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Life Expectancy in India: Contributing Factors

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Abstract:

Life expectancy is the expected (in the statistical sense) number of years of life remaining at a given age. It is denoted by e_x , which means the average number of subsequent years of life for someone now aged x , according to a particular mortality experience. Because life expectancy is an average, a particular person may well die many years before or many years after their "expected" survival.

It is important to note that life expectancy is an average. In many cultures, particularly before modern medicine was widely available, the combination of high infant mortality and deaths in young adulthood from accidents, epidemics, plagues, wars, and childbirth, significantly lowers the overall life expectancy. But for someone who survived past these early hazards, living into their sixties or seventies would not be uncommon. For example, a society with a life expectancy of 40 may have very few people dying at age 40: most will die before 30 years of age or after 55.

Factors that are associated with variations in life expectancy include family history, marital status, economic status, physique, exercise, diet, drug use including smoking and alcohol consumption, disposition, education, environment, sleep, climate, and health care

The Constitution charges every state with "raising the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties". The National Health Policy was endorsed by the Parliament of India in 1983 and updated in 2002.

India has a life expectancy of 64/67 years (m/f), and an infant mortality rate of 46 per 1000 live births. The health care issues addressed by the government which resulted in increased life expectancy in India are: Malnutrition, High Infant Mortality Rate, Diseases, Hepatitis, Poor Sanitation, Safe Drinking Water, Female health issues, Rural Health.

1. Introduction

Life expectancy is an indicator of how long a person can expect to live on average given prevailing mortality rates. Technically, it is the average number of years of life remaining to a person at a specified age, assuming current age-specific mortality rates continue during the person's lifetime.

Life expectancy is a common measure of population health in general, and is often used as a summary measure when comparing different populations (such as for international comparisons). For example, high life expectancy indicates low infant and child mortality, an ageing population, and a high quality of healthcare delivery. Life expectancy is also used in public policy planning, especially as an indicator of future population ageing in developed nations.

The expected length of a life is inversely related to the mortality rates at that time. In India, life expectancy has increased significantly over the past century, reflecting the considerable falls in mortality rates, initially from infectious diseases and, in later years, from cardiovascular disease.

1.1. Some major highlights of 2011 census

- The population of India has increased by more than 181 million during the decade 2001-2011.
- Percentage growth in 2001-2011 is 17.64; males 17.19 and females 18.12.
- 2001-2011 is the first decade (with the exception of 1911-1921) which has actually added lesser population compared to the previous decade.
- Literacy rate has gone up from 64.83 per cent in 2001 to 74.04 per cent in 2011 showing an increase of 9.21 percentage points.
- Percentage growth in literacy during 2001-2011 is 38.82; males: 31.98% & females: 49.10%.
- Literates constitute 74 per cent of the total population aged seven and above and illiterates form 26 per cent.

- The proportion of Child Population in the age group of 0-6 years to total population is 13.1 percent while the corresponding figure in 2001 was 15.9 percent. The decline has been to the extent of 2.8 points.

2. Concept of Life Expectancy

Life expectancy is the expected (in the statistical sense) number of years of life remaining at a given age. It is denoted by e_x , which means the average number of subsequent years of life for someone now aged "x", according to a particular mortality experience. In technical literature, this symbol means the average number of "complete" years of life remaining, excluding fractions of a year. The corresponding statistic including fractions of a year, the normal meaning of life expectancy, has a symbol with a small circle over the "e". The life expectancy of a group of individuals is heavily dependent on the care.

2.1. Calculating Life Expectancy

The starting point for calculating life expectancies is the age-specific death rates of the population members. A very simple model of age-specific mortality uses the Gompertz function, although these days more sophisticated methods are used. In cases where the amount of data is relatively small, the most common methods are to fit the data to a mathematical formula, such as an extension of the Gompertz function, or to look at an established mortality table previously derived for a larger population and make a simple adjustment to it (e.g. multiply by a constant factor) to fit the data. With a large amount of data, one looks at the mortality rates actually experienced at each age, and applies smoothing (e.g. by cubic splines) to iron out any apparently random statistical fluctuations from one year of age to the next.

The age-specific death rates are calculated separately for separate groups of data which are believed to have different mortality rates (e.g. males and females, and perhaps smokers and non-smokers if data is available separately for those groups) and are then used to calculate a life table, from which one can calculate the probability of surviving to each age. In actuarial notation the probability of surviving from age "x" to age "x+n" is denoted ${}_n p_x$ and the probability of dying during age "x" (i.e. between ages "x" and "x+1") is denoted q_x . For example, if 10% of a group of people alive at their 90th birthday die before their 91st birthday, then the age-specific death probability at age 90 would be 10%. Note that this is a probability rather than a mortality rate.

The life expectancy at age "x", denoted e_x , is then calculated by adding up the probabilities to survive to every age. This is the expected number of complete years lived (one may think of it as the number of birthdays they celebrate).

$$e_x = \sum_{t=1}^{\infty} {}_t p_x = \sum_{t=0}^{\infty} {}_t p_x q_{x+t}$$

Because age is rounded down to the last birthday, on average people live half a year beyond their final birthday, so half a year is added to the life expectancy to calculate the full life expectancy. (This is denoted by e_x with a circle over the "e".)

Life expectancy is by definition an arithmetic mean. It can also be calculated by integrating the survival curve from ages 0 to positive infinity (or equivalently to the maximum lifespan, sometimes called 'omega'). For an extinct or completed cohort (all people born in year 1850, for example), of course, it can simply be calculated by averaging the ages at death. For cohorts with some survivors, it is estimated by using mortality experience in recent years. These estimates are called period cohort life expectancies.

It is important to note that this statistic is usually based on past mortality experience, and assumes that the same age-specific mortality rates will continue into the future. Thus such life expectancy figures need to be adjusted for temporal trends before calculating how long a currently living individual of a particular age is expected to live. Period life expectancy remains a commonly used statistic to summarize the current health status of a population.

However for some purposes, such as pensions calculations, it is usual to adjust the life table used, thus assuming that age-specific death rates will continue to decrease over the years, as they have done in the past. This is often done by simply extrapolating past trends; however some models do exist to account for the evolution of mortality (e.g., the Lee-Carter model).

As discussed above, on an individual basis, there are a number of factors that have been shown to correlate with a longer life. Factors that are associated with variations in life expectancy include family history, marital status, economic status, physique, exercise, diet, drug use including smoking and alcohol consumption, disposition, education, environment, sleep, climate, and health care which uses the singular value decomposition on a set of transformed age-specific mortality rates to reduce their dimensionality to a single time series, forecasts that time series, and then recovers a full set of age-specific mortality rates from that forecasted value. Software for this approach includes Professor Rob J. Hyndman's R package and UC Berkeley's LCFIT system.

3. Factors Affecting Life Expectancy

Factors that are associated with variations in life expectancy include family history, marital status, economic status, physique, exercise, diet, drug use including smoking and alcohol consumption, disposition, education, environment, sleep, climate, and health care

3.1. Factors Affecting Life Expectancy - Specific to India

The Constitution charges every state with "raising the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties". The National Health Policy was endorsed by the Parliament of India in 1983 and updated in 2002. India has a life expectancy of 64/67 years (m/f), and an infant mortality rate of 46 per 1000 live births.

The health care issues addressed by the government which resulted in increased life expectancy in India are Malnutrition, High Infant Mortality Rate, Diseases like Hepatitis, Poor Sanitation, Unavailability of Safe Drinking Water, Female health issues, Rural Health.



Figure 1: National Rural Health Mission (A community health center in Kerala)

The National Rural Health Mission (NRHM) was launched in April 2005 by the Government of India. The goal of the NRHM was to provide effective healthcare to rural people with a focus on 18 states which have poor public health indicators and/or weak infrastructure.

Though the government has many schemes in place but not all are implemented effectively the funds do not reach the people who deserve it the most but due to government initiative there definitely is increase in awareness about health care. Rashtriya Swasthya Bhima Yojana (RSBY) is the most popular of the Government health care schemes.

There are also some Pension Schemes launched by Govt. of India and many state Governments for the poor old people. Due to these pension schemes the aged people are able to take care of their health. But again these schemes provide only paltry sums ranging from Rs.300/- to Rs.500/- per month. Literacy rate has also increased in India which contributes to awareness about health care and consequently this also contributes to increased life expectancy.

4. Challenges for Increasing Life Expectancy for Indians

4.1. For Individuals and Families

With lengthening lives, however, the biggest issue for humanity may well be disability. Although we live longer, we do not necessarily enjoy more years of health. More money goes for health care.

Cost of supporting those who are retired is dramatically increasing at the same time there are going to be fewer and fewer young people to shoulder that burden.

4.2. For the Government and Society

With a largely young population, problems associates with ageing of population may not appear urgency for the country. Nevertheless, these problems need to be tackled with advance planning. While the going is still good, India needs to look into the future and plan how it will take care of its elderly in the years to come.

First of all, it is believed that the phenomenon of aging population be perhaps regarded as a positive sign for the society as a whole as nothing is worthier than the fact that people can live longer and better enjoy their life. Nevertheless, is it truly advantageous whilst old age is argued to be frequently associated with a wide range of diseases such as insomnia, hypertension, Alzheimer, dementia and others? The older people become the more pressure burden governments. That is to say, more demands for health care services and nursing to cure and take care of them are needed. Moreover, even if the elderly are free from illness, it still waste the governments and society a considerable amount of budget paying their age-old pensions so as to ensure that the old could afford their life without working. Another major hindrance is that extended expectation of life also means a smaller working population is seen. It is youngsters that possess physical vigour and immense enthusiasm, as opposed to the old people; thereby the young are likely to work more productively and capable of dedicating more to the society. In other words, aging population possibly give a rise to a significant loss in terms of economy.

5. Desirable Policy Interventions by Government/Policy Makers

In order to stem the adverse effects of increasing life expectancy, some of the solutions are put forward as below. Firstly, maybe medical advances and healthcare programs are some one of the panaceas. Doctors and health experts are required to work harder to give a birth to new treatments and then maintain health for human beings. Another cost-effective method might be for the governments to offer a longer working period to people; therefore it can release the society from the burden of funding a huge amount of pension. One further solution would be that the authorities should impose fewer constraints on immigration. This is mainly because that no sooner will the governments treat immigrants more leniently than there would be an increasing number of young adults relocating to their countries in search of better jobs. Consequently, a growing working population is seen.

There are some ways that can alleviate these problems. First is for the government to pass a law that will increase the retirement age of older people. In this way, they can save more money for their pensions which can help in decreasing the pressure on the taxpayers in paying for their health care. Another way is to encourage immigration of working population. By doing this there would be enough to fill the hole that is left by ageing population so the economic status would not be affected.

To conclude, ageing population is a situation that is inevitable. Thus, it is important that these problems can be solved earlier so that it would not be a problem in the foreseeable future. If not solved we will be the generation that will be remembered as the one that failed its children and grandchildren.

Population	1,205,073,612 (July 2012 est.)
Age structure	0-14 years: 29.3% (male 187,386,162/female 165,345,284) 15-24 years: 18.2% (male 116,019,042/female 103,660,359) 25-54 years: 40.2% (male 249,017,538/female 235,042,251) 55-64 years: 6.8% (male 41,035,270/female 40,449,880) 65 years and over: 5.6% (male 31,892,823/female 35,225,003) (2012 est.)
Median age	total: 26.5 years male: 25.9 years female: 27.2 years (2012 est.)
Population growth rate	1.312% (2012 est.)
Birth rate	20.6 births/1,000 population (2012 est.)
Death rate	7.43 deaths/1,000 population (July 2012 est.)
Net migration rate	-0.05 migrant(s)/1,000 population (2012 est.)
Urbanization	Urban population: 30% of total population (2010) rate of urbanization: 2.4% annual rate of change (2010-15 est.)
Major cities - population	NEW DELHI (capital) 21.72 million; Mumbai 19.695 million; Kolkata 15.294 million; Chennai 7.416 million; Bangalore 7.079 million (2009)
Sex ratio	at birth: 1.12 male(s)/female under 15 years: 1.13 male(s)/female 15-64 years: 1.07 male(s)/female 65 years and over: 0.9 male(s)/female total population: 1.08 male(s)/female (2011 est.)
Infant mortality rate	total: 46.07 deaths/1,000 live births male: 44.71 deaths/1,000 live births female: 47.59 deaths/1,000 live births (2012 est.)
Life expectancy at birth	total population: 67.14 years male: 66.08 years female: 68.33 years (2012 est.)
Total fertility rate	2.58 children born/woman (2012 est.)
HIV/AIDS - adult prevalence rate	0.3% (2009 est.)
HIV/AIDS - people living with HIV/AIDS	2.4 million (2009 est.)
HIV/AIDS - deaths	170,000 (2009 est.)
Sanitation facility access	improved: urban: 54% of population rural: 21% of population total: 31% of population unimproved: urban: 46% of population rural: 79% of population total: 69% of population
Major infectious diseases	degree of risk: high food or waterborne diseases: bacterial diarrhea, hepatitis A and E, and typhoid fever vector borne diseases: chikungunya, dengue fever, Japanese encephalitis, and malaria animal contact disease: rabies water contact disease: leptospirosis note: highly pathogenic H5N1 avian influenza has been identified in this country; it poses a negligible risk with extremely rare cases possible among US citizens who have close contact with birds (2009)
Nationality	noun: Indian(s)

	adjective: Indian
Ethnic groups	Indo-Aryan 72%, Dravidian 25%, Mongoloid and other 3% (2000)
Religions	Hindu 80.5%, Muslim 13.4%, Christian 2.3%, Sikh 1.9%, other 1.8%, unspecified 0.1% (2001 census)
Languages	Hindi 41%, Bengali 8.1%, Telugu 7.2%, Marathi 7%, Tamil 5.9%, Urdu 5%, Gujarati 4.5%, Kannada 3.7%, Malayalam 3.2%, Oriya 3.2%, Punjabi 2.8%, Assamese 1.3%, Maithili 1.2%, other 5.9% note: English enjoys the status of subsidiary official language but is the most important language for national, political, and commercial communication; Hindi is the most widely spoken language and primary tongue of 41% of the people; there are 14 other official languages: Bengali, Telugu, Marathi, Tamil, Urdu, Gujarati, Malayalam, Kannada, Oriya, Punjabi, Assamese, Kashmiri, Sindhi, and Sanskrit; Hindustani is a popular variant of Hindi/Urdu spoken widely throughout northern India but is not an official language (2001 census)
Literacy	definition: age 15 and over can read and write total population: 61% male: 73.4% female: 47.8% (2001 census)
School life expectancy (primary to tertiary education)	total: 10 years male: 11 years female: 10 years (2007)
Education expenditures	3.1% of GDP (2006)
Maternal mortality rate	200 deaths/100,000 live births (2010)
Children under the age of 5 years underweight	43.5% (2006)
Health expenditures	2.4% of GDP (2009)
Physicians density	0.599 physicians/1,000 population (2005)
Hospital bed density	0.9 beds/1,000 population (2005)

Table 1: India's Demographics

6. References

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