

The epidemiological transition*

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التحول الوبائي

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خلاصة كان يُعتقد فيما مضى أن التحول الوبائي عملية وحيدة الاتجاه ، بدايتها عندما كانت الامراض المعدية هي السائدة ، وختامها عندما تصبح الامراض غير السارية هي أهم أسباب الوفاة . ولكن أصبح الآن جلياً أن هذا التحول أكثر تعقيداً وديناميكية مما كان يُظن ، حيث تتطور الصحة ويتطور المرض بكيفيات متباينة . فهي بالأحرى عملية تحول مستمرة ، تختفي خلالها بعض الامراض ، وتنبعث أمراض أخرى من مرقدتها . وتتناول هذه المقالة الآليات الضالعة في هذه العملية ، والمؤشرات التي تحدد معالم الأنماط المتغيرة للامراض .

ABSTRACT The epidemiological transition was thought to be a unidirectional process, beginning when infectious diseases were predominant and ending when noncommunicable diseases dominated the causes of death. It is now evident that this transition is more complex and dynamic where health and disease evolve in diverse ways. It is rather a continuous transformation process with some diseases disappearing and others re-emerging. This paper addresses the mechanisms involved and the indicators that demonstrate the changing patterns of diseases.

La transition épidémiologique

RESUME On pensait que la transition épidémiologique était un processus unidirectionnel, partant du moment où les maladies infectieuses prédominent et se terminant au moment où les maladies non transmissibles sont devenues les principales causes de décès. Il est maintenant évident que cette transition est plus complexe et dynamique lorsque l'état de santé et la morbidité évoluent diversement. Il s'agit donc plutôt d'un processus continu de transformation durant lequel l'on observe la disparition de certaines maladies et la réapparition d'autres. Le présent article examine les mécanismes qui entrent en jeu et les indicateurs qui montrent l'évolution du tableau des maladies.

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Introduction

The general shift from acute infectious and deficiency diseases characteristic of underdevelopment to chronic noncommunicable diseases characteristic of modernization and advanced levels of development is usually referred to as the "epidemiological transition". The most evident indicators of this transition are changes in the pattern of mortality, particularly in relation to the cause of death, as well as changes in morbidity. These changes require a change in the approach of national authorities to the emerging problems and in WHO collaborative programmes in response to national efforts.

The epidemiological transition

It used to be thought that the epidemiological transition—the shift from infectious and deficiency diseases to chronic noncommunicable diseases—was a unidirectional process, beginning when infectious diseases were predominant and ending when noncommunicable diseases dominated the causes of death. It has, however, become apparent that this transition is more complex and dynamic: the health and disease patterns of a society evolve in diverse ways as a result of demographic, socioeconomic, technological, cultural, environmental and biological changes. It is rather a continuous transformation process, with some diseases disappearing and others appearing or re-emerging. This also indicates that such a process is not unidirectional. In fact, a reversal of the trend sometimes occurs. There are some outstanding examples, such as the emergence of new infectious diseases like AIDS, and the increase in infections that were previously controlled, such as tuberculosis and dengue fever.

It is also important to note that several stages of transition may overlap in the same country. For example, the decline in infectious diseases may be slow or stagnant among some sectors of the population while noncommunicable diseases may be increasing rapidly in another sector of the same population. This is still happening in many societies of the Eastern Mediterranean Region where the less affluent sectors have a high incidence of infectious diseases among children while the wealthier sectors show completely different patterns of illness.

Mechanisms involved in the epidemiological transition

There are several factors involved in the epidemiological transition. The most important are considered below.

Demographic changes

Demographic changes are a composite of changes in both mortality and fertility. As populations become healthier, a reduction in mortality, particularly of infants and children, usually occurs, followed later by a fall in fertility rates. Therefore, more people will survive to adulthood and will have the disease patterns of adults, with noncommunicable diseases at the top of list. They will also be exposed to diseases that more frequently affect elderly people, such as cancer and cardiovascular diseases. Thus, even with constant age-specific incidence rates of noncommunicable diseases, the absolute number of cases and deaths from these diseases increases substantially with the above-mentioned demographic change.

Table 1 shows the pattern of the crude death rate for the Eastern Mediterranean Region over the past 25 years. The crude death rate decreased from 17.4 per 1000 in the early 1970s to 9.1 per 1000 in 1995.

Table 1 Crude death rate for the Eastern Mediterranean Region (1970–1995)

Year/period	Crude death rate 1000s
1970	17.4
1975	14.8
1980	12.5
1985–89	11.6
1995	9.1

Table 2 Infant mortality rate for the Eastern Mediterranean Region (1970–1995)

Year/period	Infant deaths/ 1000 live births
1970	136
1975	108
1980	97
1985–89	70
1995	68

Table 3 Trend of crude birth rate for countries in the Eastern Mediterranean Region (1970–1995)

Year/period	Crude birth rate 1000s
1970	45.4
1975	44.1
1980	42.3
1985–89	41.4
1995	35.4

The infant mortality rate—that is, mortality during the first year of life—has decreased to half its value in the past 25 years, from 136 per 1000 live births in the early 1970s to only 68 per 1000 live births in 1995. As shown in Table 2, the pattern of

decrease was sharper in the early part of this period, and the decrease is now at a much lower rate.

Table 3 shows that the crude birth rate (as an indicator of fertility) did not start to show a significant decrease until recently; an observation that supports the notion that the decrease in fertility follows the increase in mortality, particularly in infants and young children.

As life expectancy increases, the number of old people will increase. This will lead to changes in disease patterns and problems characteristic of the elderly and eventually the total number of deaths will increase as a result of the new age structure.

Changes in risk factors

The risk factors involved in the epidemiological transition include biological factors (microorganisms), environmental factors, social, cultural and behavioural factors and the practices of modern medicine.

Biological factors

It is well known that microorganisms constantly undergo changes that enable them to cope with an increasingly hostile environment. In fact, the development of mechanisms that permit survival of the most adaptable microorganisms is more rapid than the development of defence mechanisms that allow their hosts to combat microbial invaders. This adaptive process involves finding and exploiting weaknesses in the defences of the host and can happen by means of several mechanisms: alteration in antigenic identity, emergence of drug-resistant strains and dual infection.

Alteration in antigenic identity

The antigenic change of influenza viruses is well known. It permits the emergence of virulent strains of influenza viruses, against which the population has no immunity;

hence a rapid spread of disease follows, affecting all ages. With the appearance of a new strain, preceding strains tend to disappear or become sequestered for long periods of time and rarely reappear. The appearance of a new strain of the influenza virus can result in billions of cases of influenza and millions of deaths. These deaths are usually not recorded as due to influenza but are registered under the terminal cause of death, which is in most cases cardiac or chronic chest disease. This results in a misleading impression that the incidence of these latter conditions is increasing.

Cholera presents a similar picture to that of influenza. When the El Tor vibrio became pathogenic in the early 1970s, it swept the world and practically took the place of the classical strain. In 1993, a new strain, O139, appeared and is replacing the El Tor vibrio. In areas where this strain spread, it did not spare any age group, even in its usual endemic areas. This means that there is no immunity against it and indicates that it is a new variant. The pattern observed as a result of infection by O139 in endemic areas of Bangladesh and India, with thousands of cases among adults and older age groups, is very different from that observed with the classical or El Tor strains in these areas.

Emergence of drug-resistant strains

With the advent of effective therapy for many infectious diseases, many scientists assumed that these diseases would disappear. However, after several years of widespread use of certain antimicrobials, it became apparent that some strains of microorganisms could survive in the hostile environment of the drug. This has been observed more in diseases that require rather long periods of therapy with antimicrobials, such as tuberculosis. The limited resources that are available for treatment of patients suffering from these chronic diseases, especially in

developing countries, result in interruption of therapy or use of inappropriate treatment regimens. The result is the appearance of resistant strains. This change is believed to be associated with chromosomal mutations in the organism. The mutation reaches a position of dominance in the presence of the antimicrobial against which it has been developed. This behaviour has been observed in many microbes, such as tubercle bacilli and meningococci.

The development of resistance is not restricted to microbes but also occurs with parasites. The development of resistance of the malaria parasite to chloroquine has been and is still one of the main causes of setbacks in malaria control programmes.

Dual infection

A recent observation is that with the appearance of HIV infection, which affects much the same population already infected with tuberculosis, there is a significant increase in the occurrence of clinical tuberculosis. This new combination has produced two phenomena: first, the risk of developing active tuberculosis as a result of HIV infection increases from 10% in a lifetime to 10% in the first year of infection; secondly, there is an increase in drug-resistant tuberculosis affecting HIV infected persons and spreading to others. At present WHO estimates that there are at least five million people who are suffering from both HIV infection and tuberculosis. This requires a special management and treatment regimen; for example, the use of ethambutol is preferred to streptomycin to avoid transmitting HIV. Ethambutol is also preferred to thioacetazone to avoid the development of Stevens-Johnson syndrome (SJS).

Environmental factors

There is conclusive evidence that certain changes in the patterns of diseases, in par-

ticular a decrease in the occurrence of communicable diseases such as cholera, are the result of the development of environmental sanitation, particularly a clean water supply, sanitary disposal of waste and proper housing. On the other hand, environmental factors may increase the incidence of infectious diseases if they offer opportunities for transmission of etiological agents from the reservoirs of infection to susceptible hosts, for example by promoting breeding of vectors of diseases or because of overcrowding.

The main environmental factors in changing the patterns of diseases are noted below.

Exposure to environmental pollutants

The discharge of waste products from industry and many other sources of hazardous waste into the air people breathe, the water people drink and the food people eat is behind the increase in some diseases such as various types of cancer and chronic chest conditions, including asthma and chronic bronchitis.

One of the main growing environmental pollutants is ionizing radiation from medical and occupational contacts and from commercial and military use of atomic energy. Unforgettable examples are the atomic bomb explosions at Hiroshima and Nagasaki in Japan during the Second World War and the explosion of the nuclear reactor at Chernobyl in the former Soviet Union. These have been responsible for thousands of deaths and very large numbers of cases of cancer. The dangers resulting from these and similar incidents will continue for several generations.

It is not only industry and wars that are responsible for pollution. More important are the conditions of life that contribute significantly to changes in the environment and hence to changes in the patterns of diseases. Excessive use of insecticides both in agri-

culture and in public health for vector control is another source of significant environmental pollution. Excessive use of cars, some of which are not well maintained, is well known as a source of air pollution and its effect on developing lung cancer is well documented.

Overcrowding

Migration from villages to towns due to industrialization and the development of high density urban areas facilitate the spread of infections, especially of diseases spread by droplets and those related to atmospheric pollution.

With urbanization, group care for children increases, for example in nurseries and day care centres. This is well known to be associated with the risk of spread of infections due to *Haemophilus influenzae* type 6 and *Neisseria meningitidis*. Attendance at day care centres poses a real risk of illness to young children and also has an impact on parents and other family members. Children attending day care centres are known to be the transmitters of acute infections of the gastrointestinal and respiratory tracts to their families. Some of these diseases have the potential to cause significant clinical illness such as hepatitis A; other organisms have the potential for producing congenital problems when they affect pregnant mothers, such as the German measles virus, the cytomegalovirus and parvovirus B19.

Social, cultural and behavioural factors

Social, cultural and behavioural factors are closely related and interlinked. The shift from an agricultural to an industrial society and its accompanying process of modernization produce changes that affect people's health.

Changes in community relationships

Modernization has adversely affected close community ties, which used to provide opportunities to share sorrow and happiness and to alleviate stress. An evident example of maladjustment due to urbanization is the traumatic encounter of rural youth with urban values. This frequently has a serious impact on mental health.

Another example of the change in community relations is the care of the elderly. In rural communities where extended family and tribal life used to predominate, care of the elderly was essentially a family responsibility. This is no longer the case, particularly in urban areas. The elderly are now cared for away from their families in homes for the elderly. They no longer see their families growing and are deprived of the social environment required for a happy life.

Changes in lifestyle

Conditions of life and the way people live and work (sometimes called lifestyles) have been a cause of many diseases, particularly noncommunicable diseases.

The notion of lifestyle has gained wide currency in the health field. It is commonly used in a restricted manner to mean specific individual behaviour patterns that are interpreted as risk factors. This usage does not take proper account of the sociocultural context of behaviour. As a matter of fact, lifestyle refers to the manner in which the social group translates its situation into a pattern of behaviour that produces what are called behavioural risks.

Major behavioural changes in lifestyle, social behaviour and social value systems have been introduced by the mass media (television, radio, newspapers, journals, magazines, books, etc.), which are one of the main manifestations of modernization. Media influence is so powerful that it could be rightfully said that the public is almost

completely controlled by the media. One of the negative influences of the media on health comes from advertisements for commodities that are not necessarily needed by the community, but the latter is made to believe that what is advertised is needed. A particularly destructive example is tobacco advertising, which was very extensive a few decades ago and helped establish this hazardous habit. Its roots became well fixed in communities, who thought that smoking would make them appear modern and advanced.

Decreased concern about moral values

Urbanization and industrialization have unfortunately been accompanied in some communities by a decreasing concern for moral and religious values and the appearance of lifestyles that have led to changes in the pattern of some diseases. An example of such a change in this century is the so-called sexual revolution. It has simply meant more sexual activity. This is well demonstrated by the rapid spread of sexually transmitted diseases (gonorrhoea, syphilis, herpes simplex, hepatitis B and, more important, HIV infection). A factor that has facilitated sexual promiscuity is the widespread availability and use of contraceptives, which have alleviated the traditional fears of conception and led to promiscuous heterosexual relationships.

An increase in the consumption of alcohol and of smoking are also evidence of decreased concern for religious values. Their effects on health are well known, as they are major risk factors for noncommunicable diseases.

Human mobility

History tells us that the opening of trade routes between continents was accompanied by the spread of infectious diseases. The black death in Europe in the 14th century

and the cholera pandemics in the 19th and 20th centuries are well documented. The spread of syphilis in the 18th and 19th centuries has been related to wars and the movements of armies. More recently, the movement of a large number of troops by air from south-east Asia to the Pacific islands during the Second World War contributed to the introduction of dengue fever in the south Pacific region.

During the past two decades the introduction of the human immunodeficiency virus that causes AIDS to many parts of the world has been directly related to human mobility.

In the Eastern Mediterranean Region many communicable diseases are introduced through human mobility for work, trade and through tourism and the millions of workers from south-east Asia and the Pacific region coming to work in the affluent states of the area. The early introduction of HIV infection to Morocco and Tunisia was related to the return of nationals of those countries from work in southern Europe where they were exposed to infection. Many of the sexually transmitted diseases in the Arabian peninsula are related to human movement between those countries and India, Thailand and the Philippines.

Expansion of education and participation of women in the labour force

The process of urbanization and industrialization has been accompanied by two important cultural transformations: the expansion of education and the increased participation of women in the labour force. These, in turn, have caused profound modifications in the dynamics of families and communities, which have resulted in the use of contraceptives, reducing many of the problems related to reproduction by extending birth intervals and has contributed to

greater maternal and neonatal survival by reducing exposure to high-risk pregnancies.

Practices of modern medicine

Several changes have occurred in the quantity, distribution, organization and quality of health services that have contributed to the epidemiological transition. The discoveries and technological developments of the twentieth century, such as the development of antibiotics and antimicrobial agents, insecticides, vaccines and diagnostic and therapeutic technologies, have resulted in remarkable progress in the prevention and control of many diseases and in the effective management of many others. One of the most dramatic victories has been the eradication of smallpox. Another evident success has been the reduction of morbidity and mortality from diseases for which there are available protective vaccines such as poliomyelitis, diphtheria, tetanus and measles. It must, however, be remembered that relaxation of vaccination efforts can very quickly result in the re-emergence of these diseases as happened with poliomyelitis in Pakistan and is now the case with diphtheria in Russia and Ukraine.

Although therapeutic interventions have been the key element in saving millions of lives each year and in reducing some of the serious complications that often follow infection, they actually do not modify the probability of becoming ill (except in so far as early treatment reduces the risk of spread of infection to others). In chronic diseases, this type of intervention actually produces the paradoxical effect of increasing the absolute morbidity level.

On the other hand, the cure-oriented intervention techniques of modern medicine that permit the liberal use of antimicrobials and chemotherapeutic agents and an increasing number of manipulative procedures have been responsible for some side effects

of diseases. In addition to side effects such as allergy, depression of bone marrow activity and deafness, excessive use of antibiotics may cause what are described as superimposed infections. The excessive use of antimicrobials inhibits indigenous organisms that compete with external invaders and permits colonization and proliferation of organisms that are nonpathogenic under normal conditions.

Infections associated with manipulative techniques are another example, particularly under conditions where aseptic techniques are not strictly followed. The most evident of these is neonatal tetanus, which occurs through contamination of the umbilical stump. The spread of viral hepatitis B and C and HIV infection through the use of contaminated needles and through un-screened blood transfusions is another example in which intervention becomes a source of infectious disease. In addition, the use of equipment such as urethral catheters and endotracheal tubes permits organisms to gain access to otherwise healthy sterile organs.

Dynamics of epidemiological transition

From the above review of epidemiological transition, it is clear that there is no unique path in the transition that leads to low mortality, less incidence of communicable and deficiency diseases and an increase in incidence of chronic and noncommunicable diseases. On the contrary, there are many paths, a multiplicity of stages, and no society has the same experience as any other.

The course of transition is very vulnerable and many obstacles are not easily overcome by the partial interventions prevailing in many parts of the world. The results are lack of continuity, slowing down and even regressions in transition. This is because socioeconomic transformation in developing

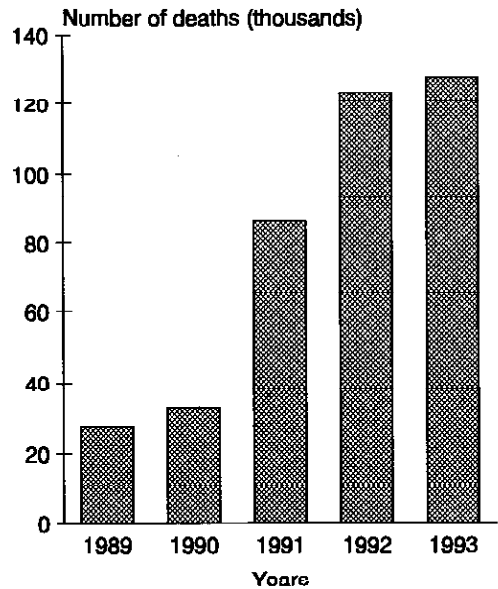


Figure 1 Total deaths from all causes in Iraq between 1989 and 1993

countries has not affected all social classes and has increased the vulnerability of some groups. An example is the slowdown and reversal of the decline in mortality during the 1970s and 1980s. In many countries this was the result of austerity programmes, which led to the erosion of the health infrastructure and the elimination of intervention programmes. All these are responses to international forces beyond the control of those countries most affected by them.

We have vivid examples of reversal within the Eastern Mediterranean Region. In Iraq, Ministry of Health statistics show a significant reversal in the epidemiological transition during the 1990s. The total number of deaths has increased almost fourfold from 1990 to 1993 (Figure 1). This reversal is more evident in the under-five mortalities, which increased by a factor of more than 5 during the period from 1990 to 1993 (Fig-

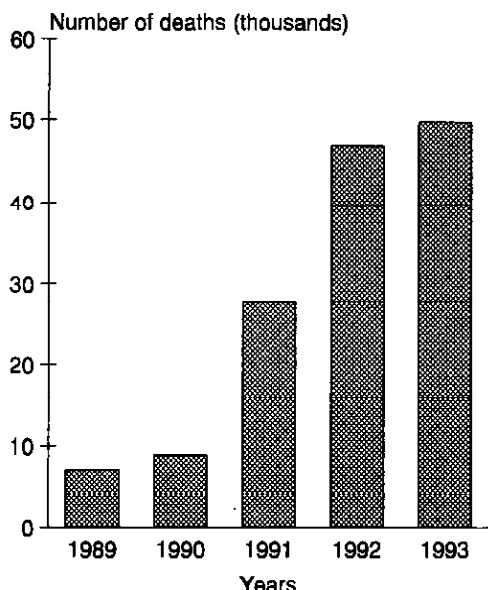


Figure 2 Deaths of under-fives from all causes in Iraq between 1989 and 1993

ure 2). If data were available, we should see the same pattern or worse in Afghanistan and Somalia. The same is expected in other countries affected by man-made disasters, especially wars.

Indicators of the epidemiological transition

It is difficult to identify particular indicators that demonstrate the changing pattern of disease. There are, however, demographic, mortality and morbidity indicators that can individually and collectively throw light on the subject.

Demographers have tended to concentrate on mortality patterns as the best indicator since they are fairly easy to measure and are unambiguous. There is also a finality about death. However, overall mortality

does not tell everything about health, hence the necessity to consider both mortality and morbidity indicators.

Mortality indicators

One of the mortality indicators is the crude death rate. Table 1 shows a pattern of decrease in the crude death rate during the past two decades in the countries of the Eastern Mediterranean Region. The rate of decrease is itself decreasing as it has already reached rather low levels.

A good and sensitive mortality indicator, the infant mortality rate, is in general highly correlated with the overall mortality rate. It has traditionally been used as the basic indicator of mortality at young ages and indeed as a general indicator of overall health status and social and economic development. Table 2 shows the situation of infant mortality in the Region and the evident trend of decrease.

In recent years more attention has been focused on other ages of early childhood. In part, this reflects the recognition that the causes of death that claim many infant lives (predominantly post neonatal) also affect young children. Table 4 reflects the estimates made by the United Nations for countries of this Region with respect to under-five mortality. It shows that in 1970,

Table 4 Estimates of under-five mortality rates for the Eastern Mediterranean Region (1970-1995)

Year/period	Under-five mortality/ 1000 live births
1970	190
1975	160
1980	140
1985-89	125
1995	101

about 1 in every 5 children born died before reaching its fifth birthday; currently only 1 in every 10 children born dies before its fifth birthday. As with all estimates, the figures have to be interpreted with caution but the pattern is clear.

Crude death rate, or even age-specific death rates, sometimes conceal important changes, particularly in the causes of death. As might be expected, infectious and parasitic diseases are still by far the leading cause of mortality in the Region. However, there is evidence that the risk of dying from major chronic diseases, such as circulatory diseases, is not insignificant. Deaths from circulatory diseases and stroke are second only to those caused by infectious and parasitic diseases. Several of the principal causes of chronic diseases, and in particular cigarette smoking, are very widespread in the Region, with no evident downward trend. It is likely that the conquest of infectious diseases will be accompanied by an increase in the deaths from chronic diseases such as lung cancer and coronary heart disease, similar to the pattern previously observed in developed countries.

Figure 3 shows the World Bank estimates and projections of the ratio of deaths from cardiovascular diseases to deaths from infectious and parasitic diseases. It shows that in the Eastern Mediterranean Region the ratio of deaths from cardiovascular diseases to deaths from infectious and parasitic diseases, which was around 0.5 in 1985, is expected to become 0.8 by the year 2000 and will then exceed 1.0. That is, by the year 2015, the number of deaths from cardiovascular diseases will exceed that caused by infectious and parasitic diseases.

Again it is essential to emphasize that estimates must be interpreted with caution. It is difficult to study the pattern of mortality from cardiovascular diseases from available mortality figures for most countries of the

Region for two reasons. First, there has been a decrease in the practice of labelling the cause of death as ill-defined and unknown during the past three decades. This shift from ill-defined causes to specific causes may produce an artificial increase in some causes of death, including cardiovascular diseases. The second reason is the fact that during the period 1960 to 1990 three revisions of the *International statistical classification of diseases and related health problems* were used for classifying causes of death. The three revisions (seventh, eighth and ninth) did not classify hypertensive heart diseases in the same manner.

Although cardiovascular diseases are becoming relatively more important than communicable diseases as a cause of death, the death rates from cardiovascular diseases

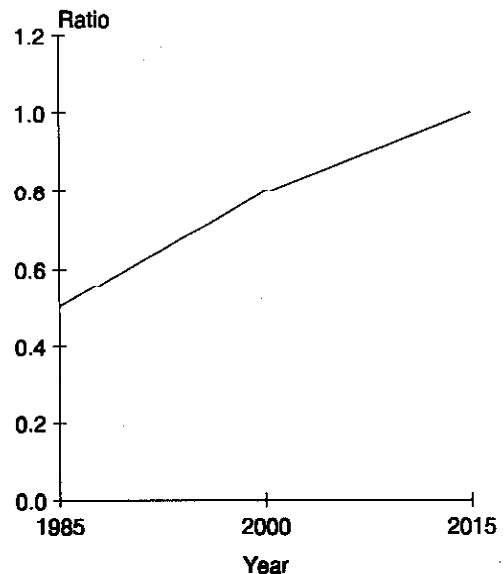


Figure 3 Changing cause-of-death structure in the Eastern Mediterranean Region (ratio of deaths from cardiovascular diseases to deaths from infectious and parasitic diseases)

Source: World Bank (1993)

Table 5 Proportionate mortality patterns from various causes for developed and developing countries (1960-1980)

Cause of death	1960		1980	
	%		%	
	Developed	Developing	Developed	Developing
Infections	12	43	8	40
Tumours	15	4	19	6
Cardiovascular diseases	49	11	53	19
Others	24	42	20	35
All causes	100	100	100	100

Source: International Agency for Research on Cancer, Scientific Publication no. 100

es, especially in developed countries, are not increasing. This means that more people will live to old age, when cancer is more likely to occur. Mortality from cancer is increasing all over the world. Of all major causes of death, cancer is the only one that is rising significantly. Table 5 shows the proportionate mortality patterns from various causes for developed and developing countries.

Morbidity indicators

It is important to realize that when fatal acute diseases dominate the health profile, mortality data often give an inadequate description of the prevailing health problems. With reduced incidence and fatality of many acute diseases and the emergence of chronic, often incurable but not immediately fatal conditions, causes of death would only reflect a small fraction of the complex health profile of the population.

Changes in the levels of sickness are extremely important to complete the picture of epidemiological transition. They are, however, very difficult to measure and a substantial proportion of ill people recover

without help or involvement from the health services and are not recorded.

It is also important to differentiate between infection and disease. "Infection" implies that the causative agent has entered the body of the host and is multiplying, but not necessarily with the appearance of signs and symptoms. In contrast, the term "disease" refers to the occurrence of clinical manifestations. The latter causes the greater concern to health authorities. For example, hepatitis B infection may only result in an infected person becoming a carrier capable of transmitting infection to susceptibles without evident clinical manifestations, at least for some years, and hence posing a covert threat to public health. This also applies to HIV infection.

Medical and epidemiologic uncertainties prevent an exact count of the number of diseases, infectious and noninfectious, that afflict human beings. There is no question that they are greater in number and variety than ever before.

Several examples have been given above of the changing pattern of communicable and noncommunicable diseases and related factors. This review shows that there is a

real pattern of decrease in the occurrence of diseases for which national immunization programmes are being implemented, specifically measles, diphtheria, poliomyelitis and tetanus, even though surveillance of these diseases has improved considerably. The reverse is observed with respect to malaria, which is showing an increase except in a few countries of the Eastern Mediterranean Region. Tuberculosis has shown a general decreasing trend, but is re-emerging and increasing in areas where HIV infection is spreading. The pattern of HIV infection shows evident continued increase.

Data on the incidence of chronic non-communicable diseases (i.e. the number of new cases per population unit per annum) would be ideal for depicting changing patterns of morbidity from these diseases. Unfortunately such data are not available in a comprehensive form that can be used to show patterns over time. Disease registers, such as those for cancer and for diabetes, and data from surveys are all recent, and surveys are rarely carried out using standardized methodology. Reliance is therefore placed on mortality data.

Predictions of incidence based on several considerations, including demographic structure and prevalence of predisposing factors, have been tried with some diseases. For cancer it is predicted that the number of new cases of all types of cancer in the world will increase from the present estimated level of 10 million cases per year to 15 million cases in 20 years (by 2015). This increase is expected to be highest in the developing countries.

The limitations with respect to morbidity data for cancer also apply to cardiovascular disease morbidity. Indirect indication of patterns may be obtained from data concerning disease risk factors. Hypertension as a risk factor for cardiovascular diseases has been recognized since the 1950s. Several studies

have examined the blood pressure levels of different population groups and the magnitude of related hypertension. At the same time, during the past 20 years the methodology used for measuring blood pressure in surveys has become more standardized, and results are also reported in a more uniform manner (according to age and sex), using a definition of hypertension laid down by the World Health Organization in 1978. It is clear from these studies that the prevalence of hypertension in the age group 40 to 60 is not low and could increase by more than 30%. However, in some populations it is reported to be very low. Even with low figures, it is clear that the number of persons with hypertension is comparatively high. Also, morbidity is increasing because of demographic changes and the increasing prevalence of major risk factors for these diseases.

It is sometimes difficult to differentiate between communicable and noncommunicable diseases. Researchers are discovering that some common illnesses with poorly understood etiologies, once considered to be noncommunicable diseases, may actually be at least partially the result of microbial infection. Examples are the relationship between *Helicobacter pylori* and peptic ulcer and the relation between human papilloma virus and cervical cancer. Also, rodent-borne hantaviruses may play a role in hypertensive renal disease, and no doubt hepatitis B and C viruses are the main causes of primary hepatocellular carcinoma.

Other indicators

Both mortality and morbidity data are outcome indicators, and it is essential to supplement them with other indicators that reflect the social and behavioural changes occurring in the community. One of these indicators is the fertility pattern.

With respect to fertility, Table 3 shows that the crude birth rate did not show a significant decrease until recently, which suggests strongly that the decrease in fertility occurs after the change in mortality, particularly in infants and young children. The fertility rate in the Region decreased from 6.7 in 1970 to 5.2 in 1990.

Conclusions and recommendations

The changing pattern of diseases observed over recent years, from acute infectious and deficiency diseases to the chronic noncommunicable diseases, is a continuous process of transformation with some diseases disappearing and others appearing or reappearing.

It is clear that infectious diseases are still an important public health problem and a major cause of death and of illness and will continue to be so for future generations. At the same time, noncommunicable diseases are coming to the forefront as causes of illness and death, especially in countries where it used to be possible to control many communicable diseases.

This transition is very vulnerable as many biological, environmental, social, cultural and behavioural factors have been responsible for structuring these patterns in the community. It is subject to breaks in continuity, slowdowns or even reversals of the transition.

Several stages of transition may overlap in the same country. This represents a challenge to national health authorities, which must continuously modify their health care services to address the needs created by this changing pattern of diseases. Epidemiological surveillance has a major role to play in identifying the chances and in planning how to address them and should be given the attention it deserves. Also, health authorities have an important duty to try and shape the transition in a positive way by all possible means.

The public has a major role to play, and hence the necessity for public health education and promotion of healthy lifestyles. Health education efforts to achieve positive behavioural changes are essential for the prevention and control of diseases. A carefully conceived media campaign can have a beneficial effect on changing behaviours related to the occurrence of diseases, such as smoking, obesity, alcohol consumption and other dangerous behaviour and lifestyles.