Epidemiologic Transition in Iran with Emphasis on the Third Stage of Transition

Mohammad Sasanipour [1*], Sajjad Asadi [2]

1- Department of Demography, School of Social Science, Yazd University, Yazd, Iran
2- Department of Demography, School of Social Science, University of Tehran, Tehran, Iran

ARTICLE INFO	ABSTRACT

Corresponding Author:
Mohammad Sasanipour
sasanipourm@gmail.com

Introduction: During the last half century, all indices of mortality imply the prompt and continuous decrease of nationwide mortality. Alongside reduction of mortality, there are comprehensive forms of mortality transition causes, from epidemical and other communicable diseases such as mothers' (birth giving) mortalities and birth related ones, to other causes like chronic diseases related to lifestyle and aging.

Methods: This study investigated stages of epidemiological transition in Iran with emphasis on the third transition and finally predicted this trend in future decades.

Results: the results show that Iran has been through the third stage of epidemiological transition for two recent decades since large proportion of deaths are related to chronic disease such as cardiovascular disease and life expectancy at birth has decreased to 70 years. Furthermore, signs of the fourth transition in Iran have been observed in recent years, because as deaths caused by chronic diseases have increased, the mean age of death has also increased remarkably.

Conclusion: epidemiological transition dynamic and changes of death causes must be considered according to other demographic components. Reduction of death rate, fertility related changes, and as a result changes of age structure are some causes that influence on the epidemiological transition in Iran and will be impressive in the coming years.

Key words: Epidemiological transition, Death causes, Life expectancy at birth, , Population Dynamics

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Introduction

Little attention has been to recent death rates in developing countries in comparison to fertility changes; however, the recent research studies show major changes in death reduction speed and pattern. These changes are important for developmental and sanitary politics. None of humanity achievements during two recent decades have been as influential as the major death reduction on daily life conditions. It's been more than four decades that researchers are studying the relationship between demographic and socio-economic changes and disease and death pattern changes [1, 2, 3]. Generally it can be concluded that in transitional stage of deaths, the causes of death changed from infectious and parasitic diseases challenge to the condition of non-infectious and non-parasitic diseases [1, 4, 5].

Omran (1971) used the term "epidemiological transition" to describe orderly classification of transitions in death cause [1]. Preston in one of his recent research endeavors about epidemiologic transitions in developing countries states: "According to the increasing trend of peopleproportion getting middle-aged and old, in developing countries the epidemiological condition increasingly reflects more on adults' diseases and health than on children. Furthermore, endogenous and chronic diseases and wounds caused by accidents have become the major causes of deaths. In most of the countries this trend has accelerated due to the fast reduction of infants and children deaths in comparison to adults' deaths. Such a change in demographic disease condition trend is called epidemiologic transition and this phenomenon is happening in most of developing countries [2]."

By following Omran (1971), several authors have tried to correct or develop the theory of epidemiologic transition, for example, by studying the relationship between changes in the pattern of death causes and changes in disease. Furthermore, a broader study had been done on "Health Transition" that studied the response of the organized health system to long-term changes in the community health conditions. The concept of epidemiologic transition is used to analyze the experience of some countries. Some researchers have challenged the theory of epidemiologic transition as a universal theory of one-way changes. And emphasized on the heterogeneity between the speed or quality of transition in different environments or referred to cases of reverse transition [5].

Iran just like many other countries has experienced multi-dimensional transition of deaths caused by epidemic and contagious diseases, communicable diseases and also maternal death at birth caused by chronic diseases related to life style and senility during the last decade [4, 6,7]. The results of investigation on death causes trend in country during the recent years show that death of contagious diseases has decreased but death of non-contagious diseases especially cardiovascular diseases, unintentional accidents and cancer has increased. Based on the recent studies, more than two-thirds of deaths in Iran have been due to cardiovascular diseases, unintentional accidents and cancers [8, 9].

There are different goals for studying patterns and causes of death but they all have a point in common and that is the importance of death in development of countries. Death scale and pattern is one of the most common indices to measure the population sanitary condition and to evaluate the quality of health care services. Theseindices using this method are also essential for politicians' socio-economic developing programs. Studying the epidemiologic transition theory causes better understanding of the process of evolution in death indices and patterns especially the causes of death. However, the epidemiologic transition theory has been a controversial subject for researchers in the few recent decades. The current study aims to study evolution of recent stages in epidemiologic transition in Iran and to find out in which stage of epidemiologic transition we are. Furthermore, these goals are achieved by examining the mortality rate, age, sex in experimental accounts.

Epidemiologic transition theory

Demographic transition theory and epidemiologic transition theory are two obvious samples of

scientists' efforts to create a conceptual framework in order to study the scientific dynamics of contemporary population. Demographic transition theory provides us a useful and operational framework to recognize and evaluate population trends and to forecast the future population and it is known as a professional model of demographic changes [10]. Years after World War II demographers tried to explain the demographic transition phenomenon and they referred to factors such as economic development, urbanization and industrialization which all are relevant. The classic demographic transition tries to demonstrate the historical path of transition from one population condition to another condition by explaining and forecasting fertility and death [11]. As all developed countries lead to transfer from a classical agricultural economic system to a developed industrial economic system based on urbanization, their demographical features also change strongly; it means they transfer from a condition in which there is high amount of death and fertility and low growth of population to a condition in which there is low amount of fertility and death and again low growth of population [11, 12].

Change in death causes from infectious and parasitic diseases to non-infectious and non-parasitic diseases happens during the demographic transition. After introducing demographic transition theory which was used to demonstrate population growth based on the change in fertility and death rates, the article written in 1971 by Omran aimed to demonstrate influential factors and the results of change in patterns of death. The main assumption of Omran theory was the phase of transferring from high levels of death to low levels of death, all the populations experience a change in main causes of disease. Epidemiologic transition theory starts with this assumption that death is a main factor in population dynamics. During the transition period a long term change happens in death and disease pattern and the infectious pandemics eventually replace man made and deadly diseases [1].

Omran (1971) distinguishes three main sequential phases of epidemiologic transition: 1. age of pestilence and famine, in which there is a high and fluctuating mortality rate. In this phase average life expectancy at birth is low and fluctuates between twenty to forty years. 2. age of receding pandemics when death rate decreases greatly and when the epidemiology peak lowers or disappears, the rate of decline is strongly accelerated. The average life expectancy at birth increases from thirty to about fifty years. 3. Age of degenerative and man-made disease when death rate keeps decreasing and achieves stability in low levels. Gradually the average of life expectancy increases till it goes beyond fifty years. In this phase fertility is the most important factor of population growth. Moving towards deadly diseases reflects controlling diseases influencing younger people and increase in diseases influences older people. In this phase death rate remains at low level and serious diseases are man-made such as cancers, cardiovascular diseases and deaths caused by accidents which are the main causes of death. In developed countries of Europe and North America second phase of transition started in the beginning of nineteenth century and ended around 1960. In developing and poor countries of the world this transition is still being done and can take a few other decades. Omran (1971) believed that during the third phase of transition, final death rate is low and remains stable [1].

In early 1970 Omran's framework created a logical summary of epidemiologic trend with long range. Communicable diseases in world have decreased. Besides demographers strongly believe that life expectancy at birth is upper than the line of 75 years which is mostly because of death rate reduction in some countries and stopping high incomes during 1960s [13, 14]. United Nations considered a line of 75 years in population forecasts for all the countries [15].

However during 1970s and 1980s progress in life expectancy in developed countries accelerated and it became obvious that epidemiologic transition would not stop at a certain level soon. Therefore, the scientists decided to modify Omran's (1971) ideas by developing the number of transition phases. The first suggestions for the fourth phase by Olshansky

and Ault (1982) -the age of delayed on degenerative diseases- [14] and by Regres and Hackenberg (1987) -the hybristic phase- [16] were greatly ignored in research endeavors. Recently Horiuchi (1999), Vallin and Mesle (2001) and Mesle and Vallin (2006) suggested a replaced fourth stage called cardiovascular revolution [13, 17, 18]. This phase was based on the collected evidences about increasing life expectancy after 1960s mostly caused by fast reduction of cardiovascular diseases. The primary epidemiologic transition framework development seems to be well supported and widely accepted in future.

Horiuchi (1999) suggested a more critical modification in which there are five transitions instead of one during the history of human. The five transitions between successive epidemiologic systems are as follows: 1. external injuries in hunting,2. infectious diseases in agricultural societies, 3. cardiovascular diseases in industrial societies, 4. cancers in high technological societies and 5. senility in future. Each of these five transitions happen when a major group of death causes reducing or is widely destroyed and replaced with other diseases which still exist and have not been controlled yet. According to Horiuchi (1999), nowadays, developed countries with low death rate have almost passed the cardiovascular diseases phase and are at the beginning of the fourth stage which is cancer phase. Based on Omran's (1971) comprehensive framework, his five phase collection of epidemiologic transition theory is in the second phase [18].

As far as the modification of Omran's (1971) framework is concerned, there is a high agreement in literature review of the total death rate trend in contemporary societies. Especially in most of the countries life expectancy has been rapidly growing and there is no sign of upper line about life expectancy. Furthermore, it can be understood that countries do not need a linear path for their epidemiologic transition since the contemporary overturn and reversal are common (for example HIV spreading in Africa and sanitary crises accompanied by Soviet collapse).

Methods

The present study was carried out firstly in order to obtain the period of the epidemiologic transition stages in Iranbased on the results of previous studies and by using the meta-analysis method, , then, the epidemiologic transition had been conducted. The mortality data utilized in the study were in terms of age, sex, and cause of death in the years 2006 and 2010. This system is known as the best source of obtaining a combination of causality, age, sexuality of mortality, and is the most complete and reliable source of death in the country [7] and this ensures the comprehensiveness and acceptable accuracy of data used in the present study. Given that, evidences show that we are on the final points of third phase of epidemiologic transition now, this stage in the country has been emphasized. Furthermore, the future of epidemiologic transition in the country and related dynamics will be paid.

Epidemiologic Transition in Iran

Many studies done in recent years persuaded to retain demographic information among Iranian and foreign historical books, itineraries, government correspondences, and tried to provide an outlook for predicting the demographic history of Iran. As mentioned before, the first epidemiological transition consists of plague and famine era in which death rate increases and is fluctuating and prevents constant population growth [19]. At this stage, mean life expectancy at birth is low and variable between 20 to 40 years old [20, 21, 22]. It can be said that in Iran the first epidemiological transition has been there until the beginning of 20 century. Morbid killing incidents like frequent famines and floods, earthquakes, wars, regional disputes, two world wars, and deadly diseases like cholera, plague, typhoid, typhus, malaria, pox, flu, during 1896 to 1956 are recorded in Iran's history. Furthermore, in this period also death rate was high and fluctuating and life expectancy at birth wasn't above 25 years [19,21].

The second transition stage is the period of pandemics reductions in which mortality reduces increasingly and when the peak of epidemiology reduces or disappears, reduction speed accelerates.

Mean rate of life expectancy at birth from 30 years reaches to 50 years. Based on Amani and Saraayi estimations, death rate reduction has been seen in the country as life expectancy at birth from 25 years at the beginning of 14th century and it has been increased to 40 years during 1941-1956. New born death rate also has decreased from 300 per thousand to 200 per thousand during 1960-1975 [19, 21].

Third epidemiologic transition is a period of deadly diseases made by human beings in which death rate is decreasing and remains stable at a low rate. Mean life expectancy gradually increases till it reaches above 50 years. Based on researche studies done in the country, from 1960's, life expectancy reaches above 50 years and a great deal of death rates is caused by non-communicable diseases such as cardiovascular diseases, cancers, and incidents. Here the data

recorded by ministry of Health and Medical Education in 2010, as period of third epidemiologic transition of Iran has been analyzed. Based on the information in 2010 cardiovascular diseases, unintentional incidents and cancers respectively, are the most frequent death causes. The mentioned causes and other diseases like respiratory system diseases, unclassified symptoms and signs, birth related diseases, endocrine diseases, nutrition and metabolism, gastrointestinal diseases, genitourinary diseases and symptoms, undefined and vague conditions are respectively ranked from one to ten and consist about 90% of death causes in the country. The important point is that infectious diseases in the mentioned year are not included among the 10 main causes of death, although it was the sixth cause in 1980's.

Table 1. Distribution of Main Deaths Causes Percentage Recorded in the Country by Gender 2010

	both	male	Female
Cardiovascular disease	43.6	40.1	48.8
neoplasms	14.2	14.5	13.8
Unintentional accidents	12.4	16.2	6.8
other	29.7	29.1	30.6
total	100	100	100

Comparingmortality age pyramid in the investigated year with the nation age pyramid shows that the age algorithm is different. Age structure of the country is transferring from youth to old age and a great proportion of the country population is young and the base of the pyramid has become short. As discussed in theoretical discussions, in transition state of mortality, dominance of infectious diseases death causes, is transferring to a state in which non-infectious diseases are dominant. Now Iran is in the ending years of its third epidemiologic transition. The main characteristic of this period

is the dominance of manmade and chronic diseases. In the third epidemiologic transition a relative increase in those diseases that influence on older persons can be seen. Figure 1 shows that by increasing age, death rate increases and in age of 75-79 and 80-84 reaches its peak, except in childhood which death rate is high because of certain conditions. The other point is that in men age pyramid, in particular, in ages between 15 and 30 an inflation of death rate in each age pyramid can be seen, a great part of which are caused by unintentional incidents and will be discussed in next sections.
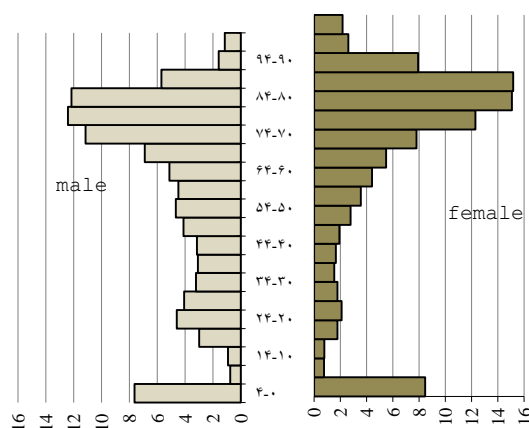
Figure 1. Age pyramid of total morality in Iran 2010

The age algorithm of deaths caused by cardiovascular diseases and cancers are shown in figures 2 and 3 . As it can be seen, in each of these two death causes in first age group, the percentage of deaths caused by these diseases is in a low level and by increasing of the age, this percentage raises and in ages between 70 and 84 reaches its peak and in later ages decreases. Based on these graphs, death age algorithm in each of these causes is the same for both genders.
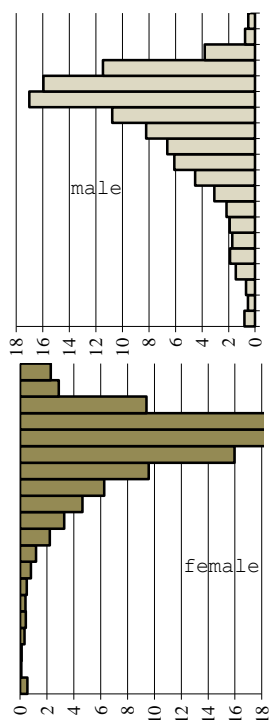

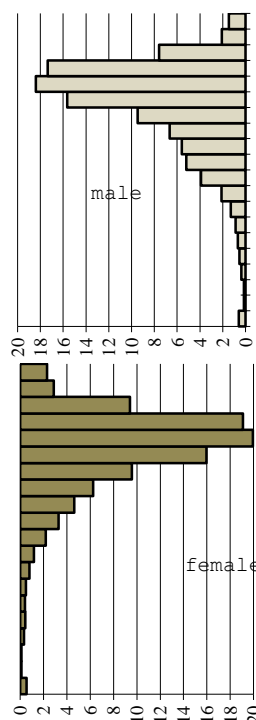**Figure 2.** Age pyramid of Deaths from cardiovascular disease in Iran 2010

Figure 3. Age pyramid of Deaths from cancers in Iran 2010

Age and gender distribution pattern of the deaths caused by unintentional incidents is shown in figure 3. As it shows age structure of this death cause, is essentially different from other main causes. This cause is the second one in death causes and has the most impact on other middle age groups of both genders. Based on above figures, most of unintentional incidents victims are among young people and the death peak in both genders is between 20 and 24 years and after this

age the percentage decreases. The difference between death rates among both genders, caused by unintentional incidents, shows that in mid ages that is the death cause peak, men are killed more

than women; therefore, in 20-24 years age group, unintentional incidents consist 16% of death causes among men and 12% of death causes among women.
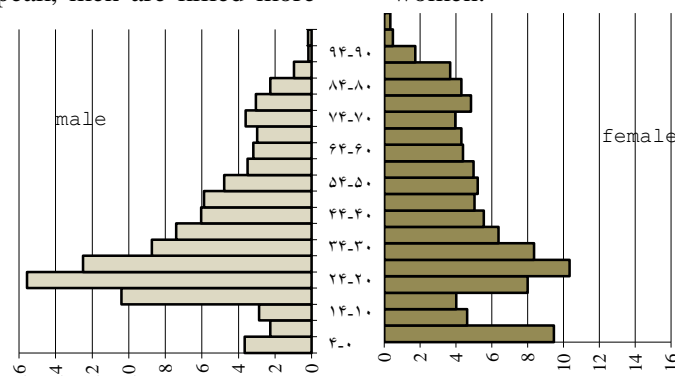

Figure 3. Age Pyramid of Deaths from Unintiontial Accident in Iran 2010

Some signs of entering the fourth epidemiologic transition in the country have been seen in recent years. Accordingly, the average age of death due to any causes, in a short period between 2006- 2010, has increased in two years. This increase is also seen in main causes. This also proves the findings of Koosheshi and others about Iran population which has entered the fourth epidemiologic

transition [8]. According to Olshansky and Alt, during the fourth epidemiologic transition, which is called 'delay period of chronic and aggravating diseases', mortality due to aggravating diseases changes older ages life style, because of death rate reduction [14]. Two-unit reduction in special rates based on all causes which have been found in the study, approves this issue.

Table 2. The Death Average Age of All Causes and Leading Death Causes by Sex

	both		male		female	
	2006	**2010**	**2006**	**2010**	**2006**	**2010**
Cardiovascular disease	71.1	72.4	69.9	71.1	72.5	73.9
neoplasms	63.0	63.9	64.2	65.2	61.1	61.8
Unintentional accidents	36.3	38.2	36.2	37.9	36.6	39.5
total	58.4	60.5	56.3	58.4	61.8	63.7

Cardiovascular diseases as the dominant cause of death in the country, in both periods, consist 43% of the death causes in Iran, however in 2010 compared to 2006, a little increase (0.5%) in deaths caused by this disease has been seen. Unintentional incidents as the second cause of death in the country in 2006 cause 5.15% of deaths and it is expected that this cause will affect men more than women . Based on gender, unintentional incidents are the second death causes in men, and the third one for women. But in 1389, compared to 2006, death rate caused by unintentional incidents decreased about 3%, reaching 4.12%. Yet, it's the

second death cause in men. Although, cancers and tumors, in 2006, with a share of 8.12%, were the third cause of death in the country, in 1389, it has increased remarkably and has become the second cause of death in the country.

The Future of Epidemiologic Transition in Iran

As it was mentioned, according to the changes in deathpatterns , researchers added a fourth stage of epidemiologic transition which the most important of them has been offered by Olaschansky and Alt, 'called delay in chronic and aggravating diseases'. death age increases and

human beings live longer. In this stage, algorithm of the death age caused by diseases is similar to the third transition but age distribution of death caused by chronic diseases transfers to older ages. This has an important impact on population, health and people life stye in their old ages, and beside the growth of elder population groups, numbers of elders increase remarkably.

According to data recorded in Ministry of Health and Medical Education, during the last years, death average age in the country has increased about two years and main causes of death in the country, like cardiovascular diseases and cancers, have affected people in elder age groups. Furthermore, according to the fourth epidemiologic transition, the age pattern of death caused by chronic diseases, particularly cardiovascular diseases and cancers in the country has not changed. It is predicted that based on Iran existing young age structure and aging in the population over the coming decades, sharing these main causes will be increased and the rate of death caused by unintentional incidents, in particular traffic accidents, will be decreased and the country will completely enter the fourth epidemiologic transition, meaning that age distribution of death caused by chronic diseases transfers to older ages. This has an important impact on population, health and people life in their old ages and besides increasing population of old age groups, the number of older people increases remarkably.

On the other hand, the increasing trend of life expectancy at birth will be continuing and according to epidemiologic transition theory in this period, population of older people will be increased, too. Death algorithm in the country will reaches close to developed industrial countries. More difference between men and women life expectancy will also be seen, since by developing the country and women modernization, women will correspond more to the new and modern state.

Discussion

Epidemiologic transition means a long time change that generally happens in diseases distribution and injuries and dangerous factors.

Based on this theory, changes and death rate reduction in a society, a long time change will also happen. Furthermore, epidemiologic transition moves beside demographic transition. In transition stage of high death rate to low death rate, all population experience a change in main causes of diseases. While among the populations which have high death rate, infectious diseases and problems related to reproduction sanitation are the main causes of death, in populations with low death rate, chronic and aggravate diseases are the main causes. There is no reliable information about death causes in the country at least until 1350's and this has made us unable to realize the time of the first and the second epidemiologic transition in the country.

Analyzing the information and data about mortality of the last two decades shows that the country is at the end of the third phase or the beginning of the fourth transition. Based on epidemiologic transition theory, in the third stage, a great deal of deaths is caused by chronic diseases. Analyzing the recorded data in the country shows that a great deal of deaths is caused by cardiovascular diseases and cancers which proves the country is in the third epidemiologic transition phase. The average age of death in the country has increased to more than 60 years old due to the increase in deaths caused by cancers and cardiovascular diseases so that this cause mostly affects older people.

One of the factors that disrupted the epidemiologic transition to the fourth stage in the last two decades was the major contributor to deaths from unintentional accidents, especially traffic accidents in the country. However, data show that deaths of unintentional accident have declined in recent years, and this decline has persisted. This can facilitate the speed of epidemiologic transition to higher levels.

On the other hand, during the last years, some signs of the fourth epidemiologic transition phase in the country have been seen ; therefore, Koosheshi and others believe that the country is in the fourth phase. In the fourth stage, chronic and non-communicable diseases consist a large share

of death causes and patterns of death caused by aging remains stable, however, death caused by aggravating diseases moves toward older ages. This situation is seen in the last years in the country and as it is shown in table 4, the average age of people suffering from the most important aggravating diseases in the country, like cardiovascular diseases and cancers, in recent years, has increased.

Generally, epidemiologic transition during the last two decades in the country must be considered as a continuation of the third phase of transition in which death rate continues to reduce and chronic diseases vastly become dominant.Reducing mortality in Iran increased the contribution of death from cardiovascular disease, especifically cancers, which has affected old ages, and has shifted the average age of death to older ages.

Conclusion

Since mortality studies in Iran are scarce, and are based on models and patterns of other countries or theatric demographic models, there is a serious defect in mortality data. Most of these studies have been conducted on the estimation of mortality indexes. Since the beginning of the 1980s, with the help of the World Health Organization, a parallel system was established to record the number of death in the Ministry of Health and Medical Education, which was more accurate at registering causes of death than the country's registration system. Access to this information provided a good opportunity for researchers to have more realistic assessment of mortality indicators with more detail and accurate elaboration. However, longitudinal studies face severe constraints in the country. It is suggested that death has to be recorded by more details and accuracy in order to produce valid data on mortality trends in the country. ; therefore, longitudinal studies such as epidemiologic transition in the country can be utilized. These kinds of studies depict mortality profile and challenge planners and policymakers.

Conflict of Interest

None

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