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Estimation Of Life Expectancy At Birth of Jammu And Kashmir By Regression Analysis Method

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ABSTRACT

Life expectancy at birth (e0) is regarded as an important index of the mortality level of a population. The paper estimates the life expectancy at birth of Jammu and Kashmir from infant mortality rate by Regression analysis. The aim of this report is to look into the influence of infant mortality on life expectancy at birth based on the SRS data In this paper. The aim of this report is to look into the influence of infant mortality on life expectancy at birth based on the SRS data In this paper. The Study created the model by taking the only input as Infant mortality rate at the state level because information on Infant is available. Examination of life expectancy at birth for different years reveals that the life expectancy of the state is satisfactory in recent years and predicated or estimated value of Life expectancy above 75 which is the highest in India after state Kerala. Hence, the results clearly affirm that the Central and J&K state government approach of health interventions and policies is working properly in checking and reducing mortality differentials in the state.

Keywords: -Infant Mortality rate, Jammu and Kashmir, Life Expectancy at birth, Regression Analysis.

I.INTRODUCTION

Life expectancy at birth is considered as an important indicator to describe the level of mortality in a population. It is one of the most preferred indicators in demographic and health analysis. The life expectancy of a birth component of the HDI is calculated using a minimum value of 25 years and the maximum value of 85 years. This is the observed maximum value of the indicators of the countries in the time series, 1980–2012 **(Koontz. D. 2005 [1]).** It was after the first Human Development Report that life expectancy became a thrust indicator. The greater the life expectancy in one country, the healthier its population is **(Jen et al. 2010 [2]).** It is well known that its main advantage over other methods of measuring mortality is that it does not reflect the effects of the age distribution of an actual population and does not require the adoption of a standard population for comparing


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levels of mortality among different populations. Since 1970, both genders have experienced a continuous rise in life expectancy in a developing country like India **(Romo and Saikia, 2013 [3])** Life expectancy is a summary measure of mortality at every age that allows us to compare mortality/longevity between geographical areas (and time periods) that may exhibit very diverse population structures **(Bravo and Malta 2010[4]).** Life expectancy at birth can be estimated by constructing the life table, but this requires the rigorous data which allows us to follow the alternative method of life expectation **(Malaker 1986; Bhat 1987 [5-6])**. There is massive evidence that life expectancy is distributed very unequally among the countries **(Smiths and Monden, 2007 [7]).** Worldwide, since mid-2000 for the first time in human history, women enjoyed longer LEB than men **(Bardford, 2006 [8]).** India is a very diverse country and there are variations in basic demographic indicators not only across states, but also in the districts **(Kapoor, 2010 [9]).** The international comparison of life expectancy at birth of India lacks behind which is 66.4 in comparison year with Norway, united kingdom's and Canada with 81.50, Germany 80.70, Japan 83.60, Turkey 75.5, Sri Lanka 74.3, Indonesia 70.8, Nepal 68.4, Pakistan 66.6, and South Africa 56.90 **(UNDESA, 2013 [10])** which is a matter of concern of our resourceful country. The Life expectancy of Jammu and Kashmir for the comparison year 2013 i.e.72 at much more satisfactory than national level 66.40 **(SRS Life Table [11]). Thakuria B, et al (2017 [12]).** The analysis that the indirect estimation is the only way to estimate life expectancy at birth at the district level. He Concluded that for males (females) 18 (11) % of the districts have LEB below 60 years, 20 (27) % between 60-65 years and 30 (62) % above 65 years amongst the 190 districts of the selected states of India. (**Monsef. A. et al, 2015 [13]).** Results of 13 studies describing eight different cohorts suggest that regular physical activity is associated with an increase of life expectancy by 0.4 to 6.9 years. Eleven studies included confounding risk factors for mortality and revealed an increase in life expectancy by 0.4 to 4.2 years with regular physical activity. Eleven case control studies on life expectancy in former athletes revealed consistently greater life expectancy in aerobic endurance athletes but inconsistent results for other athletes l.(**Samitz et al 2011 [14]).** Worked on the study of effects on the physical exercise on the life expectancy as well as reported a mean reduction of mortality of 31% to 35% in persons who participate in regular leisure-time or daily life physical activity compared to that in inactive persons. (**Halicioglu 2010 [15])** investigated the factors of life expectancy in Turkey for the period 1965- 2005. In this study, the determinants of life expectancy in Turkey have been classified into selected economic, social and environmental factors. According to the results of this study, the nutrition and food availability factors were the main positive factors for improving lifetime. But, smoking was the main cause of mortality.(**Yavari and Mehrnoosh, 2006 [16])** analyzed the effects of socioeconomic factors on life expectancy using multiple regression analysis. This study showed that there is a positive, strong correlation between life expectancy as an independent variable and per capita income, health expenditures, literacy rate and daily calorie intake. Also, it revealed that there is a strong negative correlation between life expectancy and the number of people per doctor in African countries.(**Groenewegen. P.P, 2003 [17])** Researched in The Netherlands and studied that the Healthy life expectancy has mainly been at the level of health care systems rather than at the regional level within health care

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systems. In his Research, he found that the healthy life expectancy at birth and at 65 years of age for men and women in the Netherlands has been described, and factors related to these regional variations have been explored and concluded that life expectancy shows a regional pattern. The regional distribution of male and female healthy life expectancy is different, especially at 65 years. The healthy life expectancy of women aged 65 years is independent of their total life expectancy. (**Castello and Domenech 2002 [18]).** Provided a theoretical model in which inequality affects per capita income when individuals decide to accumulate human capital depending on their life expectancy. According to the finding of this study, the distribution of education was depended on the existence of multiple steady states Bergh and Nilsson (2009) analyzed the relationship between three dimensions of globalization (economic, social and political) and life expectancy using a panel of 92 countries over the period 1970-2005. They found a very robust positive effect of economic globalization on life expectancy, even when controlling for income, nutritional intake, literacy, number of physicians and several other factors.(**Silcocks. PBS 2001 [19]).** Investigated the sampling distribution and usefulness of expectation of life in comparisons of mortality at health district level or below the district level by the method of Monte Carlo simulation and concluded that the expectation of life is approximately normal. The expectation of life shows a high negative correlation with SMR even if the oldest age band for the SMR is open-ended.

II. METHODOLOGY

There are various indirect techniques are used for the estimation of life expectancy at birth, depending on the source of availability of data. The techniques are namely (1) Stable population concept (2) Biological theories of aging (3) Age distribution of population (4) Widowhood status and (5) Regression approach **(Sarma and Choudhury, 2014 [20]).** The method of regression is the most suitable amongst all the methods mentioned for the estimation of expectation of life at birth as it depends upon limited data and the assumptions are not much demanded like other methods **(Pathak and Singh, 1992 [21])** Data Sources: the data from The sample Registration system (SRS) has been taken for the estimation of parameters. The system was initiated by the Office of Registrar General, India during 1967 with the objective of producing a reliable and continuous data on demographic indicators. In this study, the data regarding the infant mortality and life expectancy at birth is considered in developing the model for Jammu and Kashmir between infant mortality and life expectancy at birth from the year 2001-2015. The Regression analysis method is used for the estimation of life expectancy at birth of Jammu and Kashmir, which is based on the estimation on minimizing the error sum of squares of residuals. Since there is the linear Relationship between The infant Mortility and Life Expectancy at birth **(Woods, 1993 [22]).**In this method, the infant mortality is Considered as independent variable and life expectancy at birth as the dependent variable in the same way as considered by **(Ranjana. K, 2015 [23]**infant and child mortality have declined in all countries. Most proportion of child mortality is attributed to death in infants. All HDI individual components significantly inversely were related to infant mortality rate (IMR) and among them expected years of schooling has the strongest effect with regression coefficient of β= -5.9 (95% CI: -6.63, -

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5.13). **(Khazaei. S *et al* [24]).** Our final regression equation would be in the same mathematical form as followed by between the parameters infant mortality rate and crude Death rate for the same state of Jammu and Kashmir. The regression equation under the model may be as follows.

$$\mathbf{Y}=\alpha+\beta\,\mathbf{X}+e$$

Where the Life expectancy at birth is the dependent variable (Y) and Infant Mortality (X) as an independent variable. Where a and b are the estimates of parameters α and β respectively to be estimated by the least square method of estimation based on minimizing the sum of square due to error. E is random error which is normally distributed with mean 0 and variance σ^2 If we find that the slope of the regression line is significantly different from zero, we will conclude that there is a significant relationship between the independent and dependent variables. We set up the null hypothesis H_0: β = 0 (The slope of the regression line is equal to zero.) against H_1: β ≠ 0 (The slope of the regression line is *not* equal to zero). For examining the significance of regression Coefficient, we use to test to see whether the slope of the regression line differs significantly from zero. The test Under H_0 is given by I t I= $\frac{b}{s(b)}$. We will guide our decision regarding hypothesis accepting or passing up for corresponding degrees of freedom at the 5 % point of meaning and used SPSS software for F test.

III. RESULTS

The Normal Equations for estimating the constants a and b from Regression Model are

$\sum Y = b\sum X + na$ and $\sum XY = \sum X2. + a\sum X$ Subtitling the values of

$\sum Y, \sum X, \sum XY, \sum X2$ We have

1035.10=b.659+15a $\Longrightarrow$

15a+659b=1035.10 ----------1

45184.20=b.29833+a.659

$\Longrightarrow$ 659a +29833b = 45184.20 ----------2

Solving the above two linear equations 1 and 2 for the constants a and b we have

$\hat{\alpha} = a = 83.59, \hat{\beta} = b = -0.33$

The fitted regression model is $\boldsymbol{Y}= -\mathbf{0.33}\boldsymbol{X}+\mathbf{83.59}$

The life expectancy at birth for the years 2016, 2017 can be estimated from the regression model by simply substituting the value of infant mortality rate for corresponding years Infant mortality rate of Jammu and Kashmir for the year 2016 is 24 **(Ahmad, P. J. et al, 2017 [25]).**

$Y= -0.3*24+83.59 \Longrightarrow Y=-7.92+83.59 \Longrightarrow 75.67$ So estimated value of Life expectancy at birth of Jammu and Kashmir finthe year 2016 is 75.67 per thousand live births. Infant mortality rate of Jammu and Kashmir finthe year 2017 is 23 per thousand live births.; similarly estimated value of the life expectancy at birth is 76. Life expectancy at birth of Jammu and Kashmir in the year 2016 is 75.67 per thousand live births. and for the year 2017 is 76 per thousand live births. based on SRS data by the Regression analysis method of estimation.


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For testing the regression coefficient we have It1= $\frac{\hat{\beta}=b}{s(b)=s(\hat{\beta})}$.

It1= $-\frac{0.331}{0.086}$ = - 3.84, It1= 3.84. Heer the absulate value of t statistic is used hfot testing the hupothesis and validity of the model. Also the critical value of t (1 - α/2; n - 2), Here α= 0.05 and n=15, n is the total number of subjects. (Loosely we say that we lose two degrees of freedom because they are used up in the estimation of the two parameters α and β) Using the null hypothesis of β = 0 we have

t (1 – 0.05/2; 15 - 2) = 2.160 (from critical value of t Dist.for Two-tailed) **(Michael H Kutner et al, 2004 [26]).**

IV.DISCUSSION

Jammu and Kashmir have witnessed the rapid decreases in infant mortality rate **(Ahmad. P. J, et al 2017 [25])** due to which the life expectancy shows an upward trend from past decades. Life expectancy at birth of Jammu and Kashmir of the regression method of estimation and the various trends of LEB has been discussed in this research paper. The data have been taken from the SRS life tables of India for the J&K for last 15 Years, with corresponding the infant mortality rate for fitting the appropriate Regression equation between the two parameters. The LEB in J&K for the year 2001 is 60.30 which is below the national level 62.86, and have raised to 64.30 in 2005 which is almost equal to 64.35 at the national level. After 2005, LEB of Jammu and Kashmir Shows Continuously increasing trend than the national level. In the 2011 Census, LEB has Reached 70.50 for J&K state, whereas remained 66.80 at the national level. Life Expectancy at Birth for 2015 is 73.20 which is above the national level 68.60. Fig 1.1 and 1.2 shows that there is a some association between IMR and LEB of Jammu and Kashmir. There is a Tongue shaped curve between IMR and LEB for J&K from 2001-2105. For the year 2001, IMR is 57 and LEB is 60.30, in 2002 IMR slipped down to 42 consequently LEB reached in 65.90 in similar fashion forms the tongue-shaped trend. The life expectancy at birth is influenced by many factors, such as Infant Mortality, Income, Female education, Medical facility and so on) **(Joumard I. et al., 2008 [26])**. Keeping other factors constant, we have obtained the regression equation between the IMR and LEB for J&K to SRS data. From the regression equation, $\boldsymbol{Y}=-\mathbf{0.3}.\ \boldsymbol{X}+\mathbf{83.59}$ there is a high degree of negative correlation between infant mortality expectancy at birth as shown in fig 1.3 (r = 0.729). I.e. LEB of Jammu and Kashmir increases with the decrease in IMR and vice versa. Same as research work done by (**Ranjana, K, 2015 [23])** found the positive relationship between the same parameters**.** There is the 53.45 Percent association between IMR and LEB (R^2 =53.45).The similar type of Results had obtained from the Research in Assam for Life Expectancy at birth conducted by **(Sarma R, Choudhury L. 2014 [20]),** for Life expectancy at birth and infant mortality rate and found both infant and quadratic relations between two parameters. The Life expectancy at birth of Jammu and Kashmir in the year 2016, 2017 are estimated from equation $\boldsymbol{Y}=-\mathbf{0.33}\boldsymbol{X}+\mathbf{83.59}$. For the substitution of IMR 26 per thousand live births and 24 per thousand live births respectively, for 2016 and 2017.A model that fails in diagnostic checking for mode adequacy will always remain suspect and little faith can be put into the results **(Kerlinger, 1998 [27]).** Therefore, it is essential that the fitted regression model should Satisfy the important tests

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of model adequacy, therefore the fitted regression model is tested for certain degrees of freedom at a given level of significance. So we test the regression equation by setting the null hypothesis H_0: $\beta = 0$ against H_1: $\beta \neq 0$.for 13 degrees of freedom and calculated value the of test statistic is given by t= 3.84 as shown in Table 1.2 and the critical value of t for 5% percent level of significance is equal to 2.160. Since the calculated value of t is greater than critical value of t we reject the null hypothesis and conclude that The Regression Coefficient β is different from zero and conclude that there is a significant linear relationship between the Infant Mortility rate and life expectancy at birth in Jammu and Kashmir. So our fitted model is considered as best fitted model. Simlairly the above fitted regression model between IMR and LEB of jammu and Kashmir by using statistical software SPSS as shown in table 1.2 and 1.3.From the tables we have F= 14.750 which is significant at 5% level of signifance for (1,13) d.f we reject the null hypothesis and conclude that $\beta \neq 0$ and fitted regression model between IMR and LEB is considered as best fitted model to given data.

V.TABLES AND GRAPHS

Table 1.1

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Infant Mortality Rate(X)	57	42	44	50	52	49	51	49	45	43	41	39	37	34	26	$\sum X$ =659
Life Expectancy at Birth(e_0) (Y)	60.30	65.90	66	67.30	64.30	70	69.60	69.80	70	72.60	70.50	71	72	72.60	73.20	$\sum Y$ = 1035.10
X^2	3249	1764	1936	2500	2704	2401	2601	2401	2025	1849	1681	1521	1369	1156	676	$\sum X^2$ =29833
XY	3437.10	2767.80	2904	3365	3343.60	3430	3549.60	3420.20	3150	3121.80	2890.50	2769	2664	2468.40	1903.20	$\sum XY$ =45184.20

1.3 Coefficients[a]

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	83.529	3.838		21.762	.000
	IMR	-.331	.086	-.729	-3.841	.002

a. Dependent Variable: LEB

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Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96.254	1	96.254	14.750	.002[a]
	Residual	84.835	13	6.526		
	Total	181.089	14			

a. Predictors: (Constant), IMR

b. Dependent Variable: LEB

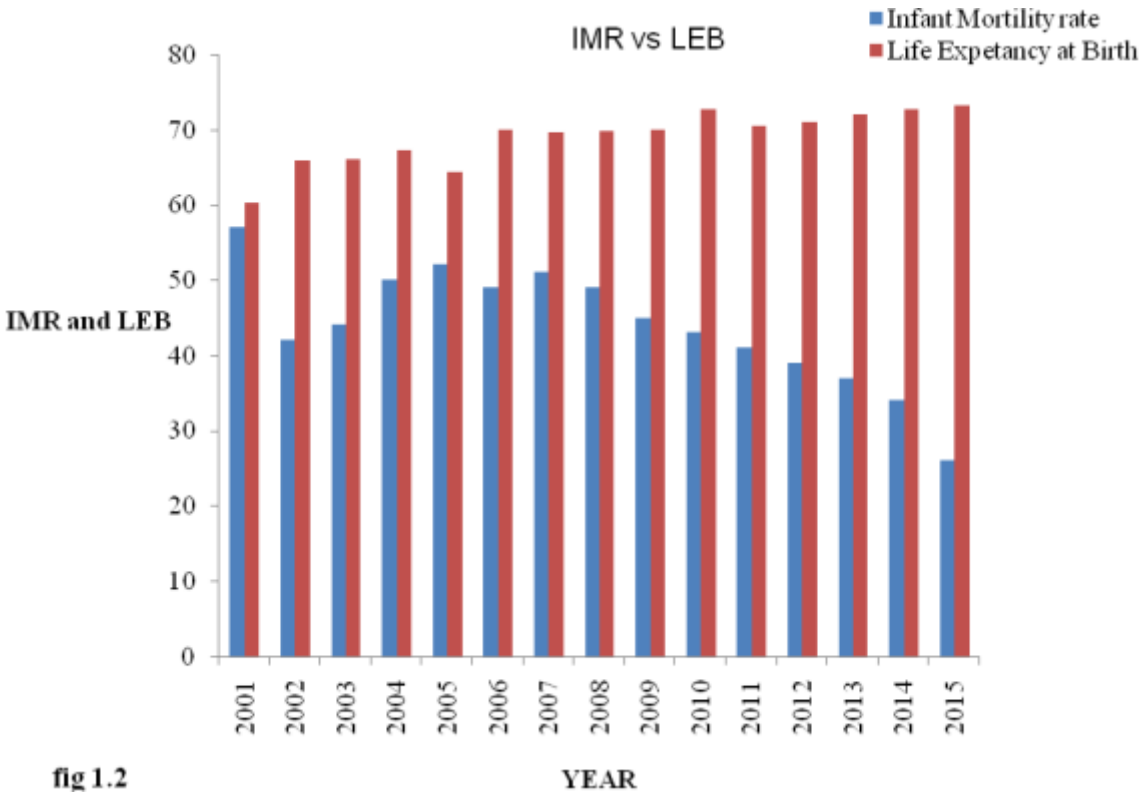

fig 1.2

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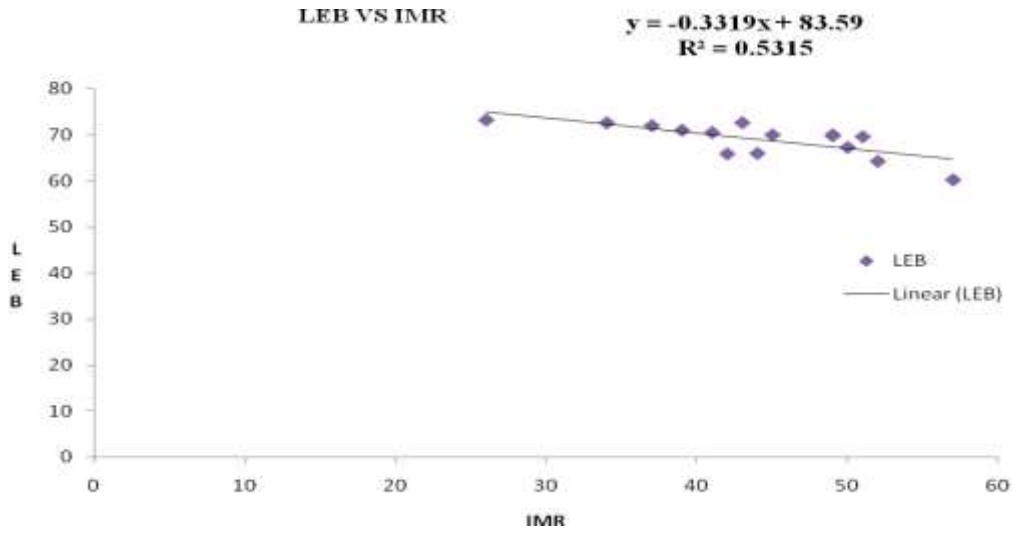

Fig 1.3

VI. CONCLUSION

From the results discussed above, we conclude that Life Expectancy at the birth of Jammu and Kashmir is Improving from almost last decade and attains its top position at the national level. We also conclude that the fitting of regression curve is considered as the best fit to above data from the appropriate validity test. This Research paper Estimates the Life expectancy at birth of Jammu and Kashmir In the year 2016, 17 is 76 and 75 Years by Regression which is also satisfactory value. There is nothing to worry about regarding such parameter. There are several factors that explain life expectancy varies, such as health expenditures, access to health care services, individuals' education, income distribution, and lifestyle (smoking and alcohol consumption) **(Joumard I. et al. 2008 [26]).** The need of the hour is to take special consideration towards these major factors. This Research paper is entirely based on the infant mortality and life expectancy at birth of Jammu and Kashmir and would be helpful to State health authorities to identify the figures and try to improve them further by taking appropriate measures.

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