

## Public health concern and initiatives on the priority action towards non-communicable diseases in Tanzania

SAYOKI G.M. MFINANGA<sup>1</sup>, SOKOINE L. KIVUYO<sup>1</sup>, LINDA EZEKIEL<sup>2</sup>, ESTHER NGADAYA<sup>1</sup>, JANNETH MGHAMBA<sup>3</sup> and KAUSHIK RAMAIYA<sup>4,5</sup>

<sup>1</sup>National Institute for Medical Research, Muhimbili Centre, P.O. Box 3436, Dar es Salaam, Tanzania

<sup>2</sup>Muhimbili National Hospital, Dar es Salaam, Tanzania

<sup>3</sup>Ministry of Health and Social Welfare, Dar es Salaam, Tanzania

<sup>4</sup>Shree Hindu Mandal Hospital, Dar es Salaam, Tanzania

<sup>5</sup>Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

---

**Abstract:** Tanzania is already facing challenges caused by existing burden of communicable diseases, and the growing trend of non-communicable diseases (NCDs), which raises a lot of concerns and challenges. The objective of this review is to provide broad insight of the “silent epidemic” of NCDs, existing policies, strategies and interventions, and recommendations on prioritized actions. A review of existing literature including published articles, technical reports, and proceedings from national and international NCDs meetings was carried out. The burden, existing interventions, socio-economic impact, lessons learnt, and potential for expanding cost effective interventions in Tanzania were explored. Challenges to catch up with global momentum on NCD agenda were identified and discussed. The review has indicated that the burden of NCDs and its underlying risk factors in Tanzania is alarming, and affects people of all socio-economic status. The costs of health care for managing NCDs are high, and thus impoverishing the already poor people. The country leadership has a high political commitment; there are policies and strategies, which need to be implemented to address the growing NCD burden. In conclusion, NCDs in Tanzania are a silent rising health burden and has enormous impact on an individual and country’s social-economical status. From the experience of other countries, interventions for NCDs are affordable, feasible and some are income generating. Multi-sectoral approach, involving national and international partners has a unique role in intensifying action on NCDs. Tanzania should strategize on implementation research on how to adapt the interventions and apply multi-sectoral approach to control and prevent NCDs in the country.

---

**Keywords:** Non-communicable diseases, public health, priority, strategies, interventions, Tanzania

### Introduction

Tanzania country strategy alongside with the international community has mainly focused on communicable diseases such as HIV/AIDS, malaria and tuberculosis. However, the non-communicable diseases (NCDs), mainly cardiovascular diseases (CVD), diabetes, chronic respiratory diseases, and cancer, have in emerged relatively unnoticed in the country, and are now raising major health concerns (WHO, 2010). Other important NCDs include haemoglobinopathies (in particular sickle cell disease), mental disorders, violence and injuries, and chronic renal conditions (Makani *et al* 2011; Garcia-Moreno *et al* 2006; Moshiro *et al.*, 2001). Based on WHO Global Status Reports (WHO, 2010) and existing clinical and public health experience, there are indications that NCDs have recently been increasing and are affecting people of all economic status. Given that Tanzania is already facing challenges caused by existing burden of communicable diseases, the growing trend of NCDs raises a lot of concerns and challenges on number of issues such as development, integration of health care, socio-economical impact and control strategies.

The objective of this review is to provide insight of the “silent epidemic” of NCDs, existing interventions and recommend on prioritized actions. This synthesis is envisaged to provide guided recommendations to priority actions required to combat NCDs. To provide this insight, existing published literature, technical reports, ongoing studies, reports by the Ministry of Health and Social Welfare (MOSHW), proceedings from NCDs meetings including UN agency and expert consultations

on NCDs burden and interventions were reviewed. An electronic literature search of PubMed for articles published up to 2011 was performed using a combination of subject headings and free text incorporating “NCDs and risk factors”, “diabetes, hypertension, cardiovascular diseases, cancer, COPDs, injuries and sickle cell anaemia”, and “ UN summit on NCDs”. The search was then extended by manually screening the reference lists of all included papers. We excluded those papers that carried the same messages and did not add value to the already selected papers. In this review the global burden is briefly reflected, and, the burden in Tanzania, existing interventions and lessons from experience are extensively explored. Furthermore, the potential for expanding to available cost effective interventions are discussed in line with the catch up with accelerating global momentum on NCDs agenda (Beaglehole *et al.*, 2011).

### **The burden of non-communicable diseases**

The epidemiological transition in most countries has reached a stage when the burden of NCDs outweighs that of communicable diseases. The burden of death and disability attributable to NCDs is rising everywhere because of the changing patterns in the way people live and work (WHO, 2010). NCDs are the leading cause of death globally - accounting for two thirds of all deaths (WHO, 2010). The four major diseases, mainly cardiovascular disease, cancer, diabetes and chronic respiratory diseases, share four common risk factors namely tobacco use including second hand smoke, unhealthy diet, physical inactivity and the harmful use of alcohol (Oberge *et al.*, 2011). The intermediate risk factors namely obesity, increased blood pressure and concentrations of glucose and cholesterol, are now common in the poorest countries, and are rising rapidly (Danaei *et al.*, 2011; Farzadfar *et al.*, 2011; Finucane *et al.*, 2011). Worldwide, there were 36.1 million deaths due to NCDs in 2008 and 80% of these deaths occurred in low and middle-income countries (WHO, 2010). Fourteen million people each year die prematurely from NCDs and there will be 52 million estimated worldwide deaths due to NCDs by 2030 (WHO, 2010). The WHO report challenges countries to review strategies for control of NCDs.

Sub-Saharan Africa (SSA) has a disproportionate burden of both infectious and chronic diseases compared with other regions of the world. Projections estimates indicate increases in NCDs are caused by demographic and epidemiologic transitions (Dalal *et al.*, 2011). Dalal *et al.*, 2011 reported that the prevalence of stroke ranged from 0.07 to 0.3%, diabetes mellitus from 0 to 16%, hypertension from 6 to 48%, obesity from 0.4 to 43% and current smoking from 0.4 to 71%. Hypertension prevalence was consistently similar among men and women, whereas women were more frequently obese and men were more frequently current smokers.

The prevalence of diabetes is increasing globally and SSA Africa is no exception. Type 2 diabetes accounts for more than 90% of diabetes in Sub-Saharan Africa, and population prevalence proportions range from 1% in rural Uganda to 12% in urban Kenya (Tuei *et al.*, 2010; Hall *et al.*, 2011). Reported type 1 diabetes prevalence ranges from 4 per 100,000 in Mozambique to 12 per 100,000 in Zambia (Hall *et al.*, 2011). The main risk factors include obesity, rapid urbanization, physical inactivity, ageing, nutrition transitions, and socioeconomic changes (Tuei *et al.*, 2010).

### **“Silent Epidemic” of NCDs in Tanzania**

Like in many other developing countries, Tanzania faces a double burden of communicable and non-communicable diseases and shall need to deal with both without jeopardizing the financing of communicable diseases (CDs). Information on non-communicable disease in the country is limited, although there is circumstantial evidence of the rise in number of the non-communicable diseases in

recent years. NCDs data is inadequate, and there is no national comprehensive data representing the country (WHO, 2010).

**Table 1: Comparable Estimates for NCDs Burden in Tanzania for 2008\***

Indicator	Males	Females	All
NCD mortality (Total NCD deaths in 100,000)	75,7	58.8	134.5
NCD deaths in <70 years (% of all NCD deaths)	64%	49.2%	56.6%
Current daily tobacco smoking (Age-standardized adjusted estimates)*	17.7%	2.5%	10.1%
Projected estimates of adult per capita consumption in litres of pure alcohol			7.86
Prevalence of raised total cholesterol (total cholesterol $\geq$ 5.0mmol/l)*	21.6%	25.5%	

\*Source (WHO Global Status Report, 2010)

The WHO Global Status Report on Non-communicable Diseases (WHO, 2010), highlights on various NCD burden estimates for Tanzania. These estimates are basing on various studies done in the country. The report states that, “there is no national comprehensive data representing the country and therefore, estimates are based on combination of country life tables, cause of death models, regional cause of death patterns, and WHO and UNAIDS programme estimates for some major causes of death (not including NCDs).” Therefore, WHO used statistical model to produce national representative estimates by country and sex. The estimates were produced basing on the following 3 general steps: Identifying data sources, accessing and extracting data; and converting extracted data to a comparable metric. The prevalence estimates by the World Health Organization somehow correlates with findings from some of the studies conducted in Tanzania. The reported estimates in this article are alarming and call for urgent community based interventions to address the situations especially considering ascertaining the burden, prevention measures and mitigating the impact caused by NCDs.

**Table 2: Prevalence of hypertension by location and type of type of study in Tanzania**

Location	Prevalence (%)	Sample size	Coverage	Design	Reference
Dar es Salaam (urban)	14.5	1222	Community	Population based, cross sectional	Ramaiya et al., 1991
Tanga Urban, Kilolo, Nyamagana,	31.3	1329	Community	Survey	MoHSW, 2007
Rungwe	21.3	9742	Hospital based	Surveillance	NIMR, 2010
Temeke	20.1	7444	Hospital based	Surveillance	NIMR, 2010
Dar es Salaam (rural), Arusha, Tanga	0.4	1673	Community	Community-based	Swai et al., 1993
Dar es Salaam, Arusha, Tanga	41.5	942	Community	Cross-sectional epidemiological	Njelekela et al., 2003
Dar es Salaam, Kilimanjaro	29.3	1698	Community	Cross-sectional population-based	Edward et al., 2002
Dar es Salaam (urban)	28.6	9254	Community	Cross-sectional epidemiological	Bovet et al., 2002
Dar es Salaam (urban)	57	209	Community	Cross-sectional epidemiological	Njelekela et al., 2009
Dar es Salaam, Mwanza, Zanzibar	88.8	498	Hospital based	Cross sectional	Huffman et al., 2011

NCD mortality (total NCDs deaths in 100,000) is 75.7 for males, and 58.8 for females (Table 1) (WHO, 2010). The country estimated prevalence of raised blood pressure and diabetes is about 45.0% and 5%, respectively, in adults aged 25+ years (Table 2 and 3) (WHO, 2010). According to the unpublished report the prevalence of raised blood pressure in Tanga, Iringa and Mwanza in 2007 was 31% (MoHSW, 2007). A study of prevalence of Chronic Obstructive Pulmonary Disease (COPD) in a sub-urban population of Kinondoni in Dar es Salaam, reported a prevalence of 12.6%. The study suggests that the prevalence of COPD in Dar es Salaam is high, despite of a young population (Knudsen, 2009).

According to the global cancer database (GLOBANCAN, 2008) for Tanzania data, and basing on 100,000 persons per year, number of new cancer is 21.2, number of death from cancer is 16.3, and five more frequent cancers, estimated at 100,000 persons per year, are cervix uteri (50.9), oesophagus (11.2), breast (10.1), Non-Hodgkin Lymphoma (2.3), lip and oral cavity (3.9), and prostate for men (8.8). In addition to the 4 major NCDs, Tanzania considers mental health, haemoglobinopathies, violence and injuries as major NCDs requiring equal attention (Moshiro *et al.*, 2001; Garcia-Moreno *et al.*, 2006; Makani *et al.*, 2011). Haemoglobinopathies are conditions that result from defects genes that control the expression of the haemoglobin protein, and due to these defects the genes produce abnormal haemoglobin, which result to anaemia diseases. Haemoglobinopathies include Sickle cell and thalassemia anaemia. Makani *et al.* (2011) reported sickle cell anaemia mortality rate of 1.9 per 100 PYO, and 7.3 per 100 PYO in under 5-years old in a hospital based cohort. According to a Global Report on Birth Defects (2006), the frequency of sickle heterozygous carrier state (AS) in Tanzania is 13% with an estimated annual birth of 8,000 homozygous SS children (Christianson *et al.*, 2006).

**Table 3: Prevalence of diabetes mellitus by geographical location in Tanzania**

Location	Prevalence (%)	Sample size	Study population	Design	Reference
Dar es Salaam	9.8	1222	Community	Population based cross-sectional	Ramaiya <i>et al.</i> , 1991
Dar es Salaam, Arusha, Tanga	0.2	1673	Community	Cross sectional survey	Kitange, 1993
Dar es Salaam (urban)	6.0	209	Community	Cross-sectional epidemiological	Njelekela <i>et al.</i> , 2009
Dar es Salaam, Mwanza, Zanzibar	15.2	498	Hospital based	Cross sectional	Huffman <i>et al.</i> , 2011

A standardized population-based household survey was done to 24, 097 women aged 15 – 49 years, between 2000 and 2003 to determine the prevalence of physical or sexual partner violence. The findings indicated a lifetime prevalence of physical or sexual partner violence, or both, of 15% to 71% (Garcia-Moreno *et al.*, 2006). In a population-based study it was found that among all ages, deaths due to injuries accounted for 5% of all deaths in Dar es Salaam, 8% in Hai and 5% in Morogoro (Moshiro *et al.*, 2001).

In a study conducted in Dar es Salaam among admitted cases from four hospitals, the largest categories of injuries were road traffic injuries (43.7%), violence and assaults (23.5%), while falls (13.8%) and burns accounted for 6.5% of the cases (Mutasingwa & Aarø, 2001). In 1994 the total number of road accidents that had occurred was 10,674 while in 2004 it had increased to 17,039 accidents, an increase of 60% (URT, 2005). Museru & Leshabari (2002) described motorcycle injuries as major but neglected emerging public health problem in major cities in Tanzania. A recent study conducted in the northern part of Tanzania showed that motorcycle injury patients constituted 37.2% of all road traffic injuries with a mortality rate of 16.7% (Chalya *et al.*, 2010). These findings shows

injury and violence should not be left aside, both conditions raise public health concerns, which need strategies to be addressed in appropriate manner. For instance, road traffic injuries could be mitigated by encouraging use of protective gear like sit belts, helmets and encouraging enforcement of traffic laws (Chalya *et al.*, 2010).

The existing limited information from the Demographic Health Surveys done in Temeke, Hai and Morogoro Rural districts, have demonstrated that the risk of dying from non-communicable diseases during adulthood (15-59 years) is considerably high in Tanzania compared to developed countries. The Adult Morbidity and Mortality Project carried out during 1994-2002 reported that NCDs account for between 15-28 % of all Years of Life Lost in Tanzania (MOHSW/AMMP, 2004). Published data from the same project reported adult male mortality rates associated with diabetes accounted for 34, 30, and 15 per 100,000 per year in Dar es Salaam, Hai and Morogoro respectively, and the figures in women were 21, 18, and 4 per 100,000 per year, respectively (McLarty *et al.*, 1996).

**Table 4: Prevalence of smoking by geographical location from community based surveys in Tanzania**

Location	Prevalence (%)	Sample size	Reference
Dar es Salaam, Arusha, Tanga	3.85	1673	Kitange, 1993
Tanga urban, Kilolo, Nyamagana	10.8	1329	MoHSW, 2007
Dar es Salaam	27.0	605	Jagoe <i>et al.</i> , 2002
Dar es Salaam	1.3	209	Njelekela <i>et al.</i> , 2009
Dar es Salaam	8.7	899	Mbatia <i>et al.</i> , 2009
Iringa (rural)	6.0	383	MoHSW, 2007

Smoking and alcohol consumption are some of the most common and major risk factors for non-communicable diseases. According to the unpublished report the prevalence of alcohol consumption was 33% and smoking was 11% (Table 2) in Tanga, Iringa and Mwanza in 2007 (Table 4) (MoHSW, 2007). Recent survey for NCD risk factors indicates that in Rungwe, Mbeya Region prevalence of the risk factors is substantially high (Manumbu, 2011). For instance, Manumbu (2011) reported that prevalence of smoking was 11.0% for males and 0.4% for females. Other risk factors reported by Manumbu (2011) included daily alcohol consumption of 28.0% for males and of 14.4% for females; vigorous intensity recreational activity of 4.9% for males and of 1.1% for females; hypertension (systolic  $\geq 140$  or diastolic  $\geq 90$ ) prevalence of 44.4% for males and of 44.8% for females; overweight with body mass index (BMI) 25-29.9 of 31.4% for females and of 17.9% for males; and obesity with BMI of 30 or more of 17.8% for females and of 8.6% for males. The report showed that vegetable and fruit consumption of 5 servings or more per day (WHO recommended) was negligible, but almost all had 1-2 vegetables daily. Other studies have reported a prevalence of obesity ranging from 4.1 to 22.8% (Table 5).

**Table 5: Prevalence of obesity (derived from body mass index) from community based studies in Tanzania**

Location	Prevalence (%)	Sample size	Reference
Dar es Salaam	13.3	1222	Ramaiya <i>et al.</i> , 1991
Dar es Salaam, Arusha, Tanga	6.0	1673	Kitange <i>et al.</i> , 1993
Dar es Salaam, Arusha, Tanga	22.8	942	Njelekela <i>et al.</i> , 2003
Dar es Salaam	4.1	209	Njelekela <i>et al.</i> , 2009

### Socio-economic impact of NCDs

Huffman *et al* (2011) conducted a multi-countries study to estimate individual and household economic impact of cardiovascular disease (CVD) in selected low- and middle-income countries (LMIC), namely Argentina, China, India, and Tanzania. For Tanzania, Huffman *et al*, (2011) indicated

that most of the people (73-92%) with heart diseases spend more than 40% of their non-food income on care and treatment (catastrophic health spending). Catastrophic Health Spending in the study was high in all income groups and was associated with rural status and lack of private/social health insurance. About one-third of the respondents did not comply with medications as prescribed, which was largely due to the high costs (76%). Furthermore, most of respondents decreased their work time, limited their work activities, and felt limited following their CVD related hospitalization. A greater proportion of family members decreased their work time rather than increased their work time to care for the patient (Huffman *et al.*, 2011). Kagaruki (2010) reported that the country is spending more than \$30m annually to treat tobacco-related cancers.

Considering that poor communities are vulnerable to NCDs, as they have access to cheap but nutritional harmful foods and are exposed to unhealthy lifestyles, the already impoverished families face serious challenges to meet the high cost of health care for NCDs. Therefore, NCDs will continue to have major impact on poverty if the current situation is left unchecked. In addition to interventions for control of NCDs, strategies for health insurance coverage need to be improved. Health insurance schemes and civil society organizations have roles in supporting the impoverished families. In this area, research is needed to prioritize on inter-sectoral and multidisciplinary approach to understand and influence the macroeconomic and social determinants of NCDs and exposure to NCD risk factors.

As regards to traffic accident injuries, Komba, (2006) reported that the technical element of the highway construction, corruption, irresponsibility, poor management, driving while using cell phone, driving without training, failure to respect and obey traffic regulations, bad condition of vehicles, age of the vehicles and poor condition of services are the important risk factors associating to the cause of traffic accidents in Tanzania.

### **Existing policies, strategies and interventions for control of NCDs**

The government of Tanzania has shown commitment for control of NCDs by establishing a Non-Communicable Disease Unit under the Ministry of Health and Social Welfare. The Unit is responsible for coordinating formulation of various NCDs policies. The MoHSW in partnership with other stakeholders has established a number of other initiatives to combat the rising epidemic of NCDs. These initiatives are briefly discussed below.

#### **Legislations, strategies and policies for control of NCDs**

The government has established law, regulations and legislations for control of NCDs. Food Regulations (GN No. 83) concerning control of quality and iodated salt was developed in 1994, followed by three laws that focus on NCDs control. These include Tanzania Food, Drugs and Cosmetics Act No 1 of 2000, Intoxicating Liquors Act Cap 77 RE 2002, and Framework Convention for Tobacco Control (FCTC). Tanzania signed the FCTC in January 2004, and ratified it in April 2007 (WHO, 2007). Seven of 11 key policies have been enacted, but more and serious efforts are needed to fully implement the FCTC. In addition, the Ministry of Health and Social Welfare has developed strategies for control and prevention of NCDs, and these include the Cancer Strategy, 2008, National Strategy for Non Communicable Diseases, 2008-2013 and Tanzania Non-Communicable Disease Action Plan developed in 2011.

#### **NCDs research and surveillance initiatives**

Research strategies on NCDs are included in research priorities of research institutions, including the National Institute for Medical Research, Ocean Road Cancer Institute, Muhimbili University of Health and Allied Sciences and Sokoine University of Agriculture. The Ministry of Health has, in addition,

directly collaborated with other institutions to conduct several research projects including Adult Morbidity and Mortality Project (1994-2002), WHO Steps Survey (2007/08), and Tanzania Demographic and Health Survey (2010).

Health facility based surveillance for NCDs in the country has not been given priority for the past many years. Consequently the Ministry of Health has no reliable statistics for NCDs. The current Integrated Diseases Response and Surveillance (IDRS) guidelines have incorporated NCDs, using experience from stakeholders including the experience gained from a programme funded by the International Association of Public Health Institutes and run by the National Institute for Medical Research. The programme entitled, Strengthening Non-Communicable Disease Surveillance and Response in Tanzania, aims at developing an evidence-based approach to establishing national surveillance for NCDs, creating the foundation for a national programme through training and exchange visits, identify additional support for Ministry of Health priorities related to NCDs, and creating community awareness of NCDs and the need for health status monitoring and seeking care.

Through this programme NIMR in collaboration with MoHSW has developed an NCD surveillance program in two urban and rural districts, namely Temeke in Dar es Salaam and Rungwe in Mbeya. The aim of the surveillance is to get comprehensive hospital based NCDs data to supplement on studies done in the community, for policy formulation and planning.

### **Other initiatives**

The Ministry of Health and Social Welfare has put in place several nutritional initiatives including Vitamin A supplementation (coverage is 60%), Iodine supplementation (coverage is 85%) programmes. Currently, all pregnant mothers do receive iron and folic acid supplementation and all school children are been dewormed. The Ministry has adapted a policy on promotion of exclusive breast-feeding, integrated management of acute malnutrition and food fortification under national reproductive care services.

The Ministry of Health and Social Welfare has been working closely with Tanzania Diabetes Association (TDA) since 2003 to establish a comprehensive programme for diabetes care in public, private and faith-based health care facilities in the country. National Diabetes Programme and National Kidney Foundation were launched in 2011.

Muhimbili University of Health and Allied Sciences (MUHAS) established and run a 2-month diploma course on diabetes education since 2009. The National Institute for Medical Research, Ministry of Health and Social Welfare, the Centers for Disease Prevention and Control (CDC), University of Copenhagen and MUHAS have developed a short annual course on NCDs in 2011. Again, NIMR, MoHSW, CDC, developed a Master degree program that has NCDs track incorporated in the Field Epidemiology and Laboratory Training Programme course. The first enrolment of candidates into this course started in 2010. In addition, currently the government is supporting 15 students undergoing a super speciality training programme for cardiology, nephrology, neurology, neurosurgery and cardiac surgery.

Further experience can be learned from the Step-by-Step training project. This program focuses on (i) targeted screening and surveillance activities; (ii) early detection of foot complications and ascertainment of risk factors that could likely lead to disease progression; (iii) improving education of healthcare personnel who are actively involved in the management of the diabetic foot and (iv) the enhancement of diabetic foot management skills. This programme has been proven to be an effective model as it has improved foot ulcer management for persons with diabetes at the local level and less referral to main tertiary care centre. It has enhanced the sharing of knowledge and skills among doctors and nurses, and resulted in permanent, operational foot clinics across the country (Abbas *et al.*, 2011).

## Implementation of policies, strategies and initiatives for control of NCDs

The aforementioned laws, regulations and various initiatives, affect the fight against non-communicable diseases in the country. The main drawback is weak implementation of the strategies and enforcement of the laws, and therefore it is becoming difficult to achieve the intended results. As it is for now, the implementation of the laws, regulations and various initiatives is fragmented. Most of these interventions address specific conditions, and none is integrative even within the health sector. Moreover, the fight against non communicable diseases should not be left to be one for the health sector or government only, the fight requires multi-sectors, multi-disciplinary and civil society approach to make sure that health laws are effectively implemented. Priorities should be directed to consolidating the fragmented efforts, promoting results oriented collaborative efforts, engaging partners outside the health sector, and scaling up by pooling limited resources together for NCDs control and prevention.

As regarding tobacco law, an unanswered question is, whose role is to ensure implementation of the law and how best can this be achieved? Tanzania needs to strengthen tobacco control strategy to save the nation from the “silent rising epidemic “of NCDs. Shafey *et al.*, (2003) reported that the total percent tobacco tax assessed in Tanzania is 47.2% (average excise tax plus sales tax). However, Mackay *et al.* (2006) doubt the evidence suggesting that Tanzania dedicates any portion of this tax to tobacco control and health promotion. Selling tobacco products to minors (<18 years) and in locations near schools are legally prohibited in Tanzania (Shafey *et al.*, 2003). However, the Global Youth Tobacco Survey (2003) showed that some of the in-school youths from the cities of Arusha, Moshi and Dar es Salaam reported to have bought their cigarettes in stores and were not refused purchases because of their age. In Tanzania, cigarettes advertising on radios, televisions, and domestic print media are banned. However, billboard advertising for tobacco products, point-of-sale advertising, and event sponsorships are still happening (Shafey *et al.*, 2003; Mackay *et al.*, 2006).

The tobacco has law prevent smoking in health care facilities, and the law requires restaurants to provide no-smoking sections as an option to customers (Shafey *et al.*, 2003). Nevertheless, there are no laws against smoking in public places, such as government worksites, educational facilities, and public transportation areas. There are no available tobacco use cessation programs in the country like the ones that are in Europe (Mackey *et al.*, 2006).

Alcohol consumption in many parts of Tanzania was traditionally linked with cultural ceremonies and rituals. A lot of young people start experimenting with alcohol out of curiosity or peer pressure. The use of alcohol is now part of Tanzania's social life, whether at a wedding, a funeral or just at a gathering of friends. Tanzania has strict legislations designed to control alcohol, like banning under 18-year olds from entering alcohol dispensing outlets as well as stating opening and closing times for bars and groceries. Alcohol is banned in government offices, educational buildings, and health care establishments. The government controls retail sale and production of alcohol by putting requirement of a license. Unfortunately, these laws and regulations are hardly enforced by the authorities partly for lack of resources, both manpower and financial. As a result some people drink throughout the day, and sometimes during office hours. For example, it is very common in urban areas to see underage children enter bars or groceries to buy drinks for their parents or guardians. This habit gradually introduces children to alcohol abuse. Also the law does not restrict advertising on TV, radio, billboards, and print media. Alcohol is also glamorized in the media in the form of advertisements and promotion. Usually people shown in alcohol promotion are associated with beauty, power and success. There is no requirement for putting health warning on advertisements, or restrictions on sponsorship of sports event or youth events.



As for tobacco and alcohol Acts take aboard most of the universal control strategies, it is recommended to ensure that appropriate measures are taken especially by addressing the rampant advertising and promotional activities by tobacco and alcohol companies and to educate the community on the benefits of the laws to the health of all people. A successful tobacco and alcohol control plan requires creativity, information sharing, well-developed strategies, and allies in the media and government.

From the foregoing discussion it appears that efforts by various stakeholders in Tanzania will need to be coordinated. To achieve this, various stakeholders need to jointly put forward a clear plan of action and implementing by dividing roles based on experience and interest of the stakeholders. Consideration should be given to employ research in order to identify the gaps and necessary and appropriate interventional strategies for tobacco control in Tanzania.

In terms of road traffic accidents, Tanzania has traffic laws, regulations and mode of enforcement designed to ensure traffic safety in Tanzania. However, traffic laws and regulations enforcement is weak. The traffic police should strengthen surveillance and enforcement to net drivers who drink alcohol, use cell phone while driving and not following traffic laws.

Concerning lifestyle and nutrition, lower, middle and upper income communities in the country have access to cheap but nutritionally harmful foods and are exposed to unhealthy lifestyles, mainly due to urbanization and trade liberalization. When people move from rural to urban settings, their lifestyle including food supplies change as well as their diets, and body shape and composition. Popkin *et al.* (2001) reported that urban diet, even in very low-income countries and the poorest areas of cities, contains much more energy from fats and sugar than the rural diet. Urban food is more likely to be processed and often contains more highly refined cereals and sugars and fewer unrefined, staple foods than rural diets. In urban areas, even poor people are able to afford processed foods (Popkin *et al.*, 2001). Observations show that prices of these commodities go down with the reduction of tariffs brought about by trade liberalization (Popkin *et al.*, 2001) and Tanzania is not exceptional. Therefore inadequate implementation of food safety standards and regulations has opened the door to low-quality processed food that may result in serious health risks. The growth of fast food services has influenced changes in the consumption and behavioural pattern of people especially in urban areas of the country. This change in food pattern, known as nutrition transition, is a shift from diets of varying nutritional quality (based on indigenous grains or starchy roots, locally grown legumes, other vegetables and fruits, and limited foods of animal origin) toward more varied diets that include pre-processed food, more foods of animal origin, more added sugar, salt and fat, and often, more alcohol (Popkin *et al.*, 2001).

Physical inactivity and leisure, often lead to overweight and obese people, and worsen the above-discussed nutritional transition. Popkin *et al.* (2001) reported that reduced physical activity and habitual inactivity accompany the nutrition transition in persons of all ages. The article further reaffirmed that modernization and industrialization lead to reduced physical activity, at work and at home, for men and women. The country will need to strategically invest in promotion of healthy lifestyle, nutrition consciousness, and awareness on common risk factors associated with non-communicable diseases. In addition, the promotion strategy should include encouragement for consumption of food with high nutritional value.

WHO recommends eating lots of fruits and vegetables, reducing fat, sugar and salt intake and exercising. The advice on type of food should depend on the available type of foods within a community and eating habits within the household. Based on height and weight, people can check their body mass index (BMI) to see if they are overweight. Individuals should be encouraged to maintain a normal BMI (18.5-25kg/m<sup>2</sup>). WHO released a Global Status Report on NCDs, which highlights the extent of the burden of diseases, underlines the role of poor nutrition as a determining factor (alongside physical inactivity, alcohol consumption and tobacco use) and calls for limiting food

marketing to children as a cost-effective policy instrument (WHO, 2010). All individuals should be encouraged to undertake regular physical activity at least five times per week, should eat health food and maintain a normal BMI (WHO, 2010).

### Catching up with Rising International Momentum for Control of NCDs

United Nation High-Level Meetings (UN HLM) provided international momentum for prevention and control of NCDs, and expanded political leadership that is necessary for multi-sectoral partnership and can serve as a respected forum for dealing with the issue across numerous key UN agencies.

**Table 6: The Road map to United Nation high level meeting**

Meeting/Activity	Dates conducted
UN General Assembly (Resolves to hold a UN High-Level Summit on NCDs)	13 May 2010
WHO Regional Consultations on the UN Summit	October 2010-Apr 2011
Eastern Mediterranean Regional Office Consultation, Tehran, Iran	25-26 October 2010
European Region Consultation, Oslo, Norway	25-26 November 2010
UN General Assembly pass a resolution (Modalities Resolution) which defines the details of the UN Summit	November-December 2010
Pan American Health Organization Consultation, Mexico City, Mexico	23-25 February 2011
South-East Asia Regional Office Consultation, Jakarta, Indonesia	1-4 March 2011
Western Pacific Regional Office Consultation, Seoul, Republic of Korea	17-18 March 2011
Civil Society Task Force established- to report to the Office of the President of the UN General Assembly	March 2011
African Regional Office Consultation, Brazzaville, Congo	4-6 April 2011
WHO Global Status Report on NCDs published	April 2011
Commonwealth Ministers of Health Meeting, Geneva, Switzerland	15 May 2011
World Health Assembly, Geneva, Switzerland (Preparations for the UN General Assembly on the prevention and control of non-communicable diseases)	16-24 May 2011
Outcomes Document negotiations	April-June 2011
Draft Outcomes Document finalized	June 2011
Civil Society Hearing in New York	16 June 2011
Final Outcomes Document agreed upon at the UN Summit on NCDs	19-20 September 2011

Tanzania government delegates participated in key meetings in the road map (Table 6). The delegates shared Tanzania experience and contributed to resolutions resulted from the meetings. A number of cost effective interventions and needed action were discussed during these meetings. During the Summit, UN member states reached a consensus to the outcome document to be referred as Political Declaration Document after long discussions. The document includes global and national targets on the NCDs epidemic that governments will commit to fulfil.

Discussions during all these UN meetings revealed that a major shortcoming of the UN Millennium Development Goals is the lack of mention of Non-Communicable Diseases (NCDs). The MDGs do not mention cardiovascular diseases, cancer or diabetes, even though this place a far greater burden on global health and economic development than the infectious diseases (e.g. Malaria and HIV/AIDS), and are predicted to continue to increase in epidemic proportions. NCDs need to be included in the development agenda and perhaps included on to the millennium development goals although the time frame is short. Now the end point for the MDGs is approaching, UN needs to consider including NCDs in future development goals.

## Available cost-effective interventions

Prevention and control of NCDs is crucial to reduce the burden, and protect future generations by providing an environmental supportive to people's healthy. Multi-sectoral approach in control and preventive interventions, including policy changes, regulations, and market interventions, are of highest priority. Once NCDs develop, the burden on health systems, already ill prepared and equipped in many countries, is substantial ( Samb *et al.*, 2010). The costs of the priority interventions that dwell on preventing NCD are likely to be small. For instance, the yearly cost to implement three priority interventions (tobacco control, salt reduction, and treatment of cardiovascular risk) in 23 high-burden countries was estimated in 2007 to be about \$6 billion ( Beaglehole *et al.*, 2007).

The most cost-effective interventions are tobacco control and salt reduction, requiring actions outside the health system to achieve the maximum effect, and low-cost generic drugs for people at high risk of a heart attack or stroke (Asaria *et al.*, 2007; Lim *et al.*, 2007). These two actions (tobacco control and salt reduction) are affordable in most countries. To implement other priority interventions, countries will need to find new resources, which for many would be well within their existing and growing health-care system budgets. In this areas, research need to focus on implementation research on how to apply the proven cost-effective strategies.

Mendis & Alwan (2011) have shown that there are effective interventions such as technologies used for diagnosis and treatment of NCDs, which are expensive. An example of this is interventions for investigative and surgical procedures for CVD, cancer and radiotherapy techniques for cancer. Research will need to focus on how to improve affordability and accessibility in the context of varying resource settings and health care systems.

## Learning from experience

Political commitment is of paramount importance in the prevention of NCDs. This include action such as increased taxes on cigarettes, bans on smoking in public places, bans on cigarette advertisements, provide alternative income generating activity for tobacco farmers. A good example can be taken from Finland, which until 30 years ago it had the highest CVDs mortality in the world due to high smoking and intake of animal fat. With the ban of tobacco advertisement, introducing low fat dairy products, replacing of animal fat with vegetable oils and aggressive public health education; cholesterol declined by 1.3 mmol, blood pressure reduced by 9.9/7.7, smoking reduced by 21% in 5 years (1992-1997) and the CHDs mortality reduced by 73% in eastern Finland (Puska, 2010).

Changes also are possible at the national level if economic measures are taken into account. Poland reduced subsidies on butter, introduced cheap vegetable oils and import duty free fruits and vegetables in 1994 – 2004. The results were decline in ischemic heart diseases by 25%, decrease in animal fat and increase vegetable oil use by 25% and 48% respectively, increase consumption of fruit and vegetable from 2.8kg/year to 10.4 kg/year (Zatonski *et al.*, 1998).

Regarding tobacco use, priority intervention should be directed to achieve a suggested global goal by 2040 of a world essentially free from tobacco where less than 5% of the population uses tobacco. Lightwood *et al* (1997) and Sims *et al.* (2010) suggested that preventive interventions can be applied in a step-wise manner, according to the country's readiness and resources available. Countries are advised to accelerate full implementation of the Framework Convention of Tobacco Control and provide simple services for tobacco cessation for all smokers. Tobacco control interventions will have immediate health and economic benefits because reduction in exposure to tobacco smoke, both direct and second hand will reduce the burden of NCDs and thus health expenditures (Lightwood *et al.* 1997; Sims *et al.*, 2010).

## Actions needed

The impending NCDs pandemic has called to action not only by the government but civil societies, non-governmental organizations, business and communities all around the country. This multilateral cooperation is important for a successful programme in control of NCDs. The Lancet NCD action group and the NCD alliance (2011), have proposed five overarching priority actions for the response to the NCD crisis; - leadership, prevention, treatment, international cooperation, and monitoring and accountability - and the delivery of five priority interventions—tobacco control, salt reduction, improved diets and physical activity, reduction in hazardous alcohol intake, and cheap essential drugs and technologies. The interventions are cost-effective, have low cost of implementation and they are politically and financially feasible. The most urgent and immediate priority is tobacco control. Increased awareness, and more attention to causal relations of COPD are important steps towards developing strategies for both prevention and treatment of COPD in accordance with the local epidemiological context, and should be prioritized in future research.

## Conclusion

It is concluded that NCD is a silent rising health epidemic and has an impact on individual and country socio-economic status. This review has highlighted the fact that Tanzania leadership has a high political commitment. There are policies and strategies, and what is needed is implementation of strategies to address the growing NCDs burden. From the experience of other countries, NCDs interventions are affordable, feasible and some are income generating such as increases in taxation for tobacco, alcohol and animal fat that will simultaneously reduce NCDs risks and contribute to economic improvement. Multi-sectoral approach, involving national and international partners have a unique role in intensifying action on NCDs by increasing funding and innovative approaches to complement available national resources.

The outcome of the UN General Assembly in September 2011 provided an avenue for setting feasible actions and interventions for which specific and timely targets and easily measurable indicators are promoted. It was appreciated that Tanzania has made good steps toward establishing important interventions for control of NCDs. However, the country will need to focus on implementation research and strategies, on new cost-effective interventions, and align its interventions to the political declarations and NCDs monitoring Framework.

## References

- Abass, Z.G., Lutale, J.K., Bakker, K., Baker, N. & Archibald, L.K. (2011) The 'Step by Step' Diabetic Foot Project in Tanzania: a model for improving patient outcomes in less-developed countries. *International Wound Journal* 8, 169-179.
- Asaria, P., Chisholm, D., Mathers, C., Ezzati, M., Beaglehole, R. (2007) Chronic disease prevention: health effects and financial costs of strategies to reduce salt intake and control tobacco use. *Lancet* 370, 2044-2054.
- Beaglehole, R., Bonita, R., Alleyne, G., Horton, R., Li, L., Lincoln, P., Mbanya, J.C., McKee, M., Moodie, R., Nishtar, S., Piot, P., Reddy, K.S., Stucker, D. For the Lancet NCD Action Group (2011) UN High-level meeting on non-communicable diseases: addressing four questions. *Lancet* 378, 449-455.
- Beaglehole, R., Bonita, R., Horton, R., Adams, C., Alleyne, G., Asaria, P., Baugh, V., Bekedam, H., Billo, N., Casswell, S., Cecchini, M., Colagiuri, R., Colagiuri, S., Collins, T., Ebrahim, S., Engelgau, M., Galea, G./, Gaziano, T., Geneau, R., Haines, A., Hospedales, J., Jha, P., Keeling, A., Leeder, S.,

- Lincoln, P., McKee, M., Mackay, J., Magnusson, R., Moodie, R., Mwatsama, M., Nishtar, S., Norrving, B., Patterson, D., Piot, P., Ralston, J., Rani, M., Reddy, K.S., Sassi, F., Sheron, N., Stuckler, D., Suh, I., Torode, J., Varghese, C., Watt, J. (2011) Priority actions for the non-communicable disease crisis. *Lancet* 377, 1438-1447.
- Beaglehole, R., Ebrahim, S., Reddy, S., Voute, J. & Leeder, S. (2007) Prevention of chronic diseases: a call to action. *Lancet* 370, 2152-2157.
- Bovet, P., Ross, A.G., Gervasoni, J.P., Mkamba, M., Mtasiwa, D.M., Lengeler, C., Whiting, D. & Paccaud, F. (2002) Distribution of blood pressure, body mass index and smoking habits in the urban population of Dar es Salaam, Tanzania. *International Journal of Epidemiology* 31, 240-247.
- Chalya, P.L., Mabula, I.H., Ngayomela, E.S., Kanumba, A.B., Chandika, G., Giiti, B., Mawala & Balumuka, D.D. (2010) Motorcycle Injuries as an Emerging Public Health Problem in Mwanza City, North-Western Tanzania. *Tanzania Journal of Health Research* 12 (4) October 2010
- Christianson, A.L., Howson, C.P. & Modell, B. (2006) *March of Dimes Global Report on Birth Defects: The Hidden Toll of Dying and Disabled Children*. White Plains, New York.
- Dalal, S., Beunza, J.J., Volmink, J., Adebamowo, C., Bajunirwe, F. & Njelekela, M. (2011) Non-communicable diseases in sub-Saharan Africa: what we know now. *International Journal of Epidemiology* 40, 885-901.
- Edwards, R., Unwin, N., Mugusi, F., Whiting, D., Rashid, S., Kissima, J. et al., (2000) Hypertension prevalence and care in an urban and rural area of Tanzania. *Journal of Hypertension* 18, 145-152.
- Danaei, G., Finucane, M.M., Lin, J.K., Singh, G.M., Paciorek, C.J., Cowan, M.J., Farzadfar, F., Stevens, G., Lim, S.S., Riley, L.M., Ezzati, M. (2011) National, regional, and global trends in systolic blood pressure since 1980: systematic analysis of health examination surveys and epidemiological studies within 321 country-years and 3.0 million participants. *Lancet* 377, 578-586.
- Farzadfar, F., Finucane, M.M., Danaei, G., Pelizzari, P.M., Cowan, M.J., Paciorek, C.J., Cowan, M.J., Farzadfar, F., Stevens, G.A., Lim, S.S., Riley, L.M., Ezzati, M. (2011). National, regional, and global trends in serum total cholesterol since 1980: systematic analysis of health examination surveys and epidemiological studies with 321 country-years and 3.0 million participants. *Lancet* 377, 578-586.
- Finucane, M.M., Stevens, G.A., Cowan, M.J., Danaei, G., Lin, J.K., Paciorek, C.J., Singh, G.M., Gutierrez, H.R., Lu, Y., Bahalim, A.N., Farzadfar, F., Riley, L.M., Ezzati, M. (2011) National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet* 377, 557-567.
- Garcia-Moreno, C., Jansen, H.A., Ellsberg, M., Heise, L. & Watts, C.H. (2006) Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet* 368, 1260-1269.
- GLOBOCAN (2008) Globocan 2008: Cancer incidence, mortality and prevalence worldwide in 2008. Available at: <http://globocan.iarc.fr/>
- Global Report of Birth Defects (2006) [http://www.marchofdimess.com/aboutus/15796\\_18678.asp](http://www.marchofdimess.com/aboutus/15796_18678.asp).
- Global Youth Tobacco Survey—Dar es Salaam, Kilimanjaro and Arusha. (2003). Retrieved from: [http://www.cdc.gov/tobacco/global/GYTS/factsheets/afro/2003/tanzaniaarusha\\_factsheet.htm](http://www.cdc.gov/tobacco/global/GYTS/factsheets/afro/2003/tanzaniaarusha_factsheet.htm)
- Hall, V., Thomsen, R.W., Henriksen, O. & Lohse, N. (2011) Diabetes in Sub Saharan Africa 1999-2011: epidemiology and public health implications. A systematic review. *BMC Public Health* 11:564.

- Huffman, M.D., Rao K.D., Pichon-Riviere, A., Zhao D., Harikrishnan, S., Ramaiya, K., Ajay, V.S., Goenka, S., Calcagno, J.I., Caporale, J.E., Niu, S., Li, Y., Liu, J., Thankappan, K.R., Daivadanam, M., van Esch, J., Murphy, A., Moran, A.E., Gaziano, T.A., Suhrcke, M., Reddy, K.S., Leeder, S. & Prabhakaran, D. (2011) A cross-sectional study of the microeconomic impact of cardiovascular disease hospitalization in four low- and middle-income countries. *PLoS One* 6: e20821.
- Jagoe, K., Edwards, R., Mugusi, F., Whiting, D. & Unwin, N. (2002) Tobacco smoking in Tanzania, East Africa: population based smoking prevalence using expired alveolar carbon monoxide as a validation tool. *Tobacco Control* 11, 210-214.
- Kagaruki, L. (2011). Community-based advocacy opportunities for tobacco control: experience from Tanzania *Global Health Promotion* 2010 17: 41 DOI: 10.1177/1757975910363932; [http://ped.sagepub.com/content/17/2\\_suppl/41](http://ped.sagepub.com/content/17/2_suppl/41)
- Kitange, H.M., Swai, A.B., Masuki, G., Kilima, P.M., Alberti, K.G. & McLarty, D.G. (1993) Coronary heart disease risk factors in sub-Saharan Africa: studies in Tanzanian adolescents. *Journal of Epidemiology and Community Health* 47, 303-307.
- Knudsen, G.T. (2009) *Prevalence of respiratory symptoms and Chronic Obstructive Pulmonary disease, and reference values for lung function testing in Kinondoni district, Dar Es Salaam, Tanzania*. MPhil Thesis, University of Bergen, Bergen, Norway
- Komba, D.D. (2006) *Risk factors and road traffic accidents in Tanzania: A case study of Kibaha District*. Master Thesis in Development Studies. Norwegian University of Science and Technology.
- Lightwood, J.M. & Glantz, S.A. (1997) Short-term economic and health benefits of smoking cessation: myocardial infarction and stroke. *Circulation* 96, 1089-1096.
- Lim, S.S., Gaziano, T.A., Gakidou, E., Reddy, K.S., Farzadfar, F., Lozano, R. & Rodgers, A. (2007) Prevention of cardiovascular disease in high-risk individuals in low-income and middle-income countries: health effects and costs. *Lancet* 370, 2054-2062.
- Mackay, J., Eriksen, M. & Shafey, O. (2006). *The tobacco atlas* (2<sup>nd</sup> ed.). Atlanta, GA: American Cancer Society.
- Makani, J., Cox, S.E., Soka, D., Komba, A.N., Oruo, J., Mwamtemi, H., Magesa, P., Rwezaula, S., Meda, E., Mgaya, J., Lowe, B., Muturi, D., Roberts, D.J., Williams, T.N., Pallangyo, K., Kitundu, J., Fegan, G., Kirkham, F.J., Marsh, K. & Newton, C.R. (2011) Mortality in sickle cell anemia in africa: a prospective cohort study in Tanzania. *PLoS ONE* 6(2):e14699.
- Manumbu, R. (2011) *Prevalence of Selected Behavioral and Biological Risk Factors for Non-Communicable Diseases Among Males and Females in Rungwe District, Mbeya Region, Tanzania*. MPhil Thesis, University of Bergen, Bergen, Norway
- Mbatia, J., Jenkins, R., Singleton, N. & White, B. (2009) Prevalence of alcohol consumption and hazardous drinking, tobacco and drug use in urban Tanzania, and their associated risk factors. *International Journal of Environmental Research and Public Health* 6: 1991 -2006.
- McLarty, D.G., Unwin, N., Kitange, H.M., Alberti, K.G.M.M. (1996) Diabetes mellitus as a cause of death in Sub-Saharan Africa: Results of a community-based Study in Tanzania. *Diabetic Medicine* 13, 990-995.
- Mendis, S., Alwan, A. (2011) *Prioritized Research Agenda for Prevention and Control of Non-Communicable Diseases*. Geneva. World Health Organization, 2011.
- MoH/AMMP (2004) Ministry of Health and AMMP Team Report 2004: The Policy Implications of Tanzania's Mortality Burden Volume 1: A Ten-Year Community-Based Perspective, United Republic of Tanzania: Dar es Salaam.
- MoHSW (2007) Report on risk factors for Non Communicable Diseases among semirural adults and the association of these factors with socio demographic variables: findings from the WHO Steps Survey in Kilolo district, Iringa, Tanzania. United Republic of Tanzania.

- Moshiro, C., Mswia, R., Alberti, K.G., Whiting, D.R. & Unwin, N. (2001) The importance of injury as a cause of death in sub-Saharan Africa: results of a community-based study in Tanzania. *Public Health* 115, 96-102.
- Museru, L.M. & Leshabari, M.T. (2002) Road traffic accidents in Tanzania: A 10-year epidemiological appraisal. *East and Central African Journal of Surgery* 7, 23-26.
- Mutasingwa, D.R. & Aarø, L.E. Injury registration in a developing country. A study based on patients' records from four hospitals in Dar es Salaam, Tanzania. *Cent Afr J Med* 2001 Aug ;47 (8 ):203 - 9
- NIMR (2010) National Institute for Medical Research, Muhimbili Centre, IANPHI Grant, Annual Report, 2010 on Strategic investment in Tanzania for capacity building in NCDs control and prevention.
- Njelekela, M., Negishi, H., Nara, Y., Tomohiro, M., Kuga, S., Noguchi, T., Kanda, T., Yamori, M., Mashalla, Y., Liu, L.J., Mtabaji, J., Ikeda, K. & Yamori, Y. (2001) Cardiovascular risk factors in Tanzania: a revisit. *Acta Tropica* 79, 231-239 .
- Njelekela, M., Sato, T., Nara, Y., Miki, T., Kuga, S., Noguchi, T., Kanda, T., Yamori, M., Ntogwisangu, J., Masesa, Z., Mashalla, Y., Mtabaji, J., Yamori, Y. (2003) Nutritional variation and cardiovascular risk factors in Tanzania—rural-urban difference. *South African Medical Journal* 93, 295-299.
- Njelekela, M.A., Mpembeni, R., Muhihi, A., Mligiliche, N.L., Spiegelman, D, Hertzmark, E., Liu, E., Finkelstein, J.L., Fawzi, W.W., Willett, W.C. & Mtabaji, J. (2009) Gender-related differences in the prevalence of cardiovascular disease risk factors and their correlates in urban Tanzania. *BMC Cardiovascular Disorders* 9 :30.
- Oberg, M., Jaakkola, M.S., Woodward, A., Peruga, A. & Pruss-Ustun, A. (2011) Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. *Lancet* 377, 139-146.
- Popkin, B.M., Horton, S.H. & Kim S. (2001) The nutrition transition and prevention of diet-related diseases in Asia and The Pacific. *Food and Nutrition Bulletin* 22, 1-58.
- Puska, P. (2010) From Framingham to North Karelia: from descriptive epidemiology to public health action. *Progress in Cardiovascular Diseases* 5, 15 -20.
- Ramaiya, K.L., Swai, A.B., McLarty, D.G., Bhopal, R.S. & Alberti, K.G. (1991) Prevalences of diabetes and cardiovascular disease risk factors in Hindu Indian subcommunities in Tanzania. *BMJ* 303, 271-276.
- Samb, B., Desai, N., Nishtar, S., Mendis, S., Bekedam, H., Wright, A., Hsu, W., Martiniuk, A., Celletti, F., Patel, K., Adshear, F., McKee, M., Evans, T., Alwan, A. & Etienne, C. (2010) Prevention and management of chronic disease: a litmus test for health-systems strengthening in low-income and middle-income countries. *Lancet* 376, 1785-1797.
- Shafey, O., Dolwick, S. & Guindon, G. E. (eds.), (2003) *Tobacco Control Country Profiles*. American Cancer Society: Atlanta, GA.
- Sims, M., Maxwell, R., Bauld, L. & Gilmore, A. (2010) Short term impact of smoke-free legislation in England: retrospective analysis of hospital admissions for myocardial infarction. *BMJ* 340:c2161 doi : 10 1136 /bmj c2161 2010 Jun 8.
- Tuei, V.C., Maiyoh, G.K., Ha, C.E. (2010) Type 2 diabetes mellitus and obesity in sub-Saharan Africa. *Diabetes/ Metabolic Research and Review* 26, 433-445.
- URT (2005) Tanzania Annual Road Convention Report, 2005. United Republic of Tanzania, Dar es Salaam, Tanzania.
- WHO (2010) *Global Status Report on Noncommunicable Diseases 2010*. World Health Organization, Geneva, Switzerland.
- WHO (2007) Updated status of the WHO Framework Convention on Tobacco Control. World Health Organization. Available at:

<http://www.who.int/tobacco/framework/countrylist/en/index.html>. Accessed on June 25, 2007.

Zatonski, W. A., McMichael, A.J. & Powles, J.W. (1998) Ecological study of reasons for sharp decline in mortality from ischaemic heart disease in Poland since 1991. *British Medical Journal* 316, 1047-1051.