1.1 General Introduction

One cannot just avert shouldering the responsibility of maintaining a minimum standard of living of the people of the country in the name of large presence of human beings. It can't be said that number is more and so it is not possible to maintain required level. It is of course a point of great concern that right from 1901 to 2000 in hundred years span the country's population has been more than three fold from 300 million to 1000 million in 11th May, 2000 increasing its size by more than 300 percent. The growth after 1961 has was around 24 in each decade and 18.75 in 2001 census and if this trend continues, it is estimated that our population may exceed the China's population by 2050.

But which factors are responsible for this tremendous growth. It's not only the absence of education, but also other factors like health, economy, housing, entertainment and other infrastructure facilities. It is the health which brings the philosophy of thought on life. One can think a better life when and only when she/he has better heath condition. So,
what is seen is that there is a link between population growth and health condition. What is understood that when health amenities are increased, growth of population is decreased? That is Health status is inversely proportion to population growth. If we see the growth of population in various countries in the world, we can see that the most advance countries like USA, France, U.K, Japan, Germany etc. which have more medical facilities have less growth rates. Why to go far off, the same can be seen in our country particularly in various parts of our country including the state of Assam.

1.2 Review of literature

Health is one of the key factors for the survival and increased life span of human beings in society. It is also important determinant of infant mortality. The reduction of mortality to low levels and the attainment of good health by the entire world's populace are regarded as a pressing goal by government and international organizations. The world population plan of action states that 'it is the goal of this plan of Action to reduce mortality levels, particularly infant and maternal mortality levels, to the maximum extent possible in all regions of the world'. And 'many developing countries consider reduction of mortality, to be one of the most important and urgent goals'.
Infant and child mortality form a large fraction of the deaths of all ages. In India one out of every fifth death is of infant and a total of about 1.8 million infants are dying annually (based on Infant Mortality Rate of 2000) as compared to 2.6 million in 1971 (National Workshop on IMR, 11-12 April 2002, Organized by ORGI in collaboration with UNICEF, UNPF, MH&FW and NCP). Most social scientists as on today view infant mortality rate as an excellent indicator of socio-economic development.

Infant mortality is relatively higher for children born to younger mothers particularly those under twenty and thirty years of age, and lower for children born to mothers aged between 20 and 29 (Mortality Differentials in India, 1984). Several studies on infant mortality conducted in different parts of the world showed a U or a shallow U or a reverse J shaped curve in its relationship with birth order (Wyon and Gorden, 1962; Ommran and standely, 1976; Morris and Heady, 1955; Shah and Abbey, 1971; New Combe, 1965; Palloni, 1981; Mahadeven, et al., 1986; Stoeckel and chouwdhury, 1976). An analysis by Huffman (1984) using data from 25 developing countries illustrates substantial impact of spacing on child mortality. It states that “If all births were spaced at least 2 years a part, infant mortality can be reduced by 10 per cent and child mortality (ages <5 years) by 16 per cent.”
It has been shown in the findings of Bhat and Kheterpal (1983) that most of the mothers are ignorant about the nutritive value of colostrum which is particularly rich in anti-infective factors and nutrients such as vitamin-A. Infant mortality, which is more widespread among children who are not breast-fed, is a major cause of a short inter birth interval (Mondot, 1981). In India the mean duration of breastfeeding was 21 months and it did not vary much across different communities. The duration of breastfeeding is negatively associated with infant mortality (mahadevan, et al., 1986). The special surveys undertaken by the Government of India in 1979 and 1984 had revealed that infant mortality also varies on religious and castes lines (Survey on Infant and Child Mortality 1979 published in 1981 and Mortality Differential in India, 1984 published in 1989, Office of the registrar General, India). The study on infant for the Northeastern states revealed that there is a rural-urban differential in infant mortality (Dey and Nath, 2003).

In view the NPP 2000, if we explore the status of Assam, the pattern may emerge the same. The possibility of the target stated in NPP 2000 can be assessed from the available data estimated through Sample Registration System (SRS) for the state of Assam. But it is a big question whether the state will be able to achieve the NPP 2000 target,
i.e. IMR of 30 per 1000 live births. The trend suggests little different from what has been targeted.

On the issue of maternal deaths it has been observed that the women of reproductive age group have to face a greater risk of death during the crucial period of pregnancy and childbirth than male. Visalia (1971) in his study on the sex ratio of India's population singled out maternal mortality as the main cause for deficit of females found in the part of the world. It's a matter of concern that no one knows how many woman dies from this cause. The subject might not have been given due importance and perhaps the present status itself is indicative of the position accorded to woman in India.

The Government's Health Survey and Development Committee report of 1946 (also known as the Bhore Committee Report) has a reference of the maternal mortality in India. This is seemed to be the earliest reference. The committee has mentioned that the country's maternal mortality ratio (MMR) was about 2000 deaths per 100,000 live births (Government of India 1946). The next committee constituted for the same purpose in the late 1950s (known as the Mudaliar committee) concluded that maternal mortality had come down to 1000 deaths per 100,000 live births (Government of India, 1961). The first National
Family Health Survey conducted throughout the country in 1992 to 93 estimated an average MMR for the 2 yrs period preceding the survey as 420 deaths per 100,000 live births for the country as a whole, with 431 deaths in rural areas and 380 deaths in urban areas (Kanitkar et al., 1994). The 2nd National Family Health Survey projected an estimated of 540 maternal deaths per 100,000 live births for the country as a whole, with 618 deaths in rural areas and 267 deaths in urban areas for the year 1998-99. The Sample Registration System in India had published estimated value of maternal mortality in India for the years 1997 and 1998 to be 408 and 407 (Sample Registration System Bulletin, April 1999 & 2000).

Due to non-availability of data on maternal mortality number of indirect techniques have been suggested for estimation of maternal mortality. Sisterhood method is one of them. In this method, women and men are asked to recall the number of their sister who died during pregnancy, delivery, and the puerperium among those who were ever married at the time of the survey (Graham et al., 1989). Though the requirement of sample size is considerably lower than direct estimation, it depends heavily on the recall of long past events. On the one hand these estimates suffer from recall lapses; on the other hand it can not be
estimated for a recent period and might not be sensitive to the assumed level of fertility.

To survive is a very common and natural character among all living beings. Since inception, man is keenly interested to know the maximum possible length of human life span. This interest in longevity which has never been spruced off in the history of mankind is shown by the frequent references in the daily news to the span of life, and to the tremendous gains which have been made in the average duration of life, particularly during the last century due to the spectacular improvement in public health measures and medical sciences.

If migration factors are insignificant, the age structure of a population will be determined by the fertility as well as mortality schedules prevailing during the period under study (Coale, 1972, pp. 3-15). Any change in the mortality level will have an impact on the whole age span because death can occur at any stage of life; whereas any change in the fertility level during a particular period will have impact only on some very early age sector. Coale found that ;the decline in mortality, though it had nearly half as great an effect on growth as fertility, had a much smaller effect on the age distribution’ (Coale, 1956, pp.79-114).
Mortality study which is the oldest subject in demography was first brought under systematic and rigorous analysis through the concept of life table. In fact, most of the techniques for analytical study of human population are in some way or other related to life table. It is not exactly known when and by whom the concept of life table was conceived for the first time. However, from various literatures on mortality investigation and other allied topics it appears that probably the first rudimentary life table was prepared by a Roman author, Ulpian sometime during the third century A.D. which apparently was used to determine the provisions of life annuity contracts (Trenerry, 1926; Dublin et al., 1949; Dorn, 1959). But several demographers are of the opinion that the harbinger of life table was John Graunt, haberdasher at London in the seventeenth century, who used to study in his spare moments, the bills of mortality during the plague periods in London (Dublin et al., 1949; Grebrik, 1959; Lorimer, 1959; Thomlinson, 1965; Benjamin and Haycocks, 1970; w.h.o., 1977). Graunt gathered an enormous amount of interesting and enlightening information, while analyzing, with great care for several years, the weekly returns of christenings and burials in the city of London which he presented in his remarkable book entitled “Natural and Political Obervation mentioned in a Following Index and
Made upon the Bills of Mortality” published in 1662 in London (Graunt, 1662). This book was highly appreciated by the members of Royal Society who brought Graunt’s contribution to the scientific world (Lorimer, 1959, p.127.)

Dr. Price’s Northampton Table published in 1873, which was based on the death returns for a parish in Northampton during 1735-80 was the first life table used for life insurance. While constructing the Northampton Table (1735-80), Price, initially, overestimated the mortality and thereby underestimated the expectation of life as he was overlooked the fact that there was large number of Baptists living in Northampton whose burial took place in churchyard but their baptisms were not registered at birth. However, this error was corrected by him later on. According to the Northampton Table, as originally constructed, the life expectancy at birth was around 25 years which became 30 years after the correction. Unfortunately, the then Government had to bear heavy loss in its annuity scheme before the error was corrected (Dublin et. al., 1949, p.35; Benjamin, 1968, p.105; W.H.O., 1977, p.79). Dr. Price also constructed a life table from the data on population and deaths by age in Sweden, which was the first national life table ever made and redounds
much more to his fame than the Northampton Table (Benjamin, 1968; p.105).

Enormous amount of research has already been done in the techniques of construction of life table. It is not possible to make a very exhaustive review of all the literatures in this field. However, an attempt has been made here to summarize the historically important and recently devised techniques on life table construction. An attempt has also been made by the present researcher to develop a method to calculate expectation of life using the method of integration in addition to the existing concept.

Though statistics on deaths by cause are mandatory for objective planning and evaluation of the health sector, the available data sets are probably inadequate. A decade ago, claims concerning child and adult mortality by disease-specific programmers at the world health organization and by individual disease expert exceeded the total deaths in group by two to threefold. Through the efforts of the World Bank and WHO, more consistent estimates of mortality, by cause, under age 5 have been developed although these still remain uncertain. Further, no conceivable or consistent estimates for death over age 5 exist despite
their increasing importance in the context of the epidemiological transition.

Data on cause-specific mortality need to be based on other approaches for virtually all of the populations of sub-Saharan Africa, most of Asia the Middle East and North Africa. Indirect techniques to do this were first developed by Preston to model the relationship between total mortality and cause-specific mortality for broad groups of causes, based on an analysis of historical vital registration data for the develop and a few developing countries.

1.3 Objective of the study

From the discussion it is clear that there are three areas of concern viz. 1. Age<1, 2. Age>= 60 and 3. women of age 15-49. These areas are important as it is be seen that assumption underlying in actuarial formula used to convert observed central death rates to probability of dying that deaths occur to a person of a particular age group are uniformly distributed does not hold because at young age mortality declines very rapidly and at old ages it increases more rapidly and assumption of linearity needs to modified. Even if <1 age is studied it can be seen that the distribution is not linear as rates in early neo-natal, late neo-natal and post neo-natal are not linearly related. One can
see that deaths in 1-7 days are highest and the probability of death monotonically decreases up to 28 days and from 29 to 1 year, its slope further declines. It can be seen that if death of 1-7 days follows a polynomial of degree 4, 7-28 days will follow a polynomial of degree 3, 29-365 days will be of degree 2. After all, it will not be linear. These issues have been discussed in the subsequent chapters.

Health status is the universal set containing the subsets population growth, infant mortality, child mortality; general mortality, life expectancy and disease prevalence or we can say that

\[ HS = f (PG, IMR, ASDR, LE, DP) \]

Where PG= Population growth

IMR= Infant mortality rate

ASDR= Age specific death rate

LE= Life expectancy

DP= Disease prevalence implying causes of death.

To discover the level of health status of the states it is necessary to see the level of demographic parameters in different parts of the state. For arriving to a specific conclusion, it is necessary to know the following:
1. District levels Infant Mortality Rates in different districts of Assam using a new method.

2. Estimated trends of Maternal Mortality at state level using a new method.

3. Expectation of life for the state of Assam through a new technique

4. Disease prevalence in different age groups for the state of Assam.

Infant death is always considered as an index of the state of public health and sanitation, environmental condition, cultural and socio-economic development. We have of course improved the condition as IMR at all India level has come down from 204 in 1911 to 68 in 2000 (Sample Registration System Bulletin, 2002). Even if this is the highest risk area. The major cause group responsible for death in rural India for infant is “condition originating in the peri-natal period” followed by “Diseases of the respiratory system” (Survey of Causes of Deaths-Rural).

One of the important sectors of health indicator is death of married women in the age group 15-49 during pregnancy and child birth. The situation in this sector has not improved in this field as the maternal death in Assam has come up to 401 per 100,000 life births in 1997 from 409 in 1998. The major cause group of female deaths in the
reproductive age groups in the rural areas in Assam is due to "with venomous animal contact" followed by "Infectious and Parasitic diseases".

Another age group responsible for maximum death with 52.5 per 1000 persons is 60+. This figure seems to be stationary as the it remains to at fifty around for quite some years implying not much improvement in this field so far as medical facilities are concerned. Health scenario in rural India seems to be in a better condition as life expectancy has increased from 48.0 years in 1970-75 to 59.9 years in 1993-97. On the other hand the number of number of Primary Health Centres has increased from 725 in the first five year plan to 21853 in March 1996.

Expectation of life is inversely proportional to ASDR and directly proportional to population. It is an established fact. But the increase in life expectancy is not the lone factor of better health status. It may be due other factor also. What is intended to show that there is some other variable also for increase in expectancy such as social awareness, coming out of old superstition due to education?
All these four issues have been discussed in the subsequent chapters and attempts have been made to derive new methodologies for estimation of vital rates at desired level for better policy planning.