LIFE EXPECTANCY IN INDIA: AN APPROXIMATION OF TIME SERIES

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ABSTRACT
Since independence our country has made astonishing progressions in various diversified fields, but somewhat has lagged behind in both education and healthcare; so, a simple estimation has been done in the following research paper so as to find an estimation to the given data (simple linear regression) to fit a trend line and to give an approximation to the data which was further confirmed by the data of UNDP. It also represents to some extent the grim aspect of our healthcare system and the expenditures in meagre amounts in the same sector which when accompanied by privatization aggravates the situation. In almost all of our paper we find an upward bias which definitely shows some extent of sagginess which gives us a diminishing increase which should not have been the case after seven decades of independence.

KEY WORDS: Average Life Expectancy, Male Life Expectancy,Female Life Expectancy
WHO, UNDP, Census of India.

INTRODUCTION
Life expectancy is a measure of the status of health condition of any group of population and it is considered by the health development theory. The role of life expectancy is in such a way that it tells us the expected life of a person under given prevailing mortality rates. So, it is all about the remaining mean life of a specified age of a group of people at given constant mortality rate.

Life expectancy become a major indicator after the publication of first human development report. Human Development Index includes the various components like, Life expectancy, educational attainment and income, so it also provides a profile of the living condition of the people deciding the strategies in health management and reduction in mortality rates.Life expectancy in India was 25.4 in the year 1800, and over the course of the next 220 years, it has increased to almost 70. Between 1800 and 1920, life expectancy in India remained in the mid to low twenties, with the largest declines coming in the 1870s and 1910s; this was because of the Great Famine of 1876-1878.According to Human Development Index, life expectancy in India is based on a minimum age of 25 years and maximum age of 85 years. This time series based on the year 1970-2014. If Life expectancy of country is 68 years then the longevity component would be 0.68.

The survival of a human life may compare with the help of "Bath-Tub" as the mortality rate is high during the early life and at old age. After the introduction of civilization & high medical facilities it shows a lower indication in infant mortality, death of young people in accident, epidemic, plague, malaria and war etc. and the result is an increment in life expectancy.

The available study about life expectancy in India discussed with respect to gender, rural-urban population, some studies have also discussed the change in life expectancy with respect to various age group. On the basis of different studies, we found that life expectancy change with respect to age group, different region and different decades. So, our objective of the study to use a time series data from 1970-2014 and analysis of life expectancy with Least Square Method.

OBJECTIVES OF THE STUDY:

The key point of the following study/paper is –

(1) To find an approximation of a possible prediction to the life expectancy of different gender as well as cumulative form.

(2) To find the approximations are based on the representative data and are liable to statistical and forecasting errors.

(3) Thus may be an error of inconsistency involved as the data compare are from two different sources that is UNDP and the census of India as the data for the year 2016 has not been released yet by the MHA.

(4) Linear as well as the logarithmic approximation were precise but the selection of linear approximation over the log form was done so as to minimize the sampling errors.

RESEARCH METHODOLOGY:

According to WHO, life expectancy at birth is an output of a life table. A life table presents a set of tabulation, which describe the death rate, survival rate for each age group. The data can be collected from vital regression, census and survey based an age- specific mortality rates and birth rate.

WHO has developed a model life table based on about 1800 life tables from vital regression judged to be a good quality. For countries, in recent years they used a time series of annual life tables and the parameters using a weighted regression model, given more weight to recent years.

DATA ANALYSIS:

The following data was collected by the census of India (Ministry of Home Affairs) and the predictions have been matched by the UNDP (United Nations Development Program).The following data is given by the census of India (MHA India) from 1970 to 2014.

Period	midyear value	total life expectancy	male avg life expectancy	female average life expectancy
1970-75	1973	49.7	50.5	49
1976-80	1978	52.3	52.5	52.1
1981-85	1983	55.4	55.4	55.7
1986-90	1988	57.7	57.7	58.1
1987-91	1989	58.3	58.1	58.6
1988-92	1990	58.7	58.6	59
1989-93	1991	59.4	59	59.7
1990-94	1992	60	59.4	60.4
1991-95	1993	60.3	59.7	60.9
1992-96	1994	60.7	60.1	61.4
1993-97	1995	61.1	60.4	61.8
1994-98	1996	61.4	60.6	62.2
1995-99#	1997	61.5	60.8	62.3
1996-00#	1998	61.9	61.2	62.7
1997-01#	1999	62.3	61.4	63.3
1998-02	2000	62.9	61.9	64
1999-03	2001	63.4	62.3	64.6
2000-04	2002	63.9	62.8	65.2
2001-05	2003	64.3	63.1	65.6
2002-06	2004	64.7	63.5	66.1
2003-07	2005	65	63.7	66.5
2004-08	2006	65.4	64	66.9
2005-09	2007	65.7	64.3	67.2
2006-10	2008	66.1	64.6	67.7
2007-11	2009	66.5	64.9	68.2
2008-12	2010	67	65.4	68.8
2009-13	2011	67.5	65.8	69.3
2010-14	2012	67.9	66.4	69.6

\# represents non-availability of data in certain districts of data in Jammu and Kashmir as well as certain districts of Kinnaur district.

midyear value	average life expectancy (cumulative)	predicted life expectancy (cumulative)
1973	49.7	50.8477
1978	52.3	53.0722
1983	55.4	55.2967
1988	57.7	57.5212
1989	58.3	57.9661
1990	58.7	58.411
1991	59.4	58.8559
1992	60	59.3008
1993	60.3	59.7457
1994	60.7	60.1906
1995	61.1	60.6355
1996	61.4	61.0804
1997	61.5	61.5253
1998	61.9	61.9702
1999	62.3	62.4151
2000	62.9	62.86
2001	63.4	63.3049
2002	63.9	63.7498
2003	64.3	64.1947
2004	64.7	64.6396
2005	65	65.0845
2006	65.4	65.5294
2007	65.7	65.9743
2008	66.1	66.4192
2009	66.5	66.8641
2010	67	67.309
2011	67.5	67.7539
2012	67.9	68.1988
2013		68.6437
2014		69.0886
2015		69.5335
2016		69.9784
2017		70.4233
2018		70.8682

The predicted value as given by the UNDP stands out at 69.4 years against our predicted value of 70.8262 i.e. an upward bias of 1.4262 years. The linear

approximation was done using the equation(**y = 0.4449x - 826.94).** where y represents predicted life expectancy and x the time period respectively.
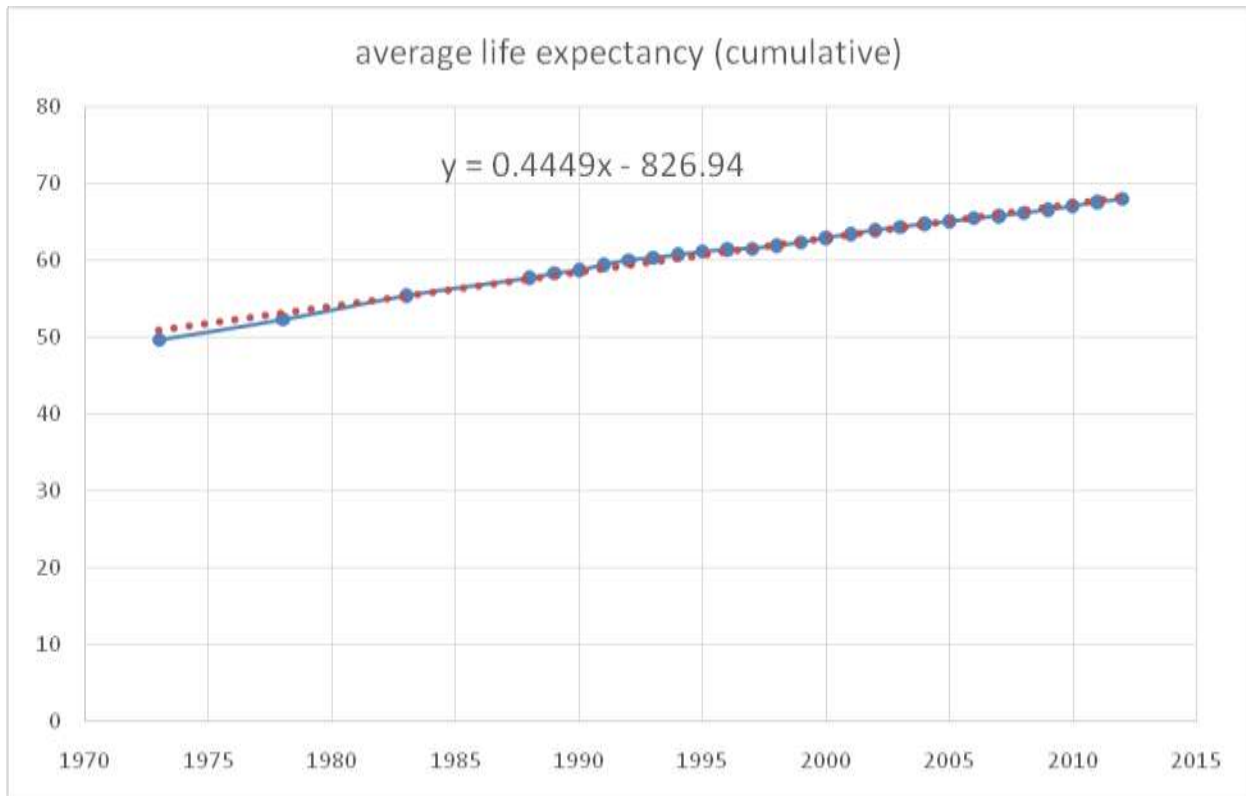
1.Average Life Expectancy (Cumulative)
$Y = 0.4449x - 826.94$
Clearly, the slope of the trend line equation is 0.4449. It shows that, every year the average life expectancy increases by 0.4449
This might be due to the provision of better health facilities, better food supply, cleaner environment, more technical development and the awareness about the basic hygiene among the people.
Deputy Registrar General, Bhaskar Mishra said, "Life Expectancy of an average Indian is improving by the year. What is most interesting is the widening gap between life expectancy of an Indian male and a female which is a trend similar to developed countries. This may be because of the rapid bridging of the gap in child mortality between males and females. The previous data on life expectancy came out in 2007.
According to a health ministry official, "More people are interested in the nutritional content of the food they eat and plan their diet accordingly. People are consciously making better lifestyle choices that reduce or delay the risk of developing diseases.

People wash their hands more often that reduces inflation rate."

midyear value	male life expectancy	predicted life expectancy
1973	50.5	51.6398
1978	52.5	53.5528
1983	55.4	55.4658
1988	57.7	57.3788
1989	58.1	57.7614
1990	58.6	58.144
1991	59	58.5266
1992	59.4	58.9092
1993	59.7	59.2918
1994	60.1	59.6744
1995	60.4	60.057
1996	60.6	60.4396
1997	60.8	60.8222
1998	61.2	61.2048
1999	61.4	61.5874
2000	61.9	61.97
2001	62.3	62.3526
2002	62.8	62.7352
2003	63.1	63.1178
2004	63.5	63.5004
2005	63.7	63.883
2006	64	64.2656
2007	64.3	64.6482
2008	64.6	65.0308
2009	64.9	65.4134
2010	65.4	65.796
2011	65.8	66.1786
2012	66.4	66.5612
2013		66.9438
2014		67.3264
2015		67.709
2016		68.0916
2017		68.4742
2018		68.8568

The following approximation was done using the trend line equation **y = 0.3826x - 703.23.** The data given by the UNDP suggested the male average life expectancy to be 68.2 years in 2018 giving us an upward bias of 0.65 years.
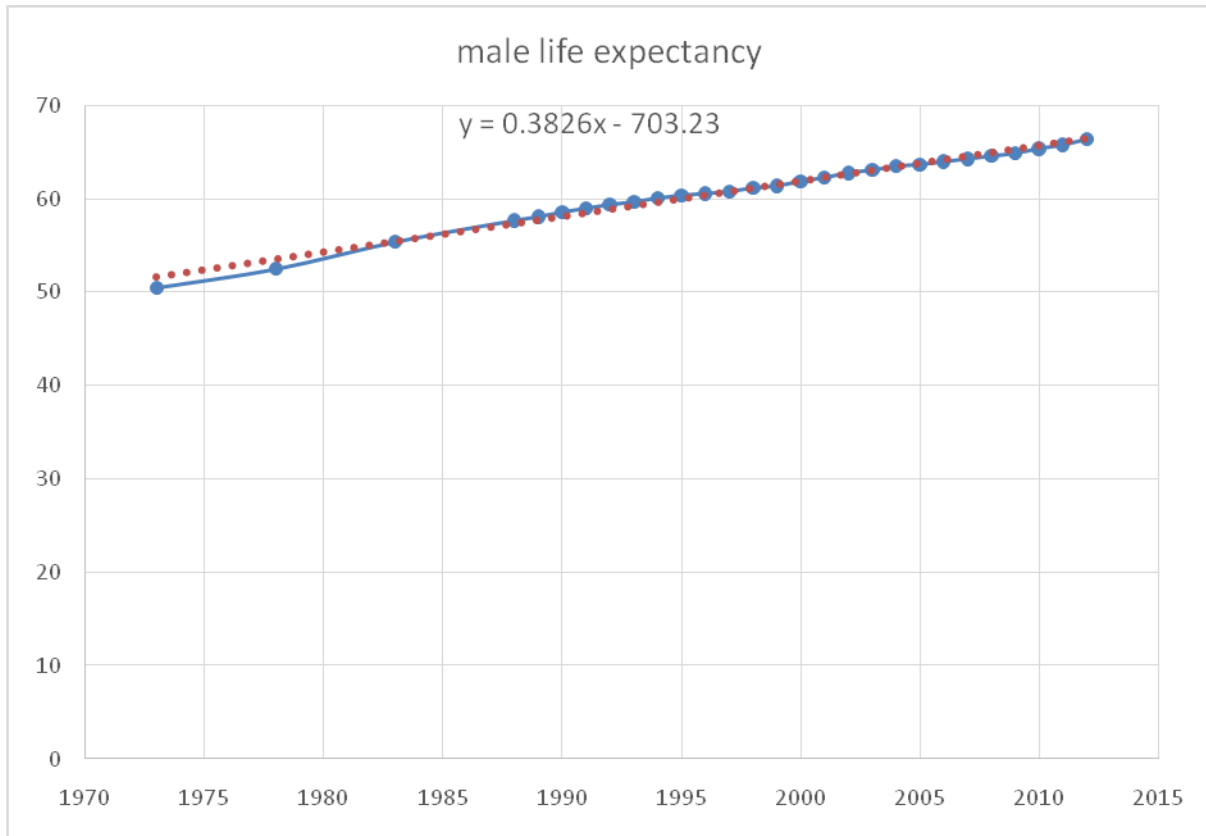
1. Male Life Expectancy

y = 0.3826x - 703.23

Here, the slope of the trend line equation is 0.3826 which means each year the life of an average male increases by 0.3826 years on an average. Here, y intercept is -703.23 which does not seem to have any economic significance.

midyear value	female life expectancy	predicted life expectancy
1973	49	50.2651
1978	52.1	52.8086
1983	55.7	55.3521
1988	58.1	57.8956
1989	58.6	58.4043
1990	59	58.913
1991	59.7	59.4217
1992	60.4	59.9304
1993	60.9	60.4391
1994	61.4	60.9478
1995	61.8	61.4565
1996	62.2	61.9652
1997	62.3	62.4739

1998	62.7	62.9826
1999	63.3	63.4913
2000	64	64
2001	64.6	64.5087
2002	65.2	65.0174
2003	65.6	65.5261
2004	66.1	66.0348
2005	66.5	66.5435
2006	66.9	67.0522
2007	67.2	67.5609
2008	67.7	68.0696
2009	68.2	68.5783
2010	68.8	69.087
2011	69.3	69.5957
2012	69.6	70.1044
2013		70.6131
2014		71.1218
2015		71.6305
2016		72.1392
2017		72.6479
2018		73.1566

The following trend line and hence prediction was done using the equation
y = 0.5087x - 953.4. where y represents the expected life expectancy of females and x the respective time period. Here the given life expectancy for females in India was 70.7 years and hence again giving an upward bias of 2.45 years.
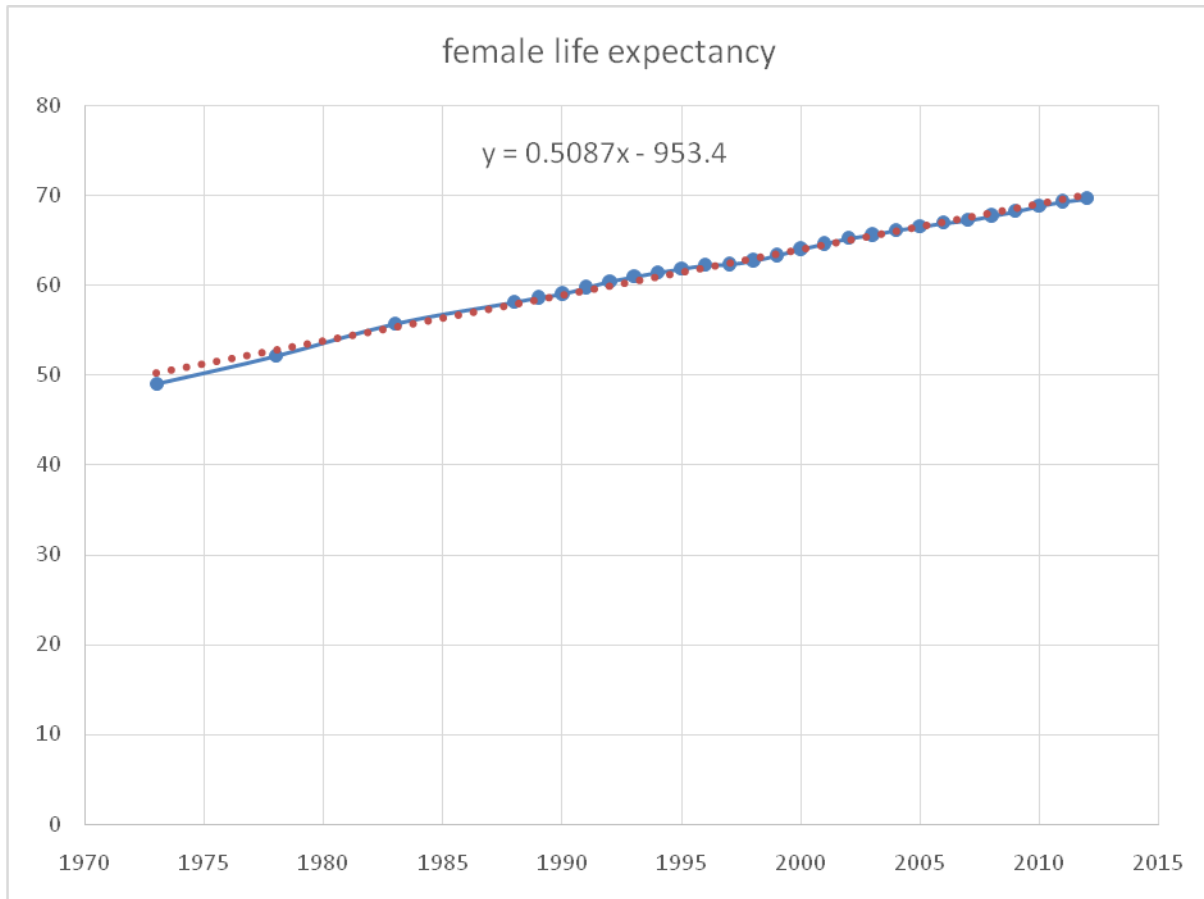
2. Female Life Expectancy

y = 0.5087x - 953.4

Here the slope of the trend line equation is 0.5087 which shows that on an average the life expectancy of an average female increases by 0.5087 years on an average. Here, y intercept is -953.4 which does not seem to have any economic significance.

CONCLUSION:

India continuous to struggle with providing basic medical care for its citizen. On the basis of two decade analysis, we see that strong economic growth, a small increase in life expectancy of India on the other hand the same pattern followed by developed, developing and some under developing countries.

Basic reason of lagging life expectancy in Indian rural communities is the accessibility of hospitals and clinics. Due to healthcare high cost, they do not afford good and qualitative medical facilities by low income& rural communities, it is estimated that 600 million of people in India having absence

of these medical facilities. However, Indian government program and innovative projects are showing commitment in healthcare & medical facilities so that our future generation will be leading healthier and longer lives.

According to UNICEF, in India, It is recommended that increase availability of specialist health services in remote locations by testing improved communication technologies, monetary incentive structures for doctors providing rural service, and increased numbers of post-graduate seats in medical colleges.

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