

The Principles of Epidemiologic Transition and the Experiences in Kenya

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Abstract

Throughout history, man has ignited dynamic changes in his ecosystem. In a cascading and feedback manner, these changes have, in return, significantly impacted on his probability of survival by exerting critical pressures that have shaped the population sizes, life styles, life expectancy and disease status. This position has been compounded further by climatic changes which have arisen as a consequence of man's activities that have disturbed the ecosystem balance. In deliberate efforts to place adequate food on the table, man has embarked on extensive land use thereby encroaching on new habitats and interrupting biodiversity balance. Within these new habitats, he has encountered new disease pathogens with expected consequences of wide oscillations in mortality rates. Migration as a result of conflicts, poverty, search for pastures and other forces have also thrown a critical spanner in these dynamics. In addition, the speed of mobility has become a key cog wheel in the process of change; in the 18th century, it took an average of six months to travel from one continent to another while today one can traverse three continents in twenty four hours. Industrialization coupled by global, regional and local socio-economic adjustments has also become a major pillar in the superstructure of these changes. The ultimate consequence of these changes on health has been one of definite transitions across phases of disease scenarios over time at both local and global levels. Phases of pestilence, receding pandemics and upsurge of chronic diseases have become evident at varying levels in different countries. The main objective of this review is to demonstrate from literature the underlying principles of epidemiologic transition and to highlight the experiences in Kenya.

Keywords: *Epidemiology, transition, pandemics, chronic diseases, demographics,*

Introduction

Epidemiologic transition is the health phenomenon in which mortality and disease shift in intensity from a pattern of high mortality in the face of infectious syndromes to one of low mortality in the face of chronic syndromes. In 1971, Abdel Omran postulated a theory which attempted to explain this phenomenon. He asserted that growth towards modernization traversed the stages of (1) Pestilence, (2) Receding pandemics and (3) Chronic diseases. In 1987, Richard Rogers and Robert Hackenberg added a fourth stage to account for the "cardiovascular revolution" of the 1970's which embraced the achievements of the treatment of cardiovascular diseases and significantly raised the life expectancies in industrialized countries (Caselli, 1996). However, some countries including those in Eastern Europe and more prominently so in Africa are still struggling to enter this stage.

Omran's theory makes the proposition that (1) mortality was fundamental in determining the population dynamics and that (2) protracted shift occurred in disease and mortality patterns such that pandemics were replaced by chronic diseases as cause of morbidity and eventual death. During the pre-modern times (ie before the industrial revolution), countries in Europe experienced cyclic rises and falls in population growth where fertility was left to the maximum and mortality escalated as a result of epidemics, famines, wars and other disasters like perpetual malnutrition and endemic diseases (Angel and Pearson 1953; Landis and Hatt 1954; Russel, 1958). These factors of population depression were popularly branded as "Malthusian Positive Checks". As a result of this, life expectancy was pushed to low ebb as reported by these authors (18

years for Greece, 22 for Rome, 35 for Britain and 34 for Geneva). The implication of this was the creation of very young populations and a long duration to bring about any detectable increase in population size.

With the inception of the modern times, populations experienced exponential growth but mortality still remained as the most important check of population growth (Chambers, 1957; Utterstrom, 1965; Vielrose, 1965). Pandemics were gradually replaced with chronic diseases at varying speeds in different countries thereby leading to the categorization of this change as “classical, accelerated or contemporary”.

Synthesis of literature reviewed

The synthesis of this review is to highlight the underlying determinants that act as drivers of changes in health in human populations. Such determinants are pegged on the ecology of human settlements, socio-economic setups and the technological advancements of man

Determinants of epidemiologic transition

Epidemiologic transition is a reflection of a complex interplay of a wide array of factors programmed to elicit changes in health and disease in human populations over time. Such factors are entrenched within demographic, socio-economic, technological, cultural, environmental and biologic confines. It is important to recognize that epidemiological transition is not unidirectional and that the changes can assume reverse directions. The transition is therefore a continuous transformation process. This is already happening in developed and industrialized countries where drug resistance by disease pathogens thought to have been eradicated is giving way to re-emergence of long forgotten diseases (Ronald et al 1998; Colwell, 1996). In Sub-Saharan Africa and other poor developing countries, an overlap of pandemics and degenerative diseases is gradually creating a new and unique scenario arising from non-functional health systems, unstable governments, civil wars, chronic famines and the unrelenting HIV, TB and Malaria infections. The combination of these factors has resulted in the plummeting of the life expectancy to a paltry 45 years (Craael and Schwartland, 1998). These factors can be classified as ecological, biological, socio-economic and medical determinants.

i). Ecological and biological determinants

A delicate balance exists between disease pathogens, the environment and man (Jianchu et al 2008; Forest and Lebel, 2001). In his struggle for survival, man initiates activities that culminate in disturbing this balance. A chain reaction is triggered by the resulting imbalance and this impinges on health and disease patterns thereby influencing mortality, morbidity and life expectancy. In an effort to sustain food security, man is constantly encroaching on new habitats for farming activities (Gardener and Dekens, 2007; Yan et al 2005). This undertaking erodes the buffer zone in the interface between man and wildlife thereby bringing him into contact with new pathogens previously confined in these habitats. This creates a conducive environment or emergence of new zoonotic diseases. Further, in the long term, residual damages become evident in terms of environmental degradation, the disturbance of the biodiversity balance and climatic changes.

ii). Socio-economic determinants

Health and disease are largely influenced by the standard of living, behavior and nutrition. Different diseases are experienced in different patterns by populations living under conditions of either poverty or affluence (Woodward et al, 2000; Navel 2000; Mukui, 2013). Poor hygiene, malnutrition and lack of adequate water are experienced by populations living below poverty

line and these are reflected in the nature and frequency of diseases in such populations. Affluent lifestyles including sedentarization and consumption of junk foods also manifest themselves in different types and frequencies of diseases. Similarly, changes in behavior and cultural values strongly impact on disease trends across time and place (Muniz, 2013; Skeldon, 2013). Changes in sexual behavior prompted either by cultural liberalization among the youth or by pressures arising from congestions in urbanized settlements have been reflected in upsurges of sexually transmitted diseases (Wasao and Bauni, 2001; Muwonge, 1980).

iii). Advancement in medicine and public health

Technological advances in both medicine and public health across time and place have significantly impacted disease patterns thereby altering both mortality and morbidity (WHO 2014). Advances in pharmaceutical sectors have come up with inventions of new highly efficacious drugs that have been used to treat diseases that previously caused high mortalities and morbidities (Weinstein et al, 2014). Likewise, advances in vaccine developments have drastically reduced mortality due to many infectious diseases through expanded immunization of vulnerable populations (Gerber et al, 2013). These curative and preventive interventions have influenced the transitions of disease and health in populations of interest.

Key issues arising from this synthesis

This synthesis brings to light three key issues, namely, recognition of the process of epidemiological transition, emerging and re-emerging infections and role of socio-economic changes in these dynamics of health and disease.

i). Process of Epidemiologic Transition

It has been advanced that, all societies experience three “ages” in the process of modernization: the “age of pestilence and famine”, during which mortality is high and fluctuating (Abdel R. Omran 1971), the “age of receding pandemics”, during which life expectancy rises considerably and the “age of degenerative and man-made diseases”, during which the visibility of degenerative diseases and man-made diseases become more frequent.

Some experts have seen life expectancies as generally converging towards a maximum age. The point of convergence has been 75 years (United Nations, 1975). Notably, in the most advanced countries, the increase in

life expectancy has slowed down since the 1960s and in some countries has even halted, in particular as concerns men (United Nations, 1975).

A new theory of the epidemiologic transition introduced the idea of a “fourth stage”⁴ (Jay Olshansky et al. (1990). The maximum point of convergence of life expectancies increases due to achievements in the treatment of cardiovascular diseases. .

This 4th stage is marked by stabilization and a decrease of cardiovascular diseases as a cause of death. It is also characterized by the emergence of new diseases (HIV, Ebola etc) and a revival of former diseases like cholera, malaria, dengue and Tuberculosis (Meslé et al, 1996).

There are, however, numerous exceptions observed to this trend. Many countries (in particular Eastern European countries did not experience the “cardiovascular revolution” (Meslé and Vallin, 1997).

Many other countries, especially in Africa, have not yet completed the second phase of the epidemiologic transition and are now hard hit by the arrival of new epidemics such as AIDS, and the re-emergence of older diseases (United Nations 2001). These African countries including Kenya now face a double burden of communicable diseases such as HIV and AIDS, TB and malaria; as well as CVD.

The Health transition process in developing countries started at a later stage and after World War II, most countries made huge progress that seemed to join the general trend of convergence (Meslé and Vallin, 2000, United Nations 2001). The struggle against infectious diseases, especially tropical diseases, was at first successful with some countries, mainly in Africa, able to reach a pace of progress sufficient to reduce the gap separating them from developed countries. During the 1980s and 1990s, this pace began to slacken with the arrival of AIDS. This caused severe reversals and towards the end of the 1980s life expectancy levels suddenly dropped (Pop Division, 1998; Caraël et Schwartländer, 1998,

Awusabo-Asare et al, 1997; IUSSP, 1997).

Countries with the highest life expectancies in 1970-75, especially those of Eastern Europe (Central Europe and European republics of the former

USSR) embarked on a period of stagnation and in some cases even a decline (G. Caselli, F. Meslé and J. Vallin 2000). These share a phenomenon which clearly set them apart from other industrialized countries.

ii). Emerging and re-emerging infections:

Centers for Disease Control and Prevention (CDC) have compiled a list of 29 newly emerging pathogens since 1973 (Barret et al 1998). The overall size is more a function of increased detection than the actual emergence of new pathogens in human populations.

Outbreaks of Ebola hemorrhagic fever have received much attention in the popular press. This has focused on the gory aspects of its clinical manifestations and high mortality rates. In 2013, a sudden outbreak of a virulent Ebola hemorrhagic fever hit the West African Region with its epicenter in the Central African Republic (CAR) (WHO 2014). Subsequently, there have been 800 confirmed or suspected cases of the hemorrhagic fever in Guinea, Liberia and Sierra Leone with 470 people dead (WHO 2014). The ongoing Ebola outbreak is the largest in terms of the number of cases and deaths as well as Geographical spread. WHO describes the epidemic as one of the most challenging since the virus was first identified in 1976 in DR Congo.

The change in climate and Ecology has been cited as a major factor in re-emerging infectious diseases (Martens et al 1995; Patz et al 1996). Warmer climates have led to increased coastal overgrowth of algae which creates a favorable environment for the proliferation of *Vibrio cholera*. Inland changes in temperature and humidity have increased the reproduction of malaria vectors (Martens et al 1995; Patz et al 2000). Most of these ecological changes are as a result of human activities.

Of the re-emerging infectious diseases, tuberculosis (TB) is the greatest contributor to human mortality especially in developing countries where 95% of all cases occur (Raviglione et al 1995). These diseases have led to the unfinished transition of most Sub-Saharan African countries including Kenya from the 2nd stage hence now the double burden of infectious and non communicable diseases.

iii). Impact of socio-economic changes

In this era of globalization health systems in Sub-Saharan Africa face challenges posed by health transition, that is, double burden of communicable and non communicable diseases. The biggest challenge is how to effectively respond to this double disease burden.

The current trend of globalization and urbanization has contributed significantly to the increasing unhealthy diet and unhealthy lifestyles resulting in an increase worldwide burden of chronic NCD e.g. cancers, cardiovascular and lung diseases, mental health and their associated risk factors (Mathenge, 2010).

The WHO data on the global burden of chronic non communicable diseases, reports show 246 million people living with *diabetes mellitus*, 70% of these live in Sub-Saharan Africa and that 65% of the estimated 972 million people with hypertension live in Africa (WHO, 2000, 2007). It is further estimated that NCD deaths will increase over the next decade, with African region taking the lion's share at 27% (WHO, 2007).

In Uganda for example the prevalence of HIV in 2007 was at 5.4% and tuberculosis incidence was 330 cases per 100,000 people. Malaria had incidence of 478 cases per 1000 people. Further reports indicate a rise in NCD where diabetes stood at 98,000 in 2000 and is expected to rise to 328,000 by 2030. (WHO, 2007). Prevalence is particularly high in the urban centres, for instant, it is estimated that 8% of residents of Kampala have diabetes type II (WHO, 2007).

This challenge of disease overlap of both communicable and non communicable diseases is prevalent in all countries of East Africa. In Kenya for example, a study carried out in Nakuru to investigate the relationship of urbanization with CVD risk markers in Kenya found out that from the 5010 participants 50.1% had hypertension, 14% had obesity, 7.7% had diabetes and 23% had high cholesterol. Like the case in Uganda hypertension, diabetes and obesity were more common in urban compared to the rural participants (Mathenge, et al., 2010).

On another study on the Maasai of Kenya that set to understand the benefits of the epidemiological transition on the pastoralists communities, found out that the sedentarized participants were worse off in terms of

disease burden than the nomad participants. The researcher observed that as far as the pastoralists are concerned the epidemiological transition is not linear but rather J- shaped. This is because in the course of transitions health might decline on the shift from purely nomadic to sedentarized but might improve once households adapt (Fratkin, 2001).

Health transition therefore, represents an enormous challenge to Kenya as a country in Africa with limited resources to respond effectively to the double burden of disease facing the population today. However, this challenge presents an opportunity for synergistic care which will involve strengthening the health systems which will in turn improve primary care delivery across a wide range of health problems encountered in health transition (WHO, 2010; Maher et al., 2009).

There is need therefore, for a common strategy of response that brings together the primary care providers and the health system strengthening so as to facilitate the integration of services to deal with the problems of health transition. This strategy may potentially enable access to funds for an improved response to health transition through application of health system strengthening to the Global Health Initiative (Maher et al., 2010).

Conclusion

The WHO projections are that in the next two decades, there will be drastic changes in the patterns of the world health partly due the global warming and other players (WHO, 2010).

As the nations of the world manage to reduce the morbidity and mortality rates to manageable low levels as far as the infectious diseases are concerned, today lifestyle and behaviour are linked to 20-25% of the global burden of the disease. This proportion is reported as rapidly increasing in developing countries where majority of the world population reside (WHO, 2010).

Currently, non-communicable diseases (NCD) and injuries due to road traffic, terrorism, tribal and inter-clan conflicts, and wars are fast replacing the traditional infectious diseases and malnutrition, as the leading causes of disability and premature death. The WHO projections are that by the year 2020, lifestyle diseases and injuries will account for seven out of ten deaths in developing countries (WHO, 2010).

The global burden of disease show that the epidemiological transition is already well advanced and the public health policy for developing countries will have to adapt to the new disease threat from the traditional emphasis on infectious diseases (Maher, et al., 2010). Further, the following health transition in developing nations must be accounted for. These include the mental health illness, such as alcoholic dependences, alcoholism, drug abuse, depression and schizophrenic conditions. In developing nations, adult population under 70 years of age face a higher threat of non communicable diseases due to the changing lifestyle and behaviour than the adults of same age in developed nations. It is estimated that tobacco will kill more people than any single disease including HIV/AIDS by the year 2030 (Maher,et al., 2010; WHO,2010).

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