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Original Research Article

A multiple decrement analysis for studying the patterns of mortality in Bangladesh

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ABSTRACT

Background: The effect of mortality on population structures is to reduce the component of the population in which the mortality occurs. The purpose of this analysis was to examine the probability patterns of deaths in 2000, 2004, and 2008 year by age due to a cause of death in presence of all causes to identify the main causes of disease those influence the mortality rate.
Methods: Data were collected from the health and demographic surveillance system of ICDDR, B. Patterns of mortality were examined by multiple decrement life table and line diagram.
Results: The conditional probabilities of deaths from specific cause Dα (α=1, 2, 3, 4), naqαx (α=1, 2, 3, 4) of Matlab males by different years provide that for age <1, the female trends show the same pattern like male except maternal complications. For the age group 1-39, nearly injury and miscellaneous related causes affect most specially by drowning and accident for male. After the age 40, roughly the highest values of density function indicate non-communicable cause. For female, before age 40, mixed causes influence deaths, neonatal and maternal, communicable, injuries and miscellaneous causes. But after the age 40, more or less non-communicable disease is the leading cause in the year 2008.
Conclusions: Death from non-communicable diseases was found to be higher for males than females. Policies aimed at increasing governmental and non-governmental services shall generally contribute to a reduction of non-communicable death rates.

Keywords: Communicable diseases, Non-communicable diseases, Injuries and miscellaneous diseases, Multiple decrement table analysis

INTRODUCTION

Mortality is one of the three components of population change, the infant and child survival of a population is one of the key indicators of the improvement of the quality of life.[1] About 10 million children die every year, most of them from preventable diseases. Although chance plays its role in this tragedy, poor living conditions are the main cause of this event.[2]

In the 21st century ago, the injured has been the main cause of death among young people aged 10-24 years, accounting for 70% of the total number of deaths to 75%. The study also shows that violence and suicide are becoming the main cause of death among young people, 10-24 year-old young people, a quarter to a third died from violence and suicide. The authors pointed out that the statistical results show that non-communicable diseases in terms of global investment in too little, young people are the most affected. Future global health goals should include the study of causes of death in people aged 10-24 years.[3]

Bangladesh has made rapid progress on child mortality in the last two decades. Since Independence in 1971; Bangladesh has made significant achievements with regard to reducing poverty and improving health status. Infant mortality has declined from 153 deaths per thousand live births in 1975 to 94 in 1990, and to 44 by 2006.Child (1-4 years) mortality rate is 3.7 deaths per 1000 live births in 2006.[4]

Studying patterns of mortality is important because we would like to identify the major causes of death and its impact to public health. It is also important to grow better knowledge about which diseases will make burden in Bangladesh further and supply suitable drugs for serve the diseased people. Demographers have long been interested in examining age patterns of mortality, which provide an effective way of studying mortality differentials and their underlying causes across populations. The analysis of the causes of human mortality is a well-established area of research in medicine, public health, biostatistics demography, and actuarial science.[5-8] The research has focused primarily on the cause specific comparative study of deaths in Bangladesh and found the recent top causes of deaths. Because of the causes of deaths are different from country to country and continent to continent and causes of deaths are different from present to past. So it was necessary to modify the previous work for finding the last mortality patterns.

The well-being organization of a nation requirements to be attuned to designs of illness and mortality to alleviate the income-erosion penalties of lengthy ill-health and early death of adults. Population-based data on mortality by reason are an important to adapting the health system. However, these data are rare, particularly for rural populations in developing countries like Bangladesh.[9]

The study of mortality pattern provided information on age, sex of the diseased person as well as the cause of death, the date and place of occurrence and the death registration including the ascribed and achieved characteristics of the person died. We were zeal to analyze mortality data by cause of deaths between the sexes and between various age groups in the perspective of Bangladesh due to not much works are available in this field. We would like to investigate the probability patterns and trends of death using multiple decrement life table technique and to examine the effect of various cause of disease upon male and female person during 2000-2008.We wanted to examine the probability patterns of deaths in 2000, 2004, and 2008 year by age due to a cause of death in presence of all causes to identify the main causes of disease those influence the mortality.

METHODS

This study used the vital registration and maternal and child health data gathered from Matlab, Bangladesh, in 2000, 2004 and 2008. The data were collected and published by Health and Demographic Surveillance System of ICDDR, B. The surveillance area is divided into an ICDDR, B service area and a Government service area which receives usual government health and family planning services. The ICDDR, B service area is sub-divided into four blocks, where family planning, immunization and limited curative services are provided to under-five children and women of reproductive age.

In the 2000, 2004 and 2008 censuses 218579, 224476 and 22218 individuals were counted where 106370 are male and 112209 are female in 2000, 107439 are male and 117037 are female in 2004, 103579 are male and 118639 are female in 2008.

Of the 1530 registered deaths, 19 percent were infant, 7 percent were of children (1-4 years), and 52 percent were of age 60 and above in 2000. Of the 1,582 deaths, 15.4% were infants, 4.2% were of children age 1-4 years, and 58.5% were aged 60 years and above in 2004 and of the 1,514 deaths, 9.4% were infants, 4% were of children age 1-4 years, and 65% were aged 60 years and above in 2008. The data found 848, 858 and 815 deaths out of 106370, 107439 and 103579 midyear population for male respectively. Also, the numbers of deaths are 682, 724 and 699 out of 112209, 117037 and 118639 midyear populations for female in the year 2000, 2004 and 2008 respectively. The missing values and unknown values are not counted here because of anonymous cause that cannot fulfill our purposes. So, 48 of dead males and 49 of dead females in 2000, 13 of dead males and 16 of dead females in 2004 and 39 of dead males and 38 of dead females in 2008 are decoded.

Multiple decrement life table

Several life-table approaches have the inability to account for the individual's subject to mutually exclusive causes of death. In the single decrement life table, an individual exits the table in only one way: through death by undifferentiated cause. In the multiple decrement life table (MDLT), an individual can exit the table through differentiated causes. At the beginning, MDLT was used for human demography and now it is also used for situations that might lead to exiting the table in addition to death, such as marriage, divorce, contraception etc. In this sense, any life table that differentiates and quantifies more than one cause is a MDLT. Preston described MDLT as a life table in which the numbers of deaths in each age interval are distributed according to the cause of death.[10] Conventionally multiple decrement life table presents the data in the form of two tables. The first one is the ordinary life table for all causes of death combined. The second one may give either the distribution by cause of deaths occurring in each age interval, or the distribution by cause of deaths occurring above specified age.

Construction procedure of multiple decrement life table

The following rules and formulas are necessary to examine the probability pattern of deaths by age due to a

cause of death in presence of all causes of deaths in years 2000, 2004, and 2008. They are useful to identify the main causes of deaths-those that influence mortality the most. To construct Multiple Decrement Life Table, the following three assumptions[11] are considered:

- The death of each individual can be attributed to a single cause.
- Each individual has equal probability of dying from any cause.
- Causes are independent.

The following notions are adopted from Johnson et al in this analysis.[12]

- ${}_al_x$ denotes the expected number of survivors at exact age x out of ${}_al_0$ starters. Usually take ${}_al_0$ =100000.
- ${}_naq_x$ is the conditional death probability in [x,x+n) given alive at age x;
- ${}_nad_x$ is the total expected number of deaths in age interval [x,x+n);
- ${}_naL_x$ is the amount of person-years in [x,x+n)
- $al_{\alpha x}$ is the number living at exact age x who ultimately were expressed to die from cause D_α
- ${}_nad_{\alpha x}$ is the expected number of deaths between age x and x+n from cause $D_{\alpha,\text{ among}}$ al_xliving at age x,
- ${}_naq_{\alpha x}$ is the crude conditional probability of death from cause${}_nD_{\alpha x}$ between age x and x+n, in presence of all other causes, given alive at exact age x,
- The effective number of lives at exact age x is given by

$$N_x^{/} = \frac{1}{n}[\,{}_np_x + n(1-{}_nf_x)\,{}_nD_x\,]$$

- The probability of dying between ages x to x+n due to all categories of causes is denoted by

$${}_naq_x = \frac{{}_nD_x}{N_x^{/}}$$

- The probability of dying between ages x to x+n due to the α-th category of causes is denoted by

$${}_naq_{\alpha x} = \frac{nD\alpha x}{{}_nD_x}\,{}_naq_x,\ for\ \alpha = 1, 2, ..., k$$

- Since deaths due to various causes are additive in nature, therefore

${}_naq_x = \sum_n aq_{\alpha x}$

$al_{x+n} = al_x(1-{}_naq_x$

${}_nad_x = al_x * {}_naq_x$

${}_nad_{\alpha x} = al_x * {}_naq_{\alpha x}$

- The ${}_al_{\alpha x}$ functions are obtained by adding together all deaths from cause D_α which occur after age x, that is

${}_al_{\alpha x} = {}_nad_{\alpha x} + {}_nad_{\alpha,x+n} + \ldots + {}_\infty ad_{\alpha w}$, where w is the last recorded age.

- The conditional probabilities of death from α-th cause D_α after an exact age x given alive at age x is

$$\pi_{\alpha x} = \frac{al_{\alpha x}}{al_x}$$

- The death distributions by age is also obtained which is the analogues of

$$F_{\alpha x} = 1 - \frac{al_{\alpha x}}{al_{\alpha 0}}$$

Where $\frac{al_{\alpha x}}{al_{\alpha 0}}$ denotes the probability of surviving from age 0 to age x due to cause α denoted by D_α

- The approximate density functions evaluated at midpoint are

$$f_\alpha(x^*) = \frac{al_{\alpha x} - al_{\alpha,x+n}}{n \times al_{\alpha 0}} \text{ where } x^* = x + \frac{n}{2}$$

Statistical analyses were carried out using Microsoft Office Excell 2007 and Microsoft Office Word 2007.

RESULTS

The present paper described the study of the probability patterns of deaths by age due to different causes of disease such as maternal and neonatal cause (D1), communicable cause (D2), non-communicable cause (D3) and miscellaneous cause (D4). We calculated conditional probability of deaths for the above causes and approximate density function from various causes. At first we measured ${}_naq_{\alpha x}$ was the crude conditional probability of death from cause D_α between age x and x+n, in presence of all other causes, given alive at exact age x.

Table 1 allows us to find the age groups of males that showed highest probability of dying in 2000, 2004 and 2008. The trends of probability of dying were almost similar between 2004 and 2008. It was evident that the risks of death by neonatal complications among the infants were relatively higher than all other causes and all other ages from 1 year to 49 years except the last age groups. It was same through all the years- 2000, 2004 and 2008. Valuable information available from different years confirmed a slowly downward trend in infant mortality for males. The probability of death in males at the infancy period was 0.036 in 2000, but dropped to 0.024

in 2008. For the age 1-9, the risk of miscellaneous and injury related deaths was higher in the years 2000, 2004 and 2008. It is evident that the risks of death by different causes of deaths among the middle age groups were relatively low than all other age groups. The infant and child mortality occurred with greater intensity due to maternal and neonatal complications, and injuries respectively. Furthermore, the persons of ages over 45 were sharply fallen at the category of high risk of death. In the year 2000, the major part of male population of age 30+ did not die particularly heavily of a single cause of death. But in both of the year 2004 and 2008, the major part of male population of age 30 and above died of non-communicable diseases. The highest probabilities of death of aged 10-29 were injuries and non-communicable diseases. It is clear that the probability of dying at middle-ages had slightly declined compared to that of early ages and elderly age. For age < 1 year, cause-D1 influenced most; for ages 1-29, cause-D4 (injury related) and D3 (non-communicable) had greater impact to the number of deaths. The death pattern of other age groups was affected mainly by cause D3 (non-communicable).

Table 1: Conditional probabilities of deaths from specific cause Dα (α=1, 2, 3, 4), $_naq_{\alpha x}$ (α=1, 2, 3, 4) of Matlab males by different years.

Age group x to x+n	Highest prob. of dying,$aq_{\alpha x}$ for year 2000	Highest prob. of dying,$_naq_{\alpha x}$ for year2004	Highest prob. of dying,$_naq_{\alpha x}$ for year 2008
<1	$_nq_{1x}$=0.036447	$_nq_{1x}$=0.030683	$_nq_{1x}$=0.024295
1-4	$_nq_{4x}$=0.012713	$_nq_{4x}$=0.009042	$_nq_{4x}$=0.005415
5-9	$_nq_{4x}$=0.006484	$_nq_{4x}$=0.002335	$_nq_{4x}$=0.001882
10-14	$_nq_{4x}$=0.001389	$_nq_{3x}$=0.001562	$_nq_{3x}$=0.001685
15-19	$_nq_{4x}$=0.002934	$_nq_{3x}$=0.002168	$_nq_{4x}$=0.001944
20-24	$_nq_{4x}$=0.005130	$_nq_{4x}$=0.003017	$_nq_{4x}$=0.005569
25-29	$_nq_{3x}$=0.003004	$_nq_{4x}$=0.002417	$_nq_{3x}$=0.003467
30-34	$_nq_{4x}$=0.002419	$_nq_{3x}$=0.005356	$_nq_{3x}$=0.005262
35-39	$_nq_{4x}$=0.006500	$_nq_{3x}$=0.008551	$_nq_{3x}$=0.007800
40-44	$_nq_{3x}$=0.008838	$_nq_{3x}$=0.018362	$_nq_{3x}$=0.014269
45-49	$_nq_{3x}$=0.012906	$_nq_{3x}$=0.022422	$_nq_{3x}$=0.015519
50-54	$_nq_{4x}$=0.021450	$_nq_{3x}$=0.031508	$_nq_{3x}$=0.033396
55-59	$_nq_{2x}$=0.023999	$_nq_{3x}$=0.047492	$_nq_{3x}$=0.039835
60-64	$_nq_{3x}$=0.052614	$_nq_{3x}$=0.107977	$_nq_{3x}$=0.092535
65-69	$_nq_{3x}$=0.099636	$_nq_{3x}$=0.132462	$_nq_{3x}$=0.147934
70-74	$_nq_{3x}$=0.118410	$_nq_{3x}$=0.207418	$_nq_{3x}$=0.200089
75-79	$_nq_{4x}$=0.129118	$_nq_{3x}$=0.318818	$_nq_{3x}$=0.250261
80-84	$_nq_{4x}$=0.215440	$_nq_{3x}$=0.304926	$_nq_{3x}$=0.361865
85+	$_nq_{4x}$=0.553571	$_nq_{3x}$=0.607143	$_nq_{3x}$=0.727273

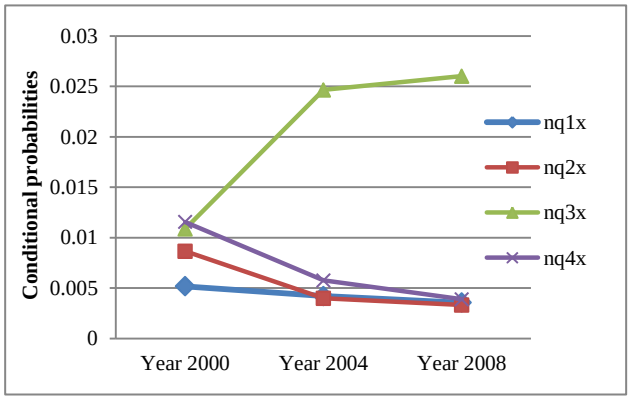

Figure 1: Total conditional probabilities of deaths from specific cause D_α (α=1, 2, 3, 4), $_naq_{\alpha x}$ (α=1, 2, 3, 4) of Matlab males by different years.

Figure 1 represents the trend of total conditional probabilities of deaths for male. The first cause, neonatal and maternal complications, showed almost decreasing trend; the second cause, communicable diseases, showed decreasing trends too; whereas the third cause, non-communicable diseases, showed the only rising trend among the categories; and the forth cause, injuries and miscellaneous, showed declining trend.

Total probabilities of dying of the two leading causes i.e. (non-communicable and injury related causes) arranging in ascending order of magnitude by different years for male population are shown in Table 2. The probabilities of death in males due to non-communicable diseases was 0.010 in 2000, but rapidly climbed to 0.025 in 2004 and rose to 0.026 in 2008 where the second highest probabilities of death due to injury related causes showed slightly decreasing pattern. It was 0.011 in 2000 but declined to 0.006 in 2004 and further to 0.004 in 2008.

The highest probabilities of dying among females in 2000, 2004 and 2008 year are presented in Table 3. The trend of probabilities of dying were almost similar between the year 2004 and 2008 for the age interval 0-4 and 30-85+. It was evident that the risks of death by neonatal and maternal complications among the infants

were relatively higher than all other causes and all other ages from 1 year to 44 years except the last age groups. It was true for all the years 2000, 2004 and 2008. The probability of dying for infancy period of male was higher than that of female infants. Valuable information from different years showed a rise and then a drop in infant mortality for males. The probabilities of death of females at the infancy period was 0.003 in 2000, but gradually increased to.029 in 2004 and dropped to 0.011 in 2008. For the age 1-4, the risk of deaths was higher for miscellaneous and injury related diseases for the year 2000, 2004 and 2008. The probabilities available in the above Table show increasing trend from the lower ages (starting at five) to higher ages. The risks of death by different causes among the middle-age groups were relatively low than other age groups. The infant and child mortality occurred with greater intensity due to maternal and neonatal complications, and injuries respectively. Furthermore, the persons of ages over 45 were sharply fallen at the category of high risk of death. The major part of female population of the age 30 and above in year 2000 died with different causes. But in both the year 2004 and 2008, the major part of female population of the age 30 and above died due to non- communicable diseases. The highest probabilities of death of aged 10-29 were maternal causes and injuries. Despite some disparities compared to males in value level, the trend for females showed the same pattern like male except maternal complications. The probabilities of dying of middle years of age had slightly declined comparing to that of early age and elderly age. For age <1, D1 cause influenced most deaths, for age 1-29, D4 (injury related) cause had greater influence on death and for other age groups, the death pattern was greatly affected by D3 (non-communicable cause) largely.

Table 2: Highest total conditional probabilities of deaths from specific cause Dα (α=1, 2, 3, 4), ${}_{n}aq_{\alpha x}$ (α=1, 2, 3, 4) of Matlab males by different years.

Highest risk of death for male	2000 year	2004 year	2008 year
1st	${}_{n}q_{4x}$=0.011552	${}_{n}q_{3x}$=0.024646	${}_{n}q_{3x}$ =0.026014
2nd	${}_{n}q_{3x}$=0.010873	${}_{n}q_{4x}$=0.005751	${}_{n}q_{4x}$ =0.003886

Table 3: Conditional probabilities of deaths from specific cause Dα (α=1, 2, 3, 4),${}_{n}aq_{\alpha x}$(α=1, 2, 3, 4) of Matlab females by different years.

Age group x to x+n	Highest prob. of dying, $aq_{\alpha x}$ for year 2000	Highest prob. of dying, ${}_{n}aq_{\alpha x}$ for year 2004	Highest prob. of dying, ${}_{n}aq_{\alpha x}$ for year 2008
<1	${}_{n}q_{1x}$=0.003471	${}_{n}q_{1x}$=0.029851	${}_{n}q_{1x}$=0.010796
1-4	${}_{n}q_{4x}$=0.011894	${}_{n}q_{4x}$=0.008621	${}_{n}q_{4x}$=0.007194
5-9	${}_{n}q_{4x}$=0.002356	${}_{n}q_{3x}$=0.002837	${}_{n}q_{4x}$=0.001959
10-14	${}_{n}q_{4x}$=0.001048	${}_{n}q_{3x}$=0.002755	${}_{n}q_{4x}$=0.000837
15-19	${}_{n}q_{4x}$=0.002229	${}_{n}q_{3x}$=0.003590	${}_{n}q_{4x}$=0.002227
20-24	${}_{n}q_{1x}$=0.001545	${}_{n}q_{3x}$=0.002899	${}_{n}q_{1x}$=0.002340
25-29	${}_{n}q_{4x}$=0.004212	${}_{n}q_{3x}$=0.001775	${}_{n}q_{1x}$=0.002241
30-34	${}_{n}q_{1x}$=0.001159	${}_{n}q_{3x}$=0.002452	${}_{n}q_{3x}$=0.001881
35-39	${}_{n}q_{1x}$=0.001245	${}_{n}q_{3x}$=0.008398	${}_{n}q_{3x}$=0.003824
40-44	${}_{n}q_{4x}$=0.001691	${}_{n}q_{3x}$=0.006601	${}_{n}q_{3x}$=0.005000
45-49	${}_{n}q_{4x}$=0.006795	${}_{n}q_{3x}$=0.014276	${}_{n}q_{3x}$=0.015816
50-54	${}_{n}q_{3x}$=0.002486	${}_{n}q_{3x}$=0.014556	${}_{n}q_{3x}$=0.016675
55-59	${}_{n}q_{3x}$=0.005936	${}_{n}q_{3x}$=0.029652	${}_{n}q_{3x}$=0.021684
60-64	${}_{n}q_{3x}$=0.021358	${}_{n}q_{3x}$=0.049667	${}_{n}q_{3x}$=0.064226
65-69	${}_{n}q_{3x}$=0.044239	${}_{n}q_{3x}$=0.122278	${}_{n}q_{3x}$=0.118186
70-74	${}_{n}q_{3x}$=0.096764	${}_{n}q_{3x}$=0.160602	${}_{n}q_{3x}$=0.188127
75-79	${}_{n}q_{3x}$=0.111505	${}_{n}q_{3x}$=0.266002	${}_{n}q_{3x}$=0.219780
80-84	${}_{n}q_{4x}$=0.314402	${}_{n}q_{3x}$=0.379107	${}_{n}q_{3x}$=0.353675
85+	${}_{n}q_{4x}$=0.641026	${}_{n}q_{3x}$=0.666667	${}_{n}q_{3x}$=0.602941

Table 4: Highest conditional total probabilities of deaths from specific cause Dα (α=1, 2, 3, 4), ${}_{n}aq_{\alpha x}$ (α=1, 2, 3, 4) of Matlab females by different years.

Highest risk of death	2000 year	2004 year	2008 year
1st	${}_{n}q_{4x}$ =0.010062	${}_{n}q_{3x}$=0.018349	${}_{n}q_{3x}$=0.019328
2nd	${}_{n}q_{3x}$=0.007030	${}_{n}q_{4x}$= 0.004882	${}_{n}q_{4x}$ =0.003616

Figure 2 show the trend of total conditional probabilities of deaths for females. The first cause, neonatal and maternal complications, showed declining trend in 2000 to 2008, communicable diseases also provided decreasing trend whereas non-communicable diseases, the third cause, presented rising trend and the forth cause, injuries and miscellaneous cause showed diminishing trend.

Total probabilities of dying from a specific cause (non-communicable and injury related) are arranged in descending order of magnitude by different years for female population in Table 4. The probabilities of death of females due to non-communicable diseases was 0.007 in 2000, but went up to 0.018 in 2004, and to 0.019 in 2008 which was slightly different from male population. The second highest probabilities of deaths, deaths due to injury related causes, showed slow decreasing pattern similar to the male population. It was 0.010 in 2000 but declined to 0.005 in 2004 and to 0.004 in 2008.

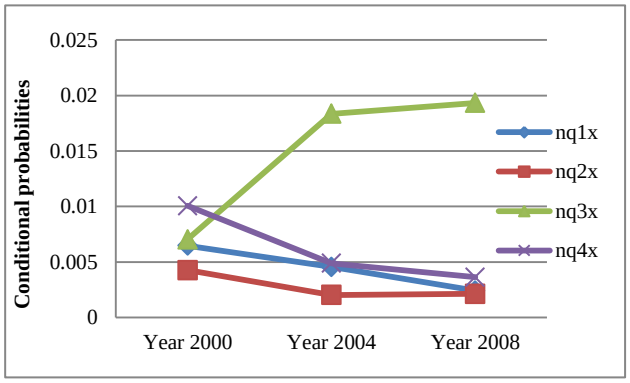

Figure 2: Total conditional probabilities of deaths from specific cause D_α (α=1, 2, 3, 4), ${}_naq_{\alpha x}$ (α=1, 2, 3, 4) of Matlab females by different years.

DISCUSSION

The risks of deaths by neonatal cause among the infants were relatively higher than all other causes and all other ages from 1 year to 44 years except the last age groups. It was true for all the years 2000, 2004 and 2008.Valuable information available from various years confirms a slowly downward trend in Infant mortality for males. The probability of death in males at the infancy period was 0.036 in 2000, but gradually dropped to 0.024 in 2008. The result was in agreement with the findings 'gradual improvement in South Asia's infant and child mortality rates.[13] For the age 1-9, the risk of deaths was higher for injury related diseases for the study years of 2000, 2004 and 2008. The infant and child mortality occurred with greater intensity due to maternal and neonatal causes and injuries respectively. The major part of male population of the age 30 and above in year 2000 died with different causes of death say, communicable cause, non-communicable cause and miscellaneous and injury causes but both the year 2004 and 2008, the major part of male population of the age 30 and above died with only non-communicable diseases. Diabetes (a non-communicable disease) of around 3.9% among people aged >25 years. We have found that the highest probabilities of death of aged 10-29 are injuries and non-communicable diseases.[14]

For female, the risks of death by neonatal and maternal cause among the infants were relatively higher than all other causes and all other ages from 1 year to 49 years except the last age groups. It is true for all the years 2000, 2004 and 2008. The probability of dying for infancy period of male was higher than that of female infants. Males have higher mortality than females at every age in most countries. For the age 1-4, the risk of deaths is higher for miscellaneous and injury related diseases for the study years of 2000, 2004 and 2008.[15] The major part of female population of the age 30 and above in year 2000 died with different causes of death, communicable cause, non-communicable cause and miscellaneous and injury causes but both the year 2004 and 2008 the persons of ages over 30 were at risk of death because of non-communicable diseases. The highest probabilities of death of aged 10-29 were maternal causes and injuries. Finally, despite of some disparities with male in value level; the female trends showed the same pattern like male except maternal complications. The probability of dying rate of middle years of age was slightly declined comparing to that of early age and elderly age and for age <1, D1 (neonatal and maternal) cause influence most, for age 1-29, D4 (injuries and maternal causes) had greater effect to death and for other age groups mainly D3 (non-communicable) cause affects the death pattern greatly as seen from Nurul that the proportion of non-communicable diseases increasing with age.[9]

The first cause, neonatal and maternal cause showed almost decreasing trend, the second cause, communicable diseases offered also decreasing trends whereas the third cause, non-communicable diseases represented rising trend and the forth cause, injuries and miscellany cause signified declining trend for both sexes.[16] This result supported that non-communicable diseases impose a sizeable and growing disease burden.[17-19]

The two leading causes were non-communicable diseases and injury related causes respectively. The probability of death in males due to non-communicable diseases was 0.010 in 2000, but rapidly climbed to 0.025 in 2004 and rose to 0.026 in 2008 where the second highest probability of death due to injury related causes show slightly decreasing pattern. It was 0.011 in 2000 but decline to 0.006 in 2004 and also decreases to 0.004 in 2008.The probability of death in females due to non-communicable diseases was 0.007 in 2000, but rapidly climbed to 0.018 in 2004 and rising to 0.019 in 2008 which was slightly differ from male population. The second highest probability of death due to injury related causes showed slightly decreasing pattern as same as the male population. It was 0.010 in 2000 but decline to 0.005 in 2004 and also decreases to 0.004 in 2008.[20, 21]

Total conditional probabilities of deaths from all causes, ${}_{n}aq_{x}$ of Matlab population was relatively high for male population than that of female population. The neonatal and maternal condition cause played a significant role for female in the year 2000 and 2004 but in 2008 the conditional probability of female in case of neonatal and maternal condition was less than male as seen from Yach et al, that male infants had higher mortality from most causes of death, the sex differential varies by cause.[22] The communicable conditional probabilities of deaths were always low for female compare to male all over the years. The conditional probabilities of non-communicable deaths were relatively high for male population. Non-communicable diseases (NCDs) impose the largest health burden.[20,14,23] An important point of view was the conditional probabilities of non-communicable deaths of female was only 0.007 in 2000, it reached 0.0183 in 2004 and 0.0193 in 2008. The conditional probabilities of injury related causes were greater for male than that of female.

CONCLUSION

The conditional probabilities of deaths by age-groups from specific disease groups provided that, for Matlab males in age <1, cause-D1 (neonatal and maternal complications) was most influential. For age 1-29, cause-D4 (injuries and miscellaneous) had greater impact to death. For other age groups, cause-D3 (non-communicable) primarily affected the death pattern. Despite some disparities compared to the males in value level, the females' trend showed the same pattern like male except for maternal complications. Non-communicable diseases were the highest ranked group. The second highest cause of deaths was neonatal and maternal complications which had high intensity of probability for female population compared to the male population. The probability of females' being the NCD victims was low compared to the male population. Overall death rates of males were generally higher than death rates of females. Government should mobilize and coordinate multi-sectored organizations and monitor NCD prevention and control. Policies aimed at increasing governmental and non-governmental services shall generally contribute to a reduction of non-communicable death rates.

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