-23.29	3.54	-30.23	-16.35
2054	-17.53	1.68	-20.83	-14.23	-23.65	3.58	-30.67	-16.62
2055	-17.79	1.70	-21.13	-14.45	-24.00	3.63	-31.12	-16.89
2056	-18.06	1.73	-21.44	-14.68	-24.36	3.67	-31.56	-17.16
2057	-18.32	1.75	-21.74	-14.90	-24.71	3.72	-32.00	-17.43
2058	-18.58	1.77	-22.04	-15.12	-25.07	3.76	-32.44	-17.70
2059	-18.85	1.79	-22.35	-15.35	-25.43	3.80	-32.88	-17.97
2060	-19.11	1.81	-22.65	-15.57	-25.78	3.84	-33.32	-18.25
2061	-19.37	1.83	-22.95	-15.80	-26.14	3.89	-33.75	-18.52
2062	-19.64	1.84	-23.25	-16.02	-26.49	3.93	-34.19	-18.80
2063	-19.90	1.86	-23.55	-16.25	-26.85	3.97	-34.63	-19.07
2064	-20.17	1.88	-23.86	-16.48	-27.21	4.01	-35.06	-19.35

Table 5(a): Forecast age-specific death rate for males in India

Age Group	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
0-4	8.05	6.53	5.30	4.30	3.49	2.83	2.30	1.86	1.51	1.23
5-9	0.66	0.53	0.43	0.34	0.28	0.22	0.18	0.14	0.11	0.09
10-14	0.60	0.52	0.45	0.39	0.34	0.30	0.26	0.23	0.20	0.17
15-19	1.02	0.93	0.85	0.78	0.71	0.65	0.59	0.54	0.50	0.45
20-24	1.58	1.48	1.38	1.30	1.21	1.14	1.06	1.00	0.93	0.87
25-29	2.04	1.96	1.88	1.80	1.73	1.66	1.59	1.52	1.46	1.40
30-34	2.53	2.42	2.31	2.20	2.10	2.01	1.92	1.83	1.75	1.67
35-39	3.42	3.28	3.14	3.00	2.87	2.75	2.63	2.52	2.41	2.31
40-44	4.27	4.01	3.76	3.53	3.31	3.11	2.91	2.73	2.57	2.41
45-49	6.03	5.62	5.25	4.89	4.56	4.25	3.97	3.70	3.45	3.22
50-54	8.78	8.13	7.53	6.98	6.47	5.99	5.55	5.14	4.76	4.41
55-59	13.04	12.07	11.17	10.33	9.56	8.85	8.19	7.58	7.01	6.49
60-64	19.70	18.12	16.67	15.33	14.10	12.97	11.93	10.97	10.09	9.29
65-69	32.34	30.34	28.47	26.71	25.07	23.52	22.07	20.71	19.43	18.23
70+	84.82	82.50	80.24	78.04	75.90	73.82	71.80	69.84	67.92	66.06

Table 5(b): Forecast age-specific death rate for females in India.

Age Group	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
0-4	9.93	8.22	6.80	5.63	4.66	3.86	3.20	2.65	2.19	1.81
5-9	0.79	0.63	0.51	0.41	0.33	0.27	0.22	0.17	0.14	0.11
10-14	0.63	0.55	0.48	0.41	0.36	0.31	0.27	0.24	0.20	0.18
15-19	1.13	1.00	0.88	0.78	0.69	0.61	0.54	0.48	0.42	0.37
20-24	1.43	1.26	1.10	0.97	0.85	0.75	0.66	0.58	0.51	0.45
25-29	1.41	1.23	1.08	0.95	0.83	0.73	0.64	0.56	0.50	0.43
30-34	1.45	1.27	1.11	0.97	0.85	0.75	0.65	0.57	0.50	0.44
35-39	1.75	1.55	1.38	1.22	1.08	0.96	0.85	0.75	0.67	0.59
40-44	2.32	2.08	1.87	1.68	1.50	1.35	1.21	1.09	0.98	0.88
45-49	3.33	3.01	2.72	2.45	2.22	2.00	1.81	1.64	1.48	1.33
50-54	5.20	4.69	4.23	3.82	3.45	3.11	2.81	2.54	2.29	2.07
55-59	8.51	7.77	7.10	6.49	5.92	5.41	4.94	4.51	4.12	3.77
60-64	14.30	13.05	11.90	10.85	9.90	9.03	8.24	7.51	6.85	6.25
65-69	23.71	21.96	20.35	18.85	17.46	16.17	14.98	13.88	12.86	11.91
70+	75.96	73.88	71.86	69.89	67.98	66.12	64.31	62.55	60.84	59.17

Table6: Age and sex specific probability of dying in India

Age Group	Observe						Projected							
	2001		2011		2021		2031		2041		2051		2061	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
$_5q_0$	0.083	0.093	0.054	0.061	0.014	0.014	0.010	0.010	0.007	0.007	0.005	0.005	0.004	0.003
$_{20}q_{15}$	0.046	0.048	0.039	0.030	0.037	0.024	0.033	0.019	0.031	0.014	0.028	0.012	0.026	0.009
$_{35}q_{15}$	0.126	0.098	0.114	0.067	0.101	0.054	0.092	0.043	0.084	0.034	0.077	0.027	0.071	0.022
$_{45}q_{15}$	**0.248**	**0.188**	**0.223**	**0.136**	**0.191**	**0.110**	**0.171**	**0.090**	**0.153**	**0.073**	**0.138**	**0.061**	**0.125**	**0.051**
$_{40}q_{30}$	**0.457**	**0.351**	**0.422**	**0.288**	**0.368**	**0.241**	**0.335**	**0.207**	**0.304**	**0.177**	**0.279**	**0.153**	**0.255**	**0.133**

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