

The “Epidemiological Transmission” and “Double-Burden of Disease”: A Focus on Africa

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ABSTRACT

"Double-Burden of Disease" or the "Epidemiological Transition" is a newly described insidiously growing global phenomenon, however, posing a special challenge to developing countries. Double burden of disease simply means the coexistence of communicable and non-communicable or chronic diseases. This review discuss the general outline of patterns in communicable and non-communicable disease transition, i.e. the “epidemiological transition that has occurred and is occurring in developing countries, taking Africa an example. From the Information and data on communicable and chronic diseases available online It is evident that epidemiological transition is gradually creeping in Africa, a coexistence of chronic and degenerative non-communicable diseases with the long-standing prevalence of infectious and communicable diseases in those societies. Africa, the main habitat of disease globally retaining its traditional reputation as harbouring the known communicable diseases, now is increasingly challenged by the package of the known chronic diseases characteristic of Western societies, the so-called “non-communicable diseases” which were almost not known before, are now responsible for 47% of all deaths in that region and are predicted to grow sizeably in the future. Besides malaria, Shistosoma, tuberculosis, haemorrhagic fevers, eye infections, childhood infections and HIV/AIDS, diseases of development and modernization of mostly non-communicable origin such as coronary artery disease, atherosclerosis and obesity are now topping the list disease ranking. Rural-urban migration, urbanization, overcrowding of African cities, adoption of western patterns of lifestyles or the “coca-colonization”, dietary and lifestyle change, exercise reduction, epidemic rates of tobacco & alcohol consumption, increased environmental pollution and allergen challenges, violence, psychiatric problems, are thought responsible. To conclude, the double burden of communicable and chronic diseases presents complex medical, psychosocial, economic and political challenges in Africa, these challenges undermine the development of effective and sustainable primary and secondary interventions, and a step-wise road map approach is suggested for such interventions.

Key words: Double-Burden of Disease; Epidemiological Transition; Communicable Diseases; Non-Communicable Diseases NCDs, Global Burden of Disease Studies GBDS

المخلص

«العبء المزدوج للمرض» أو «التحول الوبائي» ظاهرة عالمية تترادى تدريجياً، وتمثل تحدياً خاصاً للدول النامية. العبء المزدوج للمرض يعني ببساطة التعايش بين الأمراض المعدية والأمراض غير المعدية أو المزمنة. هذه المقالة تقدم عرضاً موجزاً للخطوط العامة لأنماط التحول الوبائي للأمراض المعدية والمزمنة التي حدثت وتحدث في الدول النامية، إفريقيا مثالاً. لقد تم استعراض المعلومات والبيانات عن الأمراض المعدية والمزمنة المتوفرة في البحوث المنشورة، التقارير، التدخلات، السياسات وأيضاً الأدبيات الرمادية. من الجلي أن الانتقال الوبائي يزحف بتدرج في القارة الإفريقية، حيث أصبحت الأمراض المعدية تتعايش في ذات الوقت مع الأمراض المزمنة والتنكسية في هذه المجتمعات. إن إفريقيا والتي تعتبر المحض الرئيس للمرض عالمياً محتقظة بسمعتها التقليدية في إيواء الأمراض المعدية المعروفة، تواجه الآن بحزمة من الأمراض المزمنة المعروفة التي تميز المجتمعات الغربية أو ما يسمى ب «الأمراض غير المعدية» والتي لم تكن معروفة من قبل، غير أنها الآن مسؤولة عن ٤٧٪ من كل الوفيات في القارة، كما أنها مرشحة للزيادة وبصورة مقدر في المستقبل. فجاناب الملاريا والبلهارسيا والدرن والحمى النزفية والتهابات العيون وأمراض الأطفال المعدية والإيدز، تأتي أمراض التمدن والتنمية الغير معدية المنشأ مثل أمراض الشريان التاجي، تصلب الشرايين، السمنة لتحل قمة ترتيب الأمراض. الهجرة من الريف إلى المدن، أنماط الحياة المدنية، ازدحام المدن الأفريقية، تبني الأنماط الحياتية للمجتمعات الغربية أو ما يسمى ب «استعمار الكوكا»، التغيير في الأنماط الغذائية والحياتية، قلة الحركة، المعدلات الوبائية لاستهلاك التبغ والكحول، التلوث البيئي المتزايد ومثيرات الحساسية، العنف والمشاكل النفسية بعضها أو كلها يعتقد أنها مسؤولة. تستجج الورقة أن العبء المزدوج للأمراض المعدية والمزمنة تمثل تحديات طبية ونفس-اجتماعية واقتصادية وسياسية على إفريقيا، وإن هذه التحديات تستلزم انشاء وتطوير تدخلات أولية وثانوية فاعلة ومستدامة، وتحتاج إلى خارطة طريق ذات نهج متدرج لإنفاذ هذه التدخلات.

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INTRODUCTION

It has long been recognized that as societies modernize, they experience significant changes in their patterns of health and disease [1]. Now, at the dawn of the third millennium, non-communicable diseases are sweeping the entire globe, not excluding developing countries where an increasing trend is also observable with the demographic and socio-economic transition imposing more constraints on dealing with the double burden of infectious and non-infectious diseases in a poor environment, characterized by ill-health systems [2].

Health and medicine are changing in Africa in many ways [3]. While endemic and communicable diseases are still predominating, the HIV/AIDS pandemic has radically changed the picture of Africa, [4] non-communicable diseases are also creeping, insidious and far reaching, and nowadays more and more Africans are now suffering from diabetes, hypertension, coronary heart diseases, malignancies, tobacco consumption, violence and psychiatric disorders; urbanization, lifestyle and dietary changes [2]. Industrialization underlies much of the increasing rates of this emerging phenomenon and is increasingly responsible for the ill health of the modern Africa, urbanization in Africa has been proceeding for several decades since the time of the so-called "Industrial Revolution" in Victorian Britain to become more rapid with more serious and diverse health and social consequences during the last decades [5].

DEFINING TERMS, AN EPIDEMIOLOGICAL TRANSITION MODEL:

Epidemiological transmission is defined as: *"a health situation on which there is a growing though insidious but rising prevalence of chronic and degenerative diseases as a result of demographic, lifestyle and behavioural changes while there is an already a persisting and existing prevalence of endemic communicable and infectious diseases"* [6].

In sub-Saharan Africa, a region plagued by infectious and parasitic diseases, nutritional deficiencies, and excessive maternal and perinatal morbidity and mortality, the prevention of cardiovascular diseases (CVD) and risk factors is rarely on the public health agenda [7]. In all countries there is the inevitable

priority given by health systems to acute infections, giving the way to misconceptions about and neglect of this creeping burden produced by chronic and degenerative diseases on the region [7]. Research since the 1970s shows that wealthy populations face higher risks of chronic diseases and poor communities face higher risks of infectious diseases as well as the "double jeopardy" of infectious and chronic diseases.⁸ Omran [1] developed an epidemiological transition model focusing on the complex changes in patterns of health and disease, the interactions between these patterns, and their demographic, economic, and sociologic determinants and consequences." In its original form, the model proposed three stages of epidemiological transition: the first stage, referred to as the "Age of Pestilence and Famine," was characterized by a demographic regime of high and fluctuating birth and death rates that reflected Old World epidemics of infection and famine, high death rates kept population growth to a minimum; the second stage was the "Age of Receding Pandemics," in which epidemics became less frequent and the impact of infectious disease on death rates declined; the third stage of the transition constituted the "Age of Degenerative and Man-made Diseases" which was largely driven by social factors such as lifestyle, diet, occupation, and income [9]. Omran [1] argued that as infectious and parasitic diseases receded, their place would be taken by a series of chronic, degenerative diseases associated with ageing populations, such as cardiovascular disease, stroke, and cancers: these diseases would become significant causes of mortality.

More recently, two additional stages have been added to Omran's model: a fourth stage constitutes the "Age of Delayed Degenerative Diseases" argues that degenerative diseases, such as cardiovascular diseases and cancers, still remain important as major causes of death, but changes in medical technology lengthen the life expectancy of elderly people suffering from cancer and cardiovascular disease, and a fifth stage or the 'Age of Emergent and Re-emergent Infections' is characterized by the resurgence of both old and new infectious and parasitic diseases [10-12]. Frenk et al. [13] has earlier proposed the protracted polarized model, a protracted coexistence of infectious and chronic diseases as a significant cause of morbidity and mortality.

CURRENT STATUS OF COMMUNICABLE & NON-COMMUNICABLE DISEASES:

THE COMMUNICABLE DISEASE BURDEN ON AFRICA:

Malaria:

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected mosquitoes. According to the latest estimates, there were about 207 million cases of malaria in 2012 (with an uncertainty range of 135 million to 287 million) and an estimated 627,000 deaths (with an uncertainty range of 473,000 to 789,000) mostly among African children [14].

HIV/AIDS & TB:

Sub-Saharan Africa is the most highly affected region in the world by HIV/AIDS, the number of people newly infected with HIV is 1.6 million–2.0 million in 2009, Kenya, Ethiopia, South Africa, Zambia and Zimbabwe composing the five largest HIV epidemics countries in sub-Saharan Africa. HIV prevalence in the region has been approximately 3% since 2005. 15 HIV/AIDS- Tuberculosis (TB) co-infection is an added burden, TB is second only to HIV/AIDS as the greatest killer worldwide due to a single infectious agent, 8.6 million people fell ill with TB and 1.3 million died from TB in 2012, among who about 320,000 were among people living with HIV [16].

Shistosoma:

Shistosoma is known to Africa since Pharaonic ancient times but then widely spread inside the continent during colonization times when huge canals and big plants to grow cotton were introduced [17]. Schistosomiasis is prevalent in tropical and sub-tropical areas, especially in poor communities without access to safe drinking water and adequate sanitation. It is estimated that at least 90% of those requiring treatment for Schistosomiasis live in Africa. In 2011, At least 243 million people required treatment for Schistosomiasis, among who only 28.1 million reported to have been treated [18].

Human African Trypanosomiasis (HAT):

HAT, also known as sleeping sickness is a parasitic disease transmitted by the bite of the 'Glossina' insect, commonly known as the tsetse fly, is typically affecting those African countries surrounding Victoria Lake, and is a main cause of morbidity and mortality as well as for people leaving away their home lands

and seek displacement elsewhere [19]. Untreated, it is usually fatal. In 1995, WHO Expert Committee estimated that 60 million people were at risk with an estimated 300,000 new cases per year in Africa, with fewer than 30,000 cases diagnosed and treated [19]. In 2004, the number of new reported cases fell to 17,616 and WHO considered in that due to increased control, estimated cumulative rate to be between 50,000 and 70,000 cases [19]. In 2009, the number of new cases reported dropped below 10,000 (9,878) for first time in 50 years and the estimated number of actual cases is currently 30,000 [19]. This trend has been maintained in 2010, with 7139 cases reported. Figure 2 maps distribution of human African trypanosomiasis (HAT) cases, 2000–2009. The next step, currently in progress, is to update the Atlas with data for 2010–2012.

River Blindness, Trachoma, Vitamin A deficiency and Measles are all still common in Africa, with approximately 10 per cent of the world's population, Africa has 19 per cent of the world's blindness, a combination of preventable and treatable conditions such as poverty, lack of education, River Blindness, Trachoma, Vitamin A deficiency, Measles and inadequate health-care services being the leading cause [20].

Cholera Epidemics:

Africa is still habitat for many cholera epidemic waves, and remains a major public health issue in the WHO African Region [21]. Between 01 January and 03 June 2013, a total of 25 762 cholera cases and 490 deaths were reported from 18 countries resulting in a CFR of 1.9%, the most affected country being DR Congo which accounted for 71% (18 375/30 283) of cases and 68% (333/490) of deaths followed by Mozambique (9% of cases and 1.7% of deaths) and Angola (7% of cases and 4% of deaths) [20,21]. The cases reported from DR Congo are mostly occurring along the borders with Congo, Tanzania, Zambia, Burundi, Rwanda and Uganda, heightening the risk of cross-border transmission of *V. Cholerae* [21].

NON-COMMUNICABLE DISEASE BURDEN ON AFRICA:

Male Dearth of accurate and representative mortality and morbidity data is one of Africa's health systems problems whether for communicable or non-communicable diseases. The Global Burden of

Disease Studies –GBDS- are an important source for such data and have relied mainly on models based on data of proportionate mortality and disease patterns from other parts of the world [22]. GBD studies estimated that, in 1990, non-communicable diseases contributed to 14% of the total burden of disease in sub-Saharan Africa and for 30% for adults aged 15-59 years; in 2005 malignant neoplasms were estimated to cause 23% of all NCD deaths mainly those cancers associated with infections as risk factors such as liver and cervical cancers; it is also postulated that by 2020 these figures are likely approximately to double[22]. According to more recent studies, the greatest number of deaths due to NCDs is in sub-Saharan Africa i.e. 1.03 million or 44% was attributable to cardio-vascular diseases and in contrast to all other regions, cerebrovascular disease rather than ischaemic heart disease was the most common single cause of NCD mortality [23].

In North Africa cardio-vascular diseases are the most important cause of death representing 62% of all NCDs with ischaemic heart disease as the largest single cause causing alone 30% of all NCD deaths followed by cerebro-vascular diseases of about 10% of the NCD deaths in that region [24].

There was a time when Africa was thought to be a continent, relatively free of diabetes mellitus illnesses. With imported dietary practices and globalization in the developing world, as Africa is, today, diabetes and its complications are considered an epidemic in Africa, the potential severity of diabetes is such that some epidemiologists predict that its economic impact and death toll will surpass the ravages of HIV and AIDS in the near future [25].

From an estimated one million Africans suffering from diabetes at the end of 2000, the figure is expected to rise to 18.6 million by 2030 [26,27].

Hypertension is an added epidemic, population growth and ageing have led to an increase in the number of people with uncontrolled hypertension from 600 million in 1980 to nearly 1 billion in 2008, with an overall global prevalence of raised blood pressure in adults aged 25 and over around 40%.28 Across the WHO regions, the prevalence of raised blood pressure was highest in Africa, 46% for both sexes combined [28].

Asthma, typically was a disease of the West that used to be an example of a chronic disease uncommon in Africa, is now showing an increasing prevalence [29]. The International Study of Asthma and Allergies in Childhood reveals an intercountry prevalence data limited to the seven African countries participated: English-speaking regions: Ethiopia 9.1%, Kenya 15.8%, Nigeria 13.0%, and South Africa 20.3%; and French-speaking regions: Algeria 8.7%, Morocco 10.4%, and Tunisia 11.9% [29].

Symptom rates are lower than in industrialized countries, while only South Africa approaches rates found in the UK. Rural African regions always showed much lower asthma prevalence rates than urban areas [30].

Major Forces for the Epidemiological Transition in Africa:

Demographic Change:

It is often unnoticed that the developing world is experiencing an aging population with its attendant increase in the burden of chronic NCDs, from July 1999 to July 2000, 77% of the world's net gain in elderly persons occurred in developing countries [31]. In sub-Saharan Africa alone, the number of persons aged 65 years and older is expected to increase by 50% in 2015, from 19.3 million to 28.9 million [32].

Changing Lifestyles & Living Conditions:

Rapid urbanization of the continent as well as the wide tobacco promoting activities practiced by multinational and global corporations are two major changes that suggest substantial rise of risk factors typically associated with an increased risk of NCDs especially cardiovascular disease and some cancers in African societies in the near future [33]. While in 1990 one-third of Africa's population were estimated to be living in towns, today's estimates talk about over 50% with predictions to reach two-third of the continent by 2020, rural-urban migration rates in Africa considered among the highest in the world [34,35].

Urban living tends to be associated with a series of NCD risk factors: high fat and sodium intakes, low levels of physical exercise, excess body fat, alcohol and tobacco consumption [33]. Data from many African countries substantiate this assumption, for

example the Tanzania study which documented that urban dwellers were significantly more likely to be overweight, less physically active, substantially higher in prevalence of diabetes and hypertension than rural counterparts [33]. Although Africa is the least urbanized continent with an estimated 34% of people in sub-Saharan Africa living in cities or towns, urbanization here is progressing at a more rapid pace than anywhere else on Earth [36].

Estimates suggest that between 1970 and 1995 the average African country's urban population grew by 5.2% per annum without being accompanied by economic growth, even Africa's gross national income declined by 0.7% per year [36].

Tobacco & the Globalization of Multinational Corporations:

The best example of globalization that is detrimental to health is provided by the tobacco industry which is actively seeking to substantially increase cigarette sales in Africa and other developing regions, as markets in developing region come under pressure[37].Lobbying African governments is an important part of their strategy, both to undermine the international tobacco control activities and to exploit some countries' economic reliance on tobacco as a cash crop [37].

Nutritional Changes & Globalization:

Globalization has had far-reaching effects on food consumption around the world, in certain developing regions the marketing and increasing availability of fast foods and fats, particularly cooking oil, has led to striking increases in average daily fat intake [37]. This phenomenon has been described as the "nutritional transition" is also occurring in Africa despite scanty data: evidence from South Africa has demonstrated a progressive shift from a traditional high carbohydrate diet to a higher fat content "western" diet over the last few decades in communities of low socio-economic status [37].

Socio-economic conditions: In general health and disease patterns are predictable from the prevailing socio-economic conditions which vary widely across Africa: NCDs are predominant in the wealthiest African countries of Mauritius and Seychelles compared to the picture found in Tanzania or Ethiopia, the very poor countries of sub-Saharan Africa [38].

Epidemiological Transition in Accra: An example from an African City:

It In their analysis of intra-urban differentials using existing data, and a study of epidemiological transition and double burden of disease in Accra city, Ghana, Stephens et al [39]. and Agyei-Mensah [40]. respectively have clearly described the phenomenon and demonstrated the creeping over of chronic diseases on the already existing burden of communicable disease:

In 1953: Infectious and parasitic diseases on top, followed by diseases of early infancy, then respiratory diseases and then low in the ranking and violence.

In 2001: Circulatory system diseases were on top, followed by infectious and parasitic diseases then respiratory diseases, neoplasms ranked fourth in the list while it was not reported in 1953.

DISCUSSION

Africa is now facing a double burden of both communicable diseases and an urgent but 'neglected epidemic' of chronic disease, the burden of which is already substantial [41]. By 2020, NCDs are predicted to cause seven out of every ten deaths in developing countries [41]. In some countries stroke, hypertension, diabetes and cancers cause a greater number of adult medical admissions and deaths compared to communicable diseases such as HIV/AIDS or tuberculosis [42]. At the same time, however, the dramatic spread of HIV virus faster in Africa than anywhere else in the world, leaves in its wake not only individual human tragedy but also huge social and economical problems, whole villages in some parts of Africa have disappeared [43].

In Eldoret teaching hospital in Kenya, the two adult medical wards experienced a rise of annual deaths from 80 deaths between 1990 and 1992 to 1200 deaths in the same wards in 2000; the mean age at death for the Kenyans declined from 52 to 38 in the same period; and twenty one percent of young women attending ante-natal clinics in Nairobi, 55% in Harare and over 60% in Kwa-Zulu had HIV/AIDS [43,44]. Health workers are themselves progressively eroded being victims of the combined TB – HIV effect: a Malawian study in 1999 showed that 2% of health workers mostly aged 35-44 died in a single year [44]. The AIDS pandemic is not, however, the only calamity

threatening the health of Africans, neither the other endemic diseases already discussed, still dominating the African scene, non-communicable diseases are also creeping, insidious and far reaching whereby more and more Africans are now suffering from diabetes, hypertension, coronary heart diseases, malignancies, tobacco consumption, violence and psychiatric disorders; urbanization, lifestyle and dietary changes [2].

Industrialization underlies much of the increasing rates of this emerging phenomenon and is increasingly responsible for the ill health of the modern Africa, urbanization in Africa has been proceeding for several decades since the time of the so-called "Industrial Revolution" in Victorian Britain to become more rapid with more serious and diverse health and social consequences during the last decades [45]. Coupled with and strongly linked to it is the adverse adoption of western lifestyle by Africans including reduced exercise and increased body weight, tobacco and alcohol use and poor quality of diets, urbanization and westernisation, sometimes referred to as the "coca-colonization", contribute to the process of epidemiological transmission [45].

Going away from village reduces snake bites, mosquitoes stings and soil-transmitted helminths, and for some provides a piped water and better sanitary conditions, however, it brings a coexistence of massive changes in lifestyle, using buses and taxis for transport instead of walking, more tobacco and alcohol consumed, quality of diet deteriorates, so rise in diabetes, hypertension, obesity, chronic obstructive pulmonary diseases, asthma, road traffic accidents, psychiatric disorders, violence and other non-communicable diseases, NCDs, but also towns and cities got overcrowded, people living in shanty towns with diseases of overcrowding like water borne diseases, TB, respiratory infections, and other communicable diseases also prevailing [46].

This is then the double burden of disease, the new challenge facing the health of the Africans, who haven't not yet got rid of the huge toll of communicable diseases and infections, now to fall prey to the classical chronic non-communicable diseases. Coronary artery disease was until recently rare in Sub-Saharan Africa, now emerging in the region as a leading cause of morbidity and mortality

in a country like Ghana [47].

It is predicted that, by 2020, non-communicable diseases will cause seven out of every ten deaths in developing countries among which special attention is devoted to cardiovascular disease, diabetes, cancer and chronic pulmonary disease [48]. NCDs have already occupied the first position in causing death and also disability worldwide, in 2000 responsible for 56% of all deaths and 40% of global disability NCDs, and not communicable diseases, are seen to mainly a challenge facing developed regions of the world causing 86% of all deaths there, now hazardous as well to developing regions already suffering the burden of communicable diseases, and responsible for 47% of all deaths [49].

A strong action is needed, and new players are to be mandated, and some experts have proposed a three-pronged solution consisting of epidemiological surveillance, primary prevention and secondary prevention [50]. In addition, interventions must be implemented through 'multifaceted multi-institutional' strategies that make efficient use of limited economic and human resources. 50 Epidemiological surveillance has been prioritized over primary and secondary prevention, but then developing effective primary and secondary prevention is seen to be the challenge to tackle Africa's chronic disease epidemic line in line with communicable and endemic diseases [50, 51].

There are best practice models within Africa, for example the South Africa's fiscal policy on tobacco which proved a good impact on tobacco use, and also the structural and community-based intervention strategies in Mauritius that led to the adoption of healthier diets and reduced cholesterol levels [52]. Robust intervention models exist from outside Africa such as those in Finland, the UK and the US [53].

CONCLUSION

The double burden of communicable and chronic diseases presents complex medical, psychosocial, economic and political challenges in Africa. These challenges undermine the development of effective and sustainable primary and secondary interventions. In a setting of low-income societies, characteristic of Africa, a double burden of disease is to be confronted

with minimal financial and human resources, necessitating practical and 'good practice' responses that can constitute replicable models of primary and secondary prevention. Good lessons can be drawn from the already mentioned best practice models within and outside Africa.

RECOMMENDATIONS

A "STEP WISE ROAD MAP" Approach – guided by the WHO standard approach, is suggested. The lower steps will be affordable by most developing countries and more detailed data collected as resources allow:

- Start with Surveillance – addressing the need for better data of the current burden [disease prevalence] and measuring prevalence of risk factors for likely future burden of major NCDs.
- Do this within available resources, both local and external agencies: this is a major challenge.
- National Programmes to Adopt an Integrated Prevention and Control of communicable and non-communicable diseases NCDs.
- Implement Evidence-Based Strategies such as:
- WHO Global Strategy on Diet, Physical Activity and Health
- A "Heart-Healthy & Stroke-Free" / "Smoke Free" World Initiatives: an aggressive prevention and control of cardiovascular risk factors in diverse community settings: schools, worksites, communities and health care systems and in promoting health aging.
- Emphasis to be placed on "Health Promotion" Approaches and models: policy development, systems change and reforms, strengthening public health capacity and infrastructures and legislative and regulatory mechanisms to address social environment and lifestyle factors which control leading risk factors.
- Action is needed to integrate Health Promotion, Risk Factor Control and Disease Prevention within the Primary Health Care Setting.
- Above all: Population-Based Approaches must be used to promote education and awareness of the importance of CVD risk factors.
- In sub-Saharan Africa where most people have no more than one CVS risk factor, a unique opportunity exists for Primordial Prevention i.e. preventing the development of risk factors from the first place.

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