

Emerging Public Health Problems in Ethiopia: Chronic Non-Communicable Diseases

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Ethiopian Public Health Association (EPHA)

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Table of Contents

Acknowledgment.....	i
List of Acronyms and Abbreviation.....	ii
Message from EPHA president.....	iii
Preface.....	vi
1. Introduction to Emerging Public Health Problems.....	1
1.1 Emerging Infectious Diseases.....	3
1.2 Neglected Tropical Diseases-.....	12
1.3 Road Traffic Injuries.....	22
2. Chronic Non-communicable Diseases.....	36
2.1 Cardiovascular diseases.....	37
2.2 Diabetes mellitus.....	40
2.3 Cancer.....	44
2.4 Chronic Respiratory Diseases.....	48
2.5 Chronic Kidney Disease (CKD).....	51
3. Risk Factors of Chronic Diseases.....	55
3.1 Contextual Factors.....	55
3.2 High Blood Pressure.....	57
3.3 High Cholesterol.....	58

3.4 Obesity, overweight, and high Body Mass	59
3.5 Low Fruit and Vegetable Intake.....	60
3.6 Physical Inactivity.....	61
3.7 Smoking and Oral Tobacco Use	62
3.8 Alcohol Use	63
4. NCDs and Their Risk Factors - The Ethiopian Situation	65
4.1 The Burden of Noncommunicable Diseases in Ethiopia.....	65
4.2 Risk factors of NCDs in Ethiopia.....	77
4.3 Policy and Strategy for Prevention of NCD.....	82
References	93

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Hailegnaw Eshete (MS, MPH)

Executive Director

List of Acronyms and Abbreviation

AAU – Addis Ababa University

BMI- Body Mass Index

CKD - Chronic Kidney Disease

COPD- Chronic Obstructive Pulmonary Disease

CVD- Cardiovascular Diseases

DM – Diabetes Mellitus

EID- Emerging Infectious Disease

EPHA – Ethiopian Public Health Association

MDR TB- Multi Drug Resistant Tuberculosis

MDG – Millennium Development Goals

MoH – Ministry of Health

NCD – Non-communicable diseases

NTD- Neglected Tropical Diseases

RTI – Road Traffic Injury

SARS – Severe Acute Respiratory Syndrome

TB- Tuberculosis

WHO – World Health Organization

XDR TB- Extremely Drug Resistant Tuberculosis

Message from EPHA president

Ethiopia is one of sub-Saharan countries where double burden epidemiological risks are rampant on increasing basis among its population Non-Communicable Diseases (NCDs) - namely cancer, cardiovascular disease, chronic respiratory diseases and diabetes - cause 60% of all global deaths, but receive just 3% of international development assistance for health. 80% of deaths caused by NCDs occur in developing countries. Yet, the international community displays no sense of urgency or outrage about NCDs, the silent killer that is threatening development and economic progress.

The World Health Organization projects that NCD deaths will increase globally by 17% over the next ten years. The greatest increase will be in the African region (27%) and the Eastern Mediterranean region (25%). The highest absolute number of deaths will occur in the Western Pacific and South-East Asia regions.

The WHO has identified the following chronic diseases as the main threats to human health: cardiovascular diseases, cancer, diabetes and chronic respiratory diseases: “These four diseases are the main causes of death and disability worldwide, representing about 60% of deaths and 44% of early deaths (35 Million deaths every year, 80% of which occur in low and middle income countries” .

Although incomplete in Ethiopia, the list of causes of morbidity and mortality at hospitals and regional health bureaus throughout the regions covered in this

assessment, indicate that hypertension and diabetes mellitus are among the leading causes of outpatient visit or mortality. On the other hand, cancers are rarely reported from regional health bureaus or hospitals out of Addis Ababa.

The risk factors that are common to most chronic diseases, such as physical inactivity, inadequate intake of fruits and vegetables, alcohol consumption and cigarette smoking, are widely prevalent in Ethiopia. Overweight and obesity and the associated high blood pressure are also widely prevalent in urban populations of the country.

NCDs have a severe impact on individuals, communities and countries, undermining the achievement of the Millennium Development Goals (MDGs). The omission of NCDs from the MDGs targets has been a critical barrier to securing donor funding for NCDs, which cause 8 million premature deaths every year in low and middle-income countries

Natural disasters, Road traffic accidents are some of the health and health related problems that also need both urgent and proper public health intervention.

In response to the above challenges, efforts have been made by FMOH and partners. The establishment of National NCDs prevention and control committee headed by FMOH, National Diabetic Steering Committee and Cancer Registration are the exemplary features of the National NCDs prevention and control activities by way of preventing these diseases, very important activities such as National Situational Analysis on NCDs, Prevention

and Control of Chronic Non communicable Diseases Strategic Framework, National Mental Health Strategy (Final Draft) have all been considered with good results. .

EPHA as main health development partner of FMOH and other stakeholders, it must align its organizational effort to public health initiatives that bring positive health outcome to our people. In this regard this is a very useful and timely document.

Programs and project development on emerging public health problems focusing on NCDs have specific role in tackling epidemiological and overall public health challenges that could be derived from both socio demographic and socio economical factors such as epidemiological transitions and globalizations.

This booklet contains evidence based health information that could address the public interest who can only read and write in local Ethiopian languages. It could also be a source of information for health planners, communicators and service providers. This work can also be regarded as an advocacy tool and material for sensitization professionals and the public in this important emerging public health issue.

My sincere thanks and appreciation for all those who participated in the development and production of this document that has great public health importance.

Dr. Tewabech Bishaw ,EPHA, president

Preface

The Ethiopian Public Health Association (EPHA) is a multidisciplinary professional association actively engaged in wide ranging advocacy, training and research activities aimed at advancing public health in Ethiopia. Its objectives include 1) Promoting public health research and active participation of members; 2) Disseminating relevant health information among the public; 3) Advocacy of relevant public health issues, and 4) Promoting the establishment of standards in public health. EPHA has also been playing a significant role in national policy and strategy development in the health sector.

Most of EPHA's efforts so far have necessarily focused on prominent national health problems and priorities, such as HIV/AIDS, TB, Malaria, and Health Extension Services which are guided by the national health policy, and by official profile of the health situation.

To date EPHA had limited participation in issues related to emerging public health challenges like non communicable diseases (NCDs). In light of the increasing burden and prevalence of NCDs in Ethiopia, EPHA recognizes the importance of addressing these emerging public health problems with the level of commitment and resources that they demand.

It is with this background that EPHA took this initiative to produce a booklet that will provide the necessary information on the existing situation of NCDs in the country. The booklet is intended to provide basic information for health

planners, service providers as well as other involved in activities and programs dealing with the prevention and control of NCDs in Ethiopia.

The booklet is informed by a comprehensive review of the literature focusing on non-communicable diseases and interviews of key informants at the federal and regional health bureaus, service providers in public and private hospitals, academic institutions, as well as civic societies (professionals and consumer associations).

The booklet is a synthesis of the global and national literature on emerging health problems with special emphasis on non-communicable chronic diseases and their risk factors in Ethiopia. Because of the vastness of the research work in the field, it is difficult to give sufficient coverage to all emerging public health challenges. Rather, an effort has been made to summarize the key messages from the available literature on issues which are thought to be relevant or are increasingly becoming important in the Ethiopian setting

1. Introduction to Emerging Public Health Problems

An emerging disease or health problem is one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographically (1).

In developing countries such as Ethiopia, the range of diseases and health problems with a growing magnitude include infectious diseases, non-communicable diseases, neglected tropical diseases and road traffic injuries.

Infectious diseases are a continuing threat in both developing and developed countries. Some diseases have been effectively controlled with the help of modern technology. But new diseases—such as the Severe Acute Respiratory Syndrome (SARS) and Influenza Virus (H5N1, H1N1) infections—are constantly appearing. Others, such as malaria, tuberculosis, and bacterial pneumonia, are now appearing in forms that are resistant to drug treatments (2).

Societal, technological, and environmental factors continue to have a dramatic effect on infectious diseases worldwide, facilitating the emergence of new diseases and the re-emergence of old ones, sometimes in drug-resistant forms. Modern demographic and ecologic conditions that favour the spread of infectious diseases include rapid population growth; increasing poverty and urban migration; more frequent movement across international boundaries by tourists, workers, immigrants, and refugees; changes in the habitats of animals and arthropods that transmit disease; increasing numbers of persons with

impaired host defences; and changes in the way that food is processed and distributed (3).

The same societal factors also contribute to the emergence of chronic non-communicable diseases and their risk factors. The changing patterns of consumption and living style, and an ageing global population, are associated with a rise in prominence of diseases such as heart disease, stroke, diabetes, cancers, respiratory illnesses, mental illness, and other conditions linked to obesity. These diseases now have serious implications for many low and middle income countries which are still dealing with the traditional problems of poverty, undernutrition and infectious diseases, contributing to the “double burden of diseases”.

Until very recently, non-communicable diseases were not been considered as priority problems in many resource-constrained settings including Ethiopia. As a result, there has done that addresses these emerging problems in reasonable detail. The present booklet mainly focuses on emerging public diseases which have received little attention compared to major infectious disease and malnutrition. However, the booklet also briefly mentions some of the most important emerging and reemerging public health challenges of infectious origin as well as motor-vehicle injuries which continue to affect significant segment of the society.

The booklet starts by providing broad overview of the global situation of emerging public health challenges (infectious and non-communicable diseases) and then dwells on major non-communicable diseases and their common risk

factors in Ethiopia with a final section dealing with general guidelines and public health measures needed for effective disease prevention and control.

1.1 Emerging Infectious Diseases

An emerging infectious disease (EID) is an infectious disease whose incidence has increased in recent years and threatens to increase in the near future. Emerging infections account for at least 12% of all human pathogens. EIDs include diseases caused by a newly identified microorganism or newly identified strain of a known microorganism (e.g. SARS, AIDS); new infections resulting from change or evolution of an existing organism (e.g. influenza), a known infection which spreads to a new geographic area or population (e.g. West Nile virus), and pre-existing and recognized infections re-emerging because of drug resistance of their agent or to a breakdown in public health (e.g, multi-drug resistant tuberculosis (MDR-TB) (4)).

Examples of emerging infectious diseases include:

- **SARS:** Severe acute respiratory syndrome. A severe form of pneumonia which appeared in outbreaks in 2003.
- **Novel H1N1 influenza:** A virus responsible for a flu pandemic in 2009 that was originally referred to as "swine flu" because many of the genes in this new virus were very similar to influenza viruses that

normally occur in pigs in North America. However, the virus is actually a new influenza A (H1N1) virus.

- **H5N1 influenza:** An Influenza A virus subtype that occurs mainly in birds, highly contagious among birds, and which can be deadly to them. Outbreaks of the avian influenza H5N1 occurred among poultry in eight countries in Asia during late 2003 and early 2004. Influenza A (H5N1) virus is a well known pathogen in birds and was first isolated from humans in 1997.
- **Ebola virus** (first outbreaks in 1976 and was discovered of the virus in 1977).
- **HIV/AIDS** (virus first isolated in 1983).
- **E. coli O157:H7** (first detected in 1982, often transmitted through contaminated food, has caused outbreaks of hemolytic uremic syndrome).
- **Creutzfeldt-Jakob disease:** Also known as mad cow disease, emerged in the 1980s and affected thousands of cattle in the UK and Europe. The agent is considered to be the same as that causing bovine spongiform encephalitis.

Worldwide, at least 30 new and re-emerging infectious diseases have been identified since 1975 (5, 6). HIV/AIDS has become a serious pandemic. Several

'old' infectious diseases, including tuberculosis, malaria, cholera and dengue fever, have proven unexpectedly problematic, because of increased antimicrobial resistance, new ecological niches, weak public health services and activation of infectious agents (e.g. tuberculosis) in people whose immune system is weakened by AIDS. Diarrhoeal disease, acute respiratory infections and consequently other infections continue to kill more than seven million infants and children annually (6). Mortality rates among children are increasing in parts of sub-Saharan Africa (7).

Severe acute respiratory syndrome (SARS) (8)

SARS - a term applied to outbreaks of a mysterious illness in Asia that appeared in February 2003, is a severe form of pneumonia. The clinical criteria for the diagnosis of SARS are:

- One or more signs or symptoms of respiratory illness including cough, shortness of breath, difficulty breathing, hypoxia, or radiographic (X-ray) findings of pneumonia or acute respiratory distress syndrome AND,
- Fever(>38° C]) AND,
- One or more of the following:
 - Close contact within 10 days of onset of symptoms with a person under investigation or suspected of having SARS
 - Travel within 10 days of onset of symptoms to an area with documented transmission of SARS.

As of March 2003 reports of outbreaks of a severe form of pneumonia have been reported in Hong Kong, Vietnam, and Guangdong province in southern China.

In Vietnam, a man became ill after travelling from Shanghai, China, and Hong Kong SAR to Hanoi, where he was hospitalized for a severe, acute respiratory syndrome. Approximately 20 members of the staff became ill with similar symptoms, which included initial influenza-like symptoms with a rapid onset of high fever, followed by muscle aches, headache, and sore throat.

The cause of this form of SARS is still unknown. The disease is highly contagious under certain situations, as in hospitals, and it can easily be deadly.

Novel H1N1 influenza (9)

A virus responsible for a flu pandemic in 2009 originally referred to as "swine flu" because many of the genes in this new virus were very similar to influenza viruses that normally occur in pigs in North America. However, the virus is actually a novel influenza A (H1N1) virus. This virus first caused illness in Mexico and the United States in March and April, 2009 that spread to a pandemic status over the following months. H1N1 flu spreads from person to person, unlike typical swine flu, although it is not clear how easily the virus is able to spread among people.

Swine flu (swine influenza) is a respiratory disease caused by viruses (influenza viruses) that infect the respiratory tract of pigs and result in nasal secretions, a barking-like cough, decreased appetite, and listless behaviour. Swine flu

produces most of the same symptoms in pigs as human flu produces in people. Swine influenza virus was first isolated from pigs in 1930 in the U.S. and has been recognized by pork producers and veterinarians to cause infections in pigs worldwide.

In a number of instances, people have developed the swine flu infection when they closely associate with pigs (for example, pig farmers, pork processors), likewise, pig populations have occasionally been infected with the human flu infection. In most instances, the cross-species infections (swine virus to man; human flu virus to pigs) have remained in local areas and have not caused national or worldwide infections in either pigs or humans.

H5N1 influenza (10) an influenza A virus subtype that occurs mainly in birds, highly contagious among birds, and capable of being deadly to them. Outbreaks of the avian influenza H5N1 occurred among poultry in eight countries in Asia during late 2003 and early 2004. At that time, more than 100 million birds in the affected countries either died from the disease or were killed in order to try to control the outbreaks. Since this outbreak, the virus has spread geographically. Reports of H5N1 infection in wild birds in Europe began in mid-2005. In early 2006, infection in wild birds and poultry were reported in Africa and the Near East.

Human cases of influenza A (H5N1) infection have been reported in several countries. Although H5N1 virus does not usually infect people, since November 2003 nearly 400 cases of human infection with highly pathogenic avian influenza A (H5N1) viruses have been reported by more than a dozen countries

in Asia, Africa, the Pacific, Europe, and the Near East. Most of these cases occurred from direct or close contact with infected poultry or contaminated surfaces; however, a few cases of human-to-human spread of H5N1 virus have occurred.

Ebola Virus (11)

Ebola is a deadly virus that causes (dreadful symptoms, the most prominent being high fever and massive internal bleeding. Ebola virus kills as many as 90% of the people it infects. It is one of the viruses that is capable of causing hemorrhagic (bloody) fever. Epidemics of Ebola virus have occurred mainly in African countries including the Democratic Republic of Congo, Gabon, Uganda, Ivory Coast, and Sudan.

Ebola virus is transmitted by contact with blood, faeces or body fluids from an infected person or by direct contact with the virus, as in a laboratory. People can be exposed to Ebola virus from direct contact with the blood or secretions of an infected person. This is why the virus has often been spread through the families and friends of infected persons: in the course of feeding, holding, or otherwise caring for them, family members and friends would come into close contact with such secretions. People can also be exposed to Ebola virus through contact with objects, such as needles, that have been contaminated with infected secretions.

At present ,there is no specific treatment for the disease and victims receive only supportive therapy which consists of balancing the victims fluids and

electrolytes by maintaining their oxygen level and blood pressure, and treating them for any complicating infections. Death can occur within 10 days of the onset of symptoms.

The prevention of the spread of Ebola fever involves practical viral hemorrhagic fever isolation precautions, or barrier nursing techniques. These techniques require wearing protective clothing, such as masks, gloves, gowns, and goggles while the use of infection-control measures include complete equipment sterilization and isolating Ebola fever victims from contact with unprotected persons. The aim of all of these techniques is to avoid any person's contact with the blood or secretions of any victim.

HIV-The history of the human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) dates back to 1981, when homosexual men with symptoms of an illness that now is considered typical of AIDS was first described in Los Angeles and New York USA. The men had an unusual type of lung infection (pneumonia) called *Pneumocystis carinii* pneumonia (PCP) and rare skin tumours called Kaposi's sarcomas. The victims were noted to have a severely low type of a type of cell in the blood (CD4 cells) that is an important part of the immune system. These cells, often referred to as T cells, help the body fight infections. Following this phenomenon of low (CD4 cells), the illness infection was recognized throughout the world, including Africa (3).

In 1983, researchers in the United States and France described the virus that causes AIDS, now known as HIV as belonging to the group of viruses known as

retroviruses. While HIV infection is known to develop AIDS, the actual definition of AIDS is the development of a low CD4 cell count (<200 cells/mm³) or any one of a long list of complications ranging from a variety of so-called "opportunistic infections," like cancers, neurologic symptom and wasting syndromes (3).

Tuberculosis-Ethiopia has a high rate of TB transmission and a high burden of the disease (378/100,000). The country is also classified as having a high burden of MDR TB (Multi Drug Resistance Tb) with an estimated 5,200 cases annually. In addition, 17% of TB patients are co-infected with HIV. Though the treatment success rate is 84% which is close to the Stop TB/MDGs target of 85%, the case detection rate remains low (34%) (14).

TB is affecting all sex and age groups. According to the national 2008/9 annual TB report, among the total smear positive TB cases reported: 56% were males; 7% are children <14 years old; and 3% are above the age of 65, the age group 15-45 years was the most affected with TB. Thus, the burden of TB in this economically active age group is a contributor to poverty (15).

Poverty is a risk factor for developing TB, which places Ethiopia as a high-risk environment. The country is one of the least developed in the world, with a per capita Gross National Income (GNI) in 2004 of US\$110 (16). Moreover, the low economic status hinders allocation of adequate budget for health in general and TB program in particular. In Ethiopia, TB disproportionately affects the poor - particularly in urban overcrowded settings - and people with HIV. Urban

rates of prevalence are much higher than rural ones ,and so the urban poor (especially those at risk of HIV) are also at highest risk of TB.

Ethiopia ranked 7th among the 22 high burden TB countries and 3rd in Africa with an estimated 301,690 cases and an incidence rate 378 per 100,000 (17). In 2008, the National TB Control and Prevention Programme treated 138,960 TB cases, the 2nd highest number in Africa, and a two-fold increase from the 71,331 reported a decade before (15).

According to WHO 2010 M(X)DR-TB surveillance report, in Ethiopia, about 5200 MDR-TB cases were estimated to have occurred in 2008. The first anti-TB drug resistance surveillance conducted nationwide in 2005 showed that among 804 newly diagnosed TB cases 1.6% had MDR-TB. The rate of MDR TB among specimens from 76 previously treated TB cases was 11.8% (18).

MDR TB treatment is presently available at the St. Peter's Specialized TB Hospital in Addis Ababa and the Gondar University Teaching Hospital in Gondar. A total of about 150 patients were receiving treatment in the two hospitals in mid 2011.

Malaria- is a major cause of morbidity and mortality in Ethiopia. Almost 75 percent of the land is malarious and 68 percent of the population lives in areas at risk of malaria. Areas at altitude below 2,000 meters above sea level are generally considered as malarious; however, incidence has been detected at altitudes as high as 2,500 meters. In 2004/5, malaria was reported as the primary cause of morbidity and mortality in the country; it accounted for 16.6

percent of outpatient consultations, 15 percent of hospital admissions, and 29 percent of deaths in health facilities across the country (19, 20).

Malaria has a serious impact on the country's economic productivity as it strikes during the planting and harvesting seasons. For instance, the annual average number of malaria cases reported from 2001 to 2005 was 9.4 million, while the annual average number of confirmed cases was 487,984 (19). To support the implementation of malaria prevention and control strategies, the government has developed two successive five-year strategic plans (2001-05 and 2006-10) (21).

1.2 Neglected Tropical Diseases-

These include leishmaniasis, lymphatic filariasis, Schistosomiasis, soil transmitted helminthiases, leprosy, buruli ulcer, yaws and other treponematoses, onchocerciasis, dracunculiasis, blinding trachoma and human African trypanosomiasis (22).

Globally, an estimated one billion people are at risk of being infected or infested by NTDs, and approximately 534,000 deaths occur annually as a result of NTDs. Up to 90% of the burden of NTDs is believed to occur in Africa. Many people are often affected by more than one of these diseases (22).

Although medically diverse, NTDs share features that allow them to persist in conditions of poverty, overlapping and thriving in the heat and humidity of tropical climates. Of the 14 diseases listed as NTDs occurring in the tropical

Region, most are parasitic, spread by insects while others multiply through contaminated water and soil infested with the eggs of worms. Poor sanitation and limited access to basic health care play a role in the heavy burden of these diseases particularly in poor communities (22).

In Ethiopia a group of eight diseases contribute to much of the burden arising from NTDs. These are: trachoma, onchocerciasis, schistosomiasis, soil transmitted helminthes (STH), lymphatic filariasis, dracunculiasis, leishmaniasis, and podoconiosis (23).

Trachoma (blindness) is one of the major health problems in Ethiopia. The prevalence of blindness and low vision in the country is among the highest in the sub-Saharan Africa (1.6% and 3.7% respectively), with active trachoma prevalent in the whole country at a rate of 40.1% (24). Onchocerciasis cases are estimated to be 10 million and about 5.8 million people live in hyper and meso-endemic areas. Amhara, Oromia, Benshangul-Gumuz, Southern Nations Nationalities and Peoples Region and Gambella regions are endemic for Onchocerciasis. Both schistosomiasis and soil-transmitted helminthes (STH) are endemic and widely spread in Ethiopia in varying prevalence (23).

Ethiopia is one of the high disease burden countries for leishmaniasis. Visceral leishmaniasis, the fatal form of the disease, is endemic in five regions of country (Tigray, Amhara, Oromia, SNNPR and Somali). The annual incidence of visceral leishmaniasis in Ethiopia is estimated to be about 5000 cases with varying HIV co-infection rate, ranging from 18.5 – 40% in Humera/Tigray and 15-18% in Libo/Amhara (25).

Lymphatic filariasis remains a major public health problem in Africa and is one of the World Health Organization's six diseases targeted for global eradication (26). Lymphatic filariasis is reported to be endemic in 36 districts of five regions in Ethiopia. However mapping of the actual distribution of the disease has been a challenge. Although the total reported cases of dracunculiasis have declined from 41 cases in 2008 to 21 in 2010, Ethiopia remains among the few countries in the world where the disease is still endemic (*personal communication*).

It is estimated that up to 1 million cases of podoconiosis (non-filarial elephantiasis) exist in Ethiopia. The socio-economic impact of the disease in endemic areas is high affecting 70-90% of the economically active age group and loss of 45% of productive work days compared to unaffected people (27).

Leishmania infection (28): A parasitic disease, also called leishmaniasis, spread by the bite of sand flies infected with a protozoa (*Leishmania*). There are several forms of leishmaniasis, the most common being cutaneous and visceral leishmaniasis. The cutaneous form of the disease causes skin sores while the visceral form strikes internal organs of the body such as the spleen, liver and bone marrow and can be fatal.

Cutaneous leishmaniasis involves one or more sores on the victim's skin. The sores can change in size and appearance over time. They often end up looking like a volcano, with a raised edge and central crater. Some sores are covered by a scab and they can be painless or painful. Some people have swollen glands near the sores (for example, under the arm if the sores are on the arm or hand).

Visceral leishmaniasis usually causes fever, weight loss, and an enlarged spleen and liver (usually the spleen being bigger than the liver). Some victims have swollen glands. Certain blood tests of victims are abnormal, for example, usually low blood counts, including a low red blood cell count (anemia), low white blood cell count, and low platelet count.

There are about two million new cases of leishmaniasis known each year - 1.5 cutaneous and 0.5 million visceral. The disease is found in Asia (not Southeast Asia), The Middle East, Africa (particularly East and North Africa, with some cases elsewhere). More than 90% of the world's visceral leishmaniasis is in India, Bangladesh, Nepal, Sudan, and Brazil.

Leishmaniasis is spread by the bite of some types of phlebotomine sand flies. Sand flies that get themselves infected by biting an infected animal (for example, a rodent or dog) or a person. Since sand flies do not make noise when they fly, people may not be aware of their presence. Sand flies are very small and may be hard to see; they are only about one-third the size of typical mosquitoes. Sand flies usually are most active in twilight, evening, and at night (from dusk to dawn). They are less active during the hottest time of the day. However, they will bite if they are disturbed, such as when a person brushes up against the trunk of a tree where they are resting. Rarely, leishmaniasis is spread from a pregnant woman to her baby and can also be spread by blood transfusions or contaminated needles.

People of all ages are at risk for Leishmaniasis if they live or travel where there is leishmaniasis. Leishmaniasis is usually more common in rural than urban

areas; but it is found in the outskirts of some cities. The risk for Leishmaniasis is at its highest from dusk to dawn because this is when sand flies are the most active. All it takes to get infected is to be bitten by one infected sand fly. Adventure travellers, people who do research outdoors at night and soldiers are examples of people who may have an increased risk for leishmaniasis (especially Cutaneous Leishmaniasis).

Visceral Leishmaniasis (28): Also known as Kala-azar, this is a chronic and potentially fatal parasitic disease of the viscera (particularly the liver, spleen, bone marrow and lymph nodes) caused by *leishmania donovani*.

Leishmania donovani is transmitted by sandfly bites in parts of Asia (primarily India), Africa (primarily Sudan) and South America (primarily Brazil) where all together there are an estimated half million cases per year.

Visceral leishmaniasis shows no or few symptoms but typically it is associated with fever, loss of appetite (anorexia), fatigue, enlargement of the liver, spleen and nodes and suppression of the bone marrow. Visceral leishmaniasis also increases the risk of other secondary infections.

Lymphatic filariasis (28): A parasitic disease caused by the African eye worm, a microscopic thread-like worm. The adult worms can live only in the human lymph system.

Lymphatic filariasis affects over 120 million people in the tropics and sub-tropics of Asia, Africa, the Western Pacific, and parts of Central and South America. The disease spreads from person to person by mosquito bites. When

a mosquito bites a person who has lymphatic filariasis, microscopic worms circulating in the person's blood enter and infect the mosquito. If the infected mosquito then bites another person, they can contract lymphatic filariasis. The microscopic worms pass from the mosquito through the skin, and travel to the lymph vessels. In the lymph vessels they grow into adults. An adult worm lives for about 7 years. The adult worms mate and produce millions that they release into the blood. When victims with worms in their blood, are bitten by a mosquito, the disease get transmitted to get another person.

A victim must suffer many mosquito bites over several months to year's in order to develop lymphatic filariasis. People living or staying for a long time in tropical or sub-tropical areas where the disease is common are at the greatest risk for infection. Hence short-term tourists are at very low risk. An infection of lymphatic filariasis shows up on a blood test.

At first, most people don't know they have lymphatic filariasis. They usually don't feel any symptoms until after the adult worms die. The disease usually is not life threatening, but it can permanently damage the lymph system and kidneys. Because the lymph system does not work right, fluid collects and causes swelling in the arms, breasts legs, and, for men, the genital area. The name for this swelling is lymphedema. The entire leg, arm, or genital area may swell to several times their normal sizes. Also, the swelling and the decreased function of the lymph system make it difficult for the body to fight germs and infections. A person with the disease tends to have more bacterial infections in

the skin and lymph system. This causes hardening and thickening of the skin, which is called elephantiasis.

Lymphatic filariasis is a leading cause of permanent and long-term disability worldwide. People with the disease can suffer pain, disfigurement, and sexual disability. Communities frequently shun women and men disfigured by the disease. Many women with visible signs of the disease will never marry, or suffer rejection by their spouses and families. Affected people frequently are unable to work because of their disabilities. This hurts their families and their communities. Poor sanitation and rapid growth in tropical and subtropical areas of the world, where the disease is common, has created more places for mosquitoes to breed leading to more people becoming infected.

Prevention includes giving entire communities medicine that kills the microscopic worms and culprst mosquitoes. Avoiding mosquito bites is another form of prevention. The mosquitoes that carry the microscopic worms usually bite between the hours of dusk and dawn.

Schistosomiasis (28):a disease of the liver, gastrointestinal tract and bladder caused by schistosomes, trematode worms that parasitize people. Infection is from infested water. Schistosomiasis is also called Bilharzia after the German physician Theodor Bilharz (1825-1862).

There are three main species of these trematode worms (flukes) --Schistosoma haematobium, S. japonicum, and S. mansoni -- that cause the disease in humans. The larval forms of the parasite live in freshwater snails. The cercaria

(form of the parasite) is liberated from the snail and burrow into people's skin, transforms to the schistosomulum stage, and migrates to the urinary tract (*S. haematobium*), liver or intestine (*S. japonicum*, *S. mansoni*) where the adult worms develop. Eggs are shed into the urinary tract or the intestine and hatch to form miracidia (yet another form of the parasite) which then infect snails, completing the life cycle of the parasite.

Onchocerciasis (28): River blindness, a disease caused by a parasitic worm (*Onchocerca volvulus*) which is transmitted to persons by biting blackflies (buffalo gnats) that breed in fast-flowing rivers. The adult worms can live for up to 15 years in nodules beneath the skin and in the muscles of infected persons, where they produce millions of worm embryos (microfilariae) that invade the skin and other tissues including the eyes. About 18 million persons in the world are affected, mostly in Africa and but also in Yemen and Latin America. Both living and dead microfilariae cause severe itching in the skin and sometimes blindness after many years.

Until the 1980s, the main control measure was to use larvicides to kill immature blackflies in rivers. This method was used effectively to reduce the incidence of the disease in parts of West Africa but it is expensive. Since 1987, the drug Ivermectin has been provided by the manufacturer free of charge for treating persons with onchocerciasis. This treatment, effective with a single oral dose administered once a year, prevents the accumulation of microfilariae in persons at risk. No drug suitable for mass treatment can kill the adult worms

in the body and onchocerciasis cannot be eradicated without such means, the blindness, caused by them can be eliminated.

Dracunculiasis (28): is a parasitic disease caused by the largest parasite that plagues people and bores into their tissues by the guinea worm *Dracunculus medinensis*. Dracunculiasis is also called guinea worm disease and end-of-the-road disease because it is not seen in the big cities.

Once it infects a people, the guinea worm within their bodies. It eventually emerges from the body (through the feet in 90% of cases) causing intensely painful edema (swelling), a blister and then an ulcer. Perforation of the skin by the guinea worm is accompanied by fever, nausea, and vomiting. Infected persons may remain sick for some months.

The disease is acquired by drinking water contaminated with the infected intermediate hosts of the parasite, called cyclops. The full-grown guinea worm begins to migrate throughout the infected person's body within about a year after ingestion. In areas where the disease is endemic (pervasive), it typically reappears every year during the agricultural season, with farmers in particular being affected.

There are no drugs to treat dracunculiasis. It's control are based on effective surveillance systems; providing safe water with appropriate supply systems, filtering devices and chemical treatment to eliminate the vector; and health education.

Dracunculiasis is the only parasitic disease that may be eradicated from the globe in the near future. Although it was widely distributed at the beginning of the 20th century, it is now confined to sub-Saharan Africa. The countries known to harbor the guinea worm are Benin, Burkina Faso, Central African Republic, Ethiopia, Ghana, Ivory Coast, Mali, Mauritania, Niger, Nigeria, Sudan, Togo and Uganda of which Sudan used to be the most affected with 100,000 annual cases

African sleeping sickness (28): Also called African trypanosomiasis, a systemic disease caused by the parasite *Trypanosoma brucei* that is transmitted by the bite of the tsetse fly, a gray-brown insect about the size of a honeybee. African trypanosomiasis is confined to tropical Africa from north of South Africa to south of Algeria, Libya, and Egypt. Tsetse flies inhabit rural areas only, living in the woods and thickets of the savannah and the dense vegetation along streams.

The signs and symptoms of the infection are initially nonspecific (high fever, rash, edema, or swollen glands) but the disease progresses to encephalitis and meningitis. Symptoms generally appear within 1 to 3 weeks of infection. Untreated cases become eventually fatal. The infection can usually be cured by an appropriate course of anti-trypanosomal therapy.

Tsetse flies are attracted by moving vehicles and dark, contrasting colors. They are not affected by insect repellents and can bite through lightweight clothing. Areas of heavy infestation tend to be sporadically distributed and are usually

well known to local residents. Avoidance of such areas is the best means of protection.

Podoconiosis (26): Podoconiosis is non-infectious geochemical elephantiasis caused by exposure of bare feet to irritant alkalic clay soils. It is found in at least 10 countries in tropical Africa, Central America and northwest India, where such soils coexist with high altitude, high seasonal rainfall and low income. Podoconiosis develops in men and women working barefoot on irritant soils, with signs becoming apparent in most patients by the third decade of life. Colloid-sized silicate particles appear to enter through the skin, are taken up into the macrophages, in the lower limb lymphatics and cause endolymphangitis and obliteration of the lymphatic lumen.

Podoconiosis is unique in being an entirely preventable non-communicable disease. Primary prevention entails promoting the use of footwear in areas of irritant soil; early stages are reversible given good foot hygiene, but late stages result under considerable negative economic and social difficulties, and require extended periods of elevation and occasionally nodulectomy.

1.3 Road Traffic Injuries

Injury is defined as “acute exposure to physical agents such as mechanical energy, heat, electricity, chemicals, and ionising radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance. In

some cases, injuries result from the sudden lack of essential agents such as oxygen or heat.” (Source: Gibson, 1961; Haddon, 1963)

By contrast, violence is defined as “the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of death, psychological harm, maldevelopment or deprivation.” (Source: WHO, 1996)

Injury is a major public health issue accounting for 12% of global burden of disease 90% of injuries result in occurring in low- and middle-income countries. Among other injuries road traffic accidents are the leading cause of injury caused deaths worldwide. Other relatively important injuries include fall and burns injuries, which are described in the following sections.

Road traffic accident is “an accident that occurs on a way or street open to public traffic; resulting in one or more persons being killed or injured, and at least one moving vehicle involved. Thus, RTA is collisions between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and fixed obstacles”, are a major global public health challenge (34).

Road traffic injuries are a growing but neglected public health challenge requiring concerted efforts for their effective and sustainable prevention. Worldwide, an estimated 1.2 million people are killed in road accidents each year and as many as 50 million are injured. Without increased efforts and new initiatives, the total number of road traffic caused deaths worldwide and injuries is forecast to rise by some 65% between 2000 and 2020 (29,30), and in

low and middle-income countries deaths are expected to increase by as much as 80%. Most of which are among “ the vulnerable road users” – pedestrians, pedal cyclists and motorcyclists. In high-income countries, deaths among car occupants continue to be predominant, but the risks per capita that are vulnerable road users face are high (31, 32).

There is considerable regional variation, both in the absolute number of road traffic injury deaths and mortality rates. The WHO African Region had the highest mortality rate in 2002, at 28.3 per 100, 000 population. According to WHO data, deaths from road traffic injuries account for around 25% of all deaths from injury (33).

Around 85% of all global road accident related deaths, 90% of the disability-adjusted life years lost because of crashes, and 96% of all children killed worldwide as a result of road traffic injuries occur in low-income and middle-income countries. Over 50% of deaths are among young adults in the age range of 15–44 years (34).

Injury is a significant cause of death and morbidity among children from the age of one, and increases to become the leading cause of death among children aged 10 to 19 years (35). Each year approximately 950 000 children aged less than 18 years die as a result of an injury or violence. Nearly 90% of these – about 830 000 – are due to unintentional injuries – about the same number that die from measles, diphtheria, polio, whooping cough and tetanus combined. Most of these unintentional injuries are the result of road traffic crashes, drowning, burns, falls and poisoning, with the highest rates occurring

in low-income and middle-income countries. In addition to these deaths, tens of millions more children sustain injuries that do not kill them but are serious enough to require hospital treatment and sometimes result in disabilities (36).

The road traffic accident caused deaths represents only the “tip of the iceberg” of the total waste of human and societal resources from road injuries (37).

Despite the growing burden because of road traffic injuries, road safety has received insufficient attention at both the international and national levels. The reasons include lack of general awareness and specific information on the scale of the problem, for the health, social and economic costs of road traffic crashes, and on the interventions that can prevent accidents or reduce the harm they cause (38).

Fall Injury-A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.

Within the WHO database fall-related deaths and non-fatal injuries exclude those due to assault and intentional self-harm. Falls from animals, burning buildings and transport vehicles, and falls into fire, water and machinery are also excluded.

Ways in which falls occur include tripping, or loss of balance (from the same level) or from one level to another (for example, in stairs, windows, furniture, playground equipment).

Outcomes of falls include

- *Medical :*
 - fractures, especially hip fractures in elderly and forearm fractures in young people
 - blunt trauma, internal injuries
 - lacerations, contusions, superficial injuries

- *Disability :*
 - range from temporary to permanent
 - head injuries can affect temperament, cognition, and physical abilities.

Burns-according to the International Society for Burn Injuries, a burn occurs when some or all of the different layers of cells in the skin are destroyed by a hot liquid (scald), a hot solid (contact burns) or a flame (flame burns).

Skin injuries caused by ultraviolet radiation, radioactivity, electricity or chemicals, as well as respiratory damage resulting from smoke inhalation, are also considered to be burns.

- Fire-related burns rank among the 15 leading causes of death and burden of disease for children and young adults 5-29 years.

- Over 90% of fatal fire-related burns occur in low- and middle-income countries.
- South-East Asia alone accounts for just over one-half of the total number of fire-related deaths worldwide and females in this region have the highest fire-related burn mortality rates globally.
- True magnitude of all burns not known because global data only exist for fire-related burns.

Outcomes of burns include: costly and prolonged hospitalizations, multiple surgeries, skin grafts, risk of infection, and disfigurement.

Burn prevention measures include

- raising or enclosing cooking areas
- electrification to reduce dependence on candles and kerosene
- safe stove design
- improved house construction
- installation and maintenance of smoke alarms and sprinkler systems
- education about prevention and first-aid management of burns
- water temperature regulation
- using flame retardant fabrics

1.4 Climate Change and Health

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, wind, and other weather conditions or patterns lasting for decades or longer. The world's climate is showing signs of a shift, becoming warmer, with more precipitation and other extremes conditions or manifestations Potential effects of such climate change are likely to include more variable weather, stronger and longer heat waves, more frequent heavy precipitation, more frequent and severe droughts, such as flooding and tropical cyclones, rises in sea level, and increased air pollution (39).

The environmental consequences of climate change are happening now and are expected to increase in the future. Signs of a changing climate include; sea-level rise, changes in precipitation causing flooding and drought, heat waves, more intense hurricanes and storms, and poor air quality. These change in climate will affect human health both directly and indirectly (39).

The recent concern over global climate change arises from accumulating evidence that, in addition to this natural climate variability, average climatic conditions measured over extended periods (conventionally 30 years or longer) are now also changing (40).

Potential risks to human health from climate change would arise from increased exposures to thermal related extreme conditions (cardiovascular and respiratory mortality) and from increases in weather related disasters (including deaths and injuries associated with floods) (39).

Other health risks may arise because of the changing dynamics of disease vectors (such as malaria and dengue fever), the seasonality and incidence of various food-related and waterborne infections, the yields of agricultural crops, the range of plant and livestock pests and pathogens (41).

There is a close link between local climate and the occurrence or severity of some diseases and other threats to human health. It is estimated that climate change contributes to 150,000 deaths and 5 million illnesses each year, and WHO estimates that a quarter of the world's disease burden is due to the contamination of air, water, soil and food (42).

In the last quarter of the 20th century, the average atmospheric temperature rose by about 1 degree Fahrenheit. By 2000, that increase was responsible for the annual loss of about 160,000 lives and 5.5 million years of healthy life, according to estimates by WHO. The toll is expected to double to about 300,000 lives and 11 million years of healthy life by 2020 (42).

The biggest tolls were in Africa, on the Indian subcontinent, and in Southeast Asia. Most of the increased burden of death and disease were from malnutrition, diarrhea, malaria, heat waves, and floods. But those diseases will probably play a minor role in many regions that nevertheless will feel the effects of global warming (42).

Some of the impacts of climate changes on health include: Increased frequencies of health threatening heat waves; more variable precipitation

patterns compromising the supply of freshwater, higher risks of water-borne diseases; and a rise in coastal flooding due to rising sea levels and the like.(42).

Impact of climate change on health

The overall health effects of a changing climate are likely to be overwhelmingly negative. Climate change affects the fundamental requirements for good health – clean air, safe drinking water, sufficient food and secure shelter.

Extreme heat

Extreme high air temperatures contribute directly to deaths from cardiovascular and respiratory disease, particularly among elderly people. In the heat wave of the summer 2003 in Europe for example, more than 70 000 extra deaths were recorded (43).

High temperatures also raise the levels of ozone gases and other pollutants in the air that exacerbate cardiovascular and respiratory disease. Urban air pollution causes about 1.2 million deaths every year. Pollen and other aeroallergen levels become higher under heat. This can trigger asthma, which affects around 300 million people. Ongoing temperature increases are expected to increase this burden (43).

Natural disasters and variable rainfall patterns

Increasingly variable rainfall patterns are likely to affect the supply of fresh water. A lack of safe water can compromise hygiene and increase the risk of

diarrhoeal disease, which kills 2.2 million people every year. In extreme cases, water scarcity leads to drought and famine (44).

Floods are also increasing in frequency and intensity. Floods contaminate freshwater supplies, heighten the risk of water-borne diseases, and create breeding grounds for disease-carrying insects like mosquitoes. They also cause drowning and physical injuries, damage property and disrupt medical and health care services.

Rising temperatures and variable precipitation are likely to decrease the production of staple foods in many of the poorest regions – by up to 50% by 2020 in some African countries (45). This will intern increase the prevalence of malnutrition and undernutrition, which presently cause 3.5 million deaths every year.

Patterns of infection

Climatic conditions strongly affect water-borne diseases and diseases transmitted through insects, snails or other cold blooded animals. Changes in climate are likely to lengthen the transmission seasons of important vector-borne diseases and to alter their geographic range. For example, climate change is projected to widen significantly the area of China where the snail-borne disease schistosomiasis occurs (46).

Malaria is strongly influenced by climate. Transmitted by Anopheles mosquitoes, malaria kills almost 1 million people every year – mainly African

children under five years old. The Aedes mosquito vector of dengue is also highly sensitive to climate conditions (47).

Impacts of natural disasters (41)

Over the period of 1995-2004, a total of 500 million people were affected by disasters. Most disasters (75%) are related to weather extremes that climate change is known to exacerbate.

A massive increase in the frequency of natural disasters such as floods, earthquakes, tsunamis, forest fires have been observed in the last decades and have had a direct impact in human health. Approximately 600, 000 deaths occurred worldwide as a result of weather-related natural disasters in the 1990s; some 95% of these were in poor countries.

Resurgence of Infectious Diseases (41)

Projections of increased temperature and precipitation suggest the emergence of more disease-conducive conditions in regions that did not previously host diseases or disease carriers. Climate change accelerates the spread of disease primarily because warmer global temperatures enlarge the geographic range in which disease-carrying animals, insects and microorganisms-as well as the germs and viruses they carry can survive. In addition to changing weather patterns, climatic conditions affect diseases transmitted via vectors such as mosquitoes (vector-borne disease) or through rodents (rodent-borne disease).

Climate-sensitive diseases are among the largest global killers. Diarrhea, malaria and protein-energy malnutrition alone caused more than 3.3 million deaths globally in 2002, with 29% of these occurring in Africa.

Extreme events--floods, storms, drought, and uncontained fires--can be devastating for health. Floods spread bacteria, viruses, and chemical contaminants, foster the growth of fungi, and contribute to the breeding of insects. Prolonged drought conditions interrupted by heavy rains, favour population explosions of both insects and rodents. Extreme weather events have been accompanied by outbreaks of malaria and other water-borne diseases, such as typhoid, hepatitis A, bacillary dysentery, and cholera.

Vector-borne Diseases (41)

Vector-borne diseases (VBD) are infections transmitted by the bite of infected arthropod species, like mosquitoes, ticks, bugs, sandflies and blackflies.

Mosquitoes, which can carry many diseases, are very sensitive to climatic changes. Warming of their environment boosts their rates of reproduction and the number of their blood intake, prolongs their breeding season, and shortens the maturation period for the microbes they disperse. Mosquitoes and the diseases they carry—including malaria, dengue fever, and West Nile virus—are especially sensitive to temperature changes and land elevation. Rates of insect bites and the maturation of microorganisms within them are temperature-dependent, and both rates increase when the air warms thereby enhancing the chances for disease transmission.

Both insects and insect-borne diseases (including malaria and dengue fever) are today being reported at higher altitudes in Africa, Asia, and Latin America. Epidemics of highland malaria have been reported in some parts of Ethiopia.

Mosquito populations, for example, are naturally controlled by reptiles, birds, spiders, and bats--as well as by pond fish that feed on mosquito larvae. Mosquitoes provide nourishment for these animals, but some carry malaria, yellow fever, dengue fever, and several types of encephalitis.

Rodent-borne Diseases (41)

Rodent-borne disease are carried by rats, mice, bats, or other rodents. There is evidence that diseases transmitted by rodents sometimes increase during heavy rainfall and flooding because of the altered patterns of human–pathogen–rodent contact. Floods are frequently followed by disease clusters: heavy rains can drive rodents out from burrows, create mosquito-breeding sites, foster fungus growth in houses, and flush out pathogens, nutrients, and chemicals into waterways.

Who is at risk? (48)

All populations are vulnerable to the negative effect of climate change, but some are more vulnerable than others. People living in small island developing states and other coastal regions, megacities, and mountainous and polar regions are particularly vulnerable.

Children – in particular, children living in poor countries – are among the most vulnerable to the health hazards connected with climate change and will be exposed longer to the ill health consequences. What is more, effects are also expected to be more severe for elderly people and people with infirmities or pre-existing medical conditions.

Areas with weak health infrastructure – mostly in developing countries – are incapable of coping with diseases without assistance to prepare and respond.

The right policies and certain measures emanating from have the potential to reduce greenhouse gas emissions and result in major health co-benefits. For example, promoting the safe use of public transportation and other means of movement – such as cycling or walking as alternatives to using private vehicles – could reduce carbon dioxide emissions and improve health.

2. Chronic Non-communicable Diseases

A non-communicable disease, or NCD, is a medical condition or disease which is non-infectious. NCDs are diseases of long duration and generally slow progression. These include heart disease, stroke, cancer, asthma, diabetes, chronic kidney disease, arthritis, osteoporosis, cataracts, and more. While often referred to as "chronic diseases", NCDs are distinguished by their non-infectious causes. In contrast, some chronic diseases such as HIV/AIDS, while also lasting medical conditions, are caused by transmissible infections. They are similar in being they also require chronic care management. The U.S. National Center for Health Statistics defines a chronic disease as one lasting three months or more (49).

Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality in the world, representing 63% of all deaths. Out of the 36 million people who died from chronic diseases in 2008, 29% were under 60.

This invisible epidemic of chronic diseases hinders the economic development of many countries and contributes to poverty. Contrary to the common perception, 80% of chronic disease related deaths occur in low and middle income countries.

The growing burden of NCDs is yet another emerging challenge to socioeconomic progress particularly in developing countries. Total deaths from NCDs are projected to increase by a further 17% over the next 10 years. The

rapidly increasing burden of these diseases is affecting poor and disadvantaged populations disproportionately, contributing to widening health gaps between and within countries. As NCDs are largely preventable, the number of premature deaths caused by them can be greatly reduced (50).

2.1 Cardiovascular diseases (51)

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and include:

Coronary heart disease: disease of the blood vessels supplying the heart muscle.

Cerebrovascular disease: disease of the blood vessels supplying the brain.

Peripheral arterial disease: disease of blood vessels supplying the arms and legs.

Rheumatic heart disease: damage to the heart muscle and heart valves from rheumatic fever, caused by the streptococcal bacteria.

Congenital heart disease: malformations of heart structure from birth.

Deep vein thrombosis and pulmonary embolism: blood clots in the leg veins, which can dislodge and move to the heart and lungs.

Heart attacks and strokes are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart or brain. The most common reason for this is a build-up of fatty deposits on the inner walls of the blood vessels that supply the heart or brain. Strokes can also be caused by bleeding from a blood vessel in the brain or from blood clots.

CVDs are the number one cause of death globally: more people die annually from CVDs than from any other cause. Over 80% of CVD deaths take place in low and middle-income countries and occur almost equally in men and women. By 2015, almost 20 million people will die from CVDs, mainly from heart disease and stroke.

The causes of CVDs are well known. The most important causes of heart disease and stroke are unhealthy diet, physical inactivity and tobacco use. These are called 'modifiable risk factors'.

The effects of unhealthy diet and physical inactivity may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity; these are called 'intermediate risk factors'.

The major modifiable risk factors are responsible for about 80% of coronary heart disease and cerebrovascular disease.

There are also a number of underlying determinants of chronic diseases, also considered as "the causes of the causes". These are a reflection of the major forces driving social, economic and cultural change – globalization,

urbanization, and population ageing. Other determinants of CVDs are poverty and stress.

CVDs are often symptomless. A heart attack or stroke may be the first warning of underlying disease.

Symptoms of a heart attack include: pain or discomfort in the centre of the chest; pain or discomfort in the arms, the left shoulder, elbows, jaw, or back. In addition the person may experience difficulty in breathing or shortness of breath; feeling sick or vomiting; feeling light-headed or faint; breaking into a cold sweat; and becoming pale. Women are more likely to have shortness of breath, nausea, vomiting, and back or jaw pain.

The most common symptom of a stroke is sudden weakness of the face, arm, or leg, most often on one side of the body. Other symptoms include sudden onset of: numbness of the face, arm, or leg, especially on one side of the body; confusion, difficulty speaking or understanding speech; difficulty seeing with one or both eyes; difficulty walking, dizziness, loss of balance or coordination; severe headache with no known cause; and fainting or unconsciousness.

At least 80% of premature deaths from heart disease and stroke could be avoided through healthy diet, regular physical activity and avoiding tobacco smoke. Individuals can reduce their risk of CVDs by engaging in regular physical activity, avoiding tobacco use and second-hand tobacco smoke, choosing a diet rich in fruit and vegetables and avoiding foods that are high in fat, sugar and salt, and maintaining a healthy body weight.

Comprehensive and integrated action is the means to prevent and control CVDs:

- Comprehensive action requires combining approaches that seek to reduce the risks throughout the entire population with strategies that target individuals at high risk or with established disease;
- Examples of population-wide interventions that can be implemented to reduce CVDs include: comprehensive tobacco control policies, taxation to reduce the intake of foods that are high in fat, sugar and salt, building walking and cycle ways to increase physical activity, providing healthy school meals to children
- Integrated approaches focus on the main common risk factors for a range of chronic diseases such as CVD, diabetes and cancer: unhealthy diet, physically inactivity and tobacco use.

2.2 Diabetes mellitus (52)

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin, or alternatively, when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycaemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

Type 1 diabetes (previously known as insulin-dependent or childhood-onset) is characterized by a lack of insulin production. Without daily administration of insulin, Type 1 diabetes is rapidly fatal.

Symptoms include excessive excretion of urine (polyuria), thirst (polydipsia), constant hunger, weight loss, vision changes and fatigue. These symptoms may occur suddenly.

Type 2 diabetes (formerly called non-insulin-dependent or adult-onset) results from the body's ineffective use of insulin. Type 2 diabetes comprises 90% of people with diabetes around the world, and is largely the result of excess body weight and physical inactivity. Until recently, this type of diabetes was seen only in adults but it is now also occurring in obese children.

Symptoms may be similar to those of Type 1 diabetes, but are often less marked. As a result, the disease may be diagnosed several years after onset, once complications have already arisen.

Gestational diabetes is hyperglycaemia which is first recognized during pregnancy.

Symptoms of gestational diabetes are similar to Type 2 diabetes. Gestational diabetes is most often diagnosed through prenatal screening, rather than reported symptoms.

Impaired Glucose Tolerance (IGT) and **Impaired Fasting Glycaemia (IFG)** are intermediate conditions in the transition between normality and diabetes.

People with IGT or IFG are at high risk of progressing to type 2 diabetes, although this is not inevitable.

Diabetes Facts

The World Health Organization (WHO) estimates that more than 180 million people worldwide have diabetes. This number is likely to more than double by 2030.

In 2005, an estimated 1.1 million people died from diabetes. However, this figure would underestimate the true burden from diabetes. Although people may live for years with diabetes, their underlying cause of death is usually recorded as heart disease or kidney failure. An alternative estimate, taking into account deaths in which diabetes was a contributory condition, suggests that approximately 2.9 million deaths per year are attributable to diabetes.

Almost 80% of diabetes deaths occur in low and middle-income countries. Almost half of diabetes deaths occur in people under the age of 70 years; 55% of diabetes deaths are in women.

WHO projects that deaths due to diabetes will increase by more than 50% in the next 10 years without urgent action. Most notably, diabetes deaths are projected to increase by over 80% in upper-middle income countries between 2006 and 2015.

Common Consequences of Diabetes

Over time, diabetes can damage the heart, blood vessels, eyes, kidneys, and nerves.

Diabetic retinopathy is an important cause of blindness, and occurs as a result of long-term accumulated damage to the small blood vessels in the retina. After 15 years of diabetes, approximately 2% of people become blind, and about 10% develop severe visual impairment.

Diabetic neuropathy is damage to the nerves as a result of diabetes, and affects up to 50% of people with diabetes. Although many different problems can occur as a result of diabetic neuropathy, common symptoms are tingling, pain, numbness, or weakness in the feet and hands.

Combined with reduced blood flow, neuropathy in the feet increases the chance of *foot ulcers* and eventual *limb amputation*.

Diabetes is among the leading causes of kidney failure. 10-20% of people with diabetes die of *kidney failure*.

Diabetes increases the risk of *heart disease and stroke*. 50% of people with diabetes die of cardiovascular disease (primarily heart disease and stroke).

The overall risk of dying among people with diabetes is at least double the risk of their peers without diabetes.

To help prevent type 2 diabetes and its complications, people should:

- Achieve and maintain healthy body weight.

- Be physically active - at least 30 minutes of regular, moderate-intensity activity on most days.
- Early diagnosis can be accomplished through relatively inexpensive blood testing.
- Treatment of diabetes involves lowering blood glucose and the levels of other known risk factors that damage blood vessels.
- Interventions that are both cost saving and feasible in developing countries include:
 - Moderate blood glucose control;
 - People with type 1 diabetes require insulin; people with type 2 diabetes can be treated with oral medication, but may also require insulin;
 - Blood pressure control;
 - Tobacco cessation is also important to avoid complications.

These measures should be supported by a healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use.

2.3 Cancer (53)

Cancer is a generic term for a group of more than 100 diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells which grow beyond their usual boundaries, and which can invade adjoining parts of

the body and spread to other organs, a process referred to as metastasis. Metastases are the major cause of death from cancer.

Cancer is a leading cause of death worldwide. In 2007, cancer accounted for 7.9 million deaths (around 13% of all deaths). About 72% of all cancer deaths in 2007 occurred in low- and middle-income countries. Deaths from cancer in the world are projected to continue rising, with an estimated 9 million people dying from it in 2015 and 12 million in 2030.

The most frequent cancer types worldwide are:

- Among men: lung, stomach, liver, colorectal, oesophagus and prostate.
- Among women: breast, lung, stomach, colorectal and cervical.

About 40% of cancer can be prevented (by a healthy diet, physical activity and not using tobacco). Tobacco use is the single largest preventable cause of cancer in the world. Tobacco use causes cancer of the lung, throat, mouth, pancreas, bladder, stomach, liver cancer, kidney and other types; Environmental tobacco smoke (passive smoking) causes lung cancer.

One-fifth of cancers worldwide are due to chronic infections, mainly from hepatitis B viruses HBV (causing liver), human papilloma viruses HPV (causing cervix cancer), *Helicobacter pylori* (causing stomach cancer), schistosomes (causing bladder cancer), the liver fluke (bile duct) and human immunodeficiency virus HIV (Kaposi sarcoma and lymphomas).

Tobacco use is the single most important risk factor for cancer and causes a large variety of cancer types such as lung, larynx, oesophagus, stomach, bladder, oral cavity and others. Dietary factors also play an important role in causing cancer. This applies to obesity as a compound risk factor per se as well as to the composition of the diet such as lack of fruit and vegetables and high salt intake. Lack of physical activity has a distinct role as risk factor for cancer. There is solid evidence about alcohol causing several cancer types such as oesophagus, pharynx, larynx, liver, breast, and other types.

Cancer Control

Cancer control involves implementation of evidence-based strategies for prevention, early detection and management.

Up to one third of the cancer burden could be reduced by implementing cancer preventing strategies which are aimed at reducing the exposure to cancer risk mainly by:

- changes in tobacco and alcohol use, dietary and physical activity patterns
- immunization against HPV infection
- the control of occupational hazards and
- Reducing exposure to sunlight.

Another third of the cancer burden could be cured through early detection and adequate and proper treatment.

Early detection of cancer improves effectiveness of treatment. Education promotes early diagnosis by recognizing early signs of cancer like: lumps, sores, persistent indigestion, persistent coughing, and bleeding from the body's orifices; and the importance of seeking prompt medical attention for these symptoms.

Screening is the identification by means of tests of people with early cancer or pre-cancer before signs are detectable. Screening tests are available for breast cancer (Mammography) and Cervical cancer (Cytology tests).

Treatment of cancer is aimed at curing, prolonging life and improving quality of life of patients with cancer. Some of the most common cancer types such as breast, cervical and the colorectal cancer have a high cure rate when detected early and treated according to best evidence. The principal methods of treatment are surgery, radiotherapy and chemotherapy. Fundamental for adequate treatment is an accurate diagnosis through investigations involving imaging technology (ultrasound, endoscopy, radiography) and laboratory (pathology).

Relief from pain and other problems can be achieved in over 90% of all cancer patients by means of palliative care. Effective strategies exist for the provision of palliative care services for both cancer patients and their families, even in low resource settings.

2.4 Chronic Respiratory Diseases (54)

Chronic respiratory diseases affect the airways and other structures of the lung. Some of the most common are asthma, chronic obstructive pulmonary disease (COPD), respiratory allergies, occupational lung diseases and pulmonary hypertension.

The most important risk factors of preventable chronic respiratory diseases are: tobacco smoking, indoor air pollution, outdoor pollution, allergens, occupational risks and vulnerability.

Chronic Obstructive Pulmonary Disease (COPD) (55)

Chronic Obstructive Pulmonary Disease (COPD) is an umbrella term used to describe chronic lung diseases that cause limitations in lung airflow. The more familiar terms 'chronic bronchitis' and 'emphysema' are no longer used, but are now included within the COPD diagnosis. COPD is an under-diagnosed, life-threatening lung disease.

The primary cause of COPD is tobacco smoke (including second-hand or passive exposure). Other risk factors include; indoor air pollution (such as biomass fuel used for cooking and heating); outdoor air pollution; occupational dusts and chemicals (vapours, irritants, and fumes); frequent lower respiratory infections during childhood.

The most common symptoms of COPD are breathlessness, or a 'need for air', excessive sputum production, and a chronic cough. Daily activities, such as

walking up a short flight of stairs, may become very difficult as the disease worsens.

A COPD diagnosis is confirmed by a simple test called spirometry, which measures how deeply a person can breathe and how fast air can move into and out of the lungs. Because COPD develops slowly, it is most frequently diagnosed in people aged 40 years or older.

COPD is preventable, but not curable. The most important measure for preventing COPD and for stopping its progression is avoiding tobacco smoke (including passive exposure). Although COPD cannot be cured, appropriate management can control symptoms, slow its progression and enable people to enjoy good quality of life.

Asthma (56)

Asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person. Symptoms may occur several times in a day or week in affected individuals, and for some people become worse during physical activity or at night. During an asthma attack, the lining of the bronchial tubes swell, causing the airways to narrow and reducing the flow of air into and out of the lungs. Recurrent asthma symptoms frequently cause sleeplessness, daytime fatigue, reduced activity levels and school and work absenteeism. Asthma has a relatively low fatality rate compared to other chronic diseases.

Facts about Asthma

According to the World Health Organization (WHO) estimates, 300 million people suffer from asthma and 255 000 people died of in 2005. Asthma is the most common chronic disease among children.

Asthma is not just a public health problem for high income countries: it occurs in all countries regardless of the level of development. Over 80% of asthma deaths occur in low and lower-middle income countries. Asthma is under-diagnosed and under-treated, creating a substantial burden to individuals and families and possibly restricting individuals' activities for a lifetime.

Although the fundamental causes of asthma are not completely understood, the strongest risk factors for developing asthma are inhaled asthma triggers.

These include:

- indoor allergens (for example house dust mites in bedding, carpets and stuffed furniture, pollution and pet dander)
- outdoor allergens (such as pollens and moulds)
- tobacco smoke and
- chemical irritants in the workplace

Other triggers can include cold air, extreme emotional arousal such as anger or fear, and physical exercise. Even certain medications can trigger asthma such as aspirin and other non-steroid anti-inflammatory drugs, and beta-blockers (which are used to treat high blood pressure, heart conditions and migraine).

Urbanization has also been associated with an increase in asthma, however the exact nature of this relationship is unclear.

Although asthma cannot be cured, appropriate management can control the disorder and enable people to enjoy good quality of life. If symptoms occur, short-term medications are used to relieve them. People with moderate to severe asthma must take long-term medication daily to control the underlying inflammation and prevent symptoms and attacks.

Medication is not the only way to control asthma. It is also important to avoid asthma triggers - stimuli that irritate and inflame the airways. With medical support, each person must learn what triggers he or she should avoid.

2.5 Chronic Kidney Disease (CKD) (57, 58, 59)

Chronic kidney disease (CKD), also known as chronic renal disease, is a progressive loss in renal function over a period of months or years. The symptoms of worsening kidney function are nonspecific, and might include feeling generally unwell and experiencing reduced appetite. Often, chronic kidney disease is diagnosed as a result of screening of people known to be at risk of kidney problems, such as those with high blood pressure or diabetes and those with a blood relative with chronic kidney disease. Chronic kidney disease may also be identified when it leads to one of its recognized complications, such as cardiovascular disease, anemia or pericarditis.

The term 'chronic' refers to a condition that is persistent or long-term or not completely reversible. However, it does not necessarily mean severe. It is important to differentiate CKD from acute renal failure (ARF) because ARF can be reversible.

There is compelling evidence that CKD is not only common, harmful and treatable but also a major contributing factor to the incidence and outcomes of diabetes, hypertension and CVD. CKD strongly predisposes to hypertension and CVD; diabetes, hypertension and CVD are all major causes of CKD; and major risk factors for diabetes, hypertension and CVD (such as obesity and smoking) also cause or exacerbate CKD. In addition, among people with diabetes, hypertension, or CVD, the subset with CKD are at highest risk of adverse outcomes and high health care costs. Thus, CKD, diabetes and cardiovascular disease are closely associated conditions that often coexist; share common risk factors and treatments; and would benefit from a coordinated approach to prevention and control.

In most cases CKD does not cause any symptoms, and is detected because tests are abnormal. These may be urine tests for blood or protein; an X-ray or scan of the kidneys; or a blood test to measure kidney function.

Chronic kidney disease is identified by a blood test for creatinine. Higher levels of creatinine indicate a falling glomerular filtration rate and as a result a decreased capability of the kidneys to excrete waste products. Creatinine levels may be normal in the early stages of CKD, and the condition is discovered if urinalysis (testing of a urine sample) shows that the kidney is allowing the loss

of protein or red blood cells into the urine. To fully investigate the underlying cause of kidney damage, various forms of medical imaging, blood tests and often renal biopsy (removing a small sample of kidney tissue) are employed to find out if there is a reversible cause for the kidney malfunction.

Early identification of patients with kidney disease is recommended, as measures may be instituted to slow progression and mitigate cardiovascular risks. Among those who should be screened are subjects with hypertension or history of cardiovascular disease, those with diabetes or marked obesity, those aged > 60 years, those with a history of renal disease in the past, as well as subjects who have relatives who had kidney disease requiring dialysis.

The most common causes of CKD are diabetes mellitus, hypertension, and glomerulonephritis. Together, these cause approximately 75% of all adult cases.

There is no specific treatment unequivocally shown to slow the worsening of chronic kidney disease. If there is an underlying cause to CKD, such as vasculitis, this may be treated directly with treatments aimed to slow the damage. In more advanced stages, treatments may be required for anaemia and bone disease. Severe CKD requires one of the forms of renal replacement therapy; this may be a form of dialysis, but ideally constitutes a kidney transplant.

There are some things that everyone with CKD should try to do. These are:-

- lose weight (if overweight), and take regular exercise

- stop smoking
- reduce the amount of salt in the diet in order to help control the blood pressure
- eat a healthy balanced diet
- drink about 2 litres of fluid a day.

If someone with CKD also has diabetes, extra care to control the blood pressure, blood sugar levels and cholesterol levels is required. More intensive monitoring will be performed, including extra urine tests to look for protein in the urine. This is because CKD can be a complication of diabetes.

3. Risk Factors of Chronic Diseases

Chronic diseases are largely preventable diseases. Beyond the appropriate medical treatment for those already affected, the public health approach of primary prevention is considered to be the most cost-effective, affordable and sustainable course of action to cope with the chronic disease epidemic worldwide. Sometimes chronic diseases are considered communicable at the risk factor level (60). Modern dietary patterns and physical activity patterns are risk behaviours that travel across countries and are transferable from one population to another like an infectious disease, affecting disease patterns globally (41).

While age, sex and genetic susceptibility are non-modifiable, many of the risks associated with age and sex are modifiable. Such risks include behavioural factors (e.g. diet, physical inactivity, tobacco use, alcohol consumption); biological factors (e.g. dyslipidemia, hypertension, overweight, hyperinsulinaemia); and finally societal factors, which include a complex mixture of interacting socioeconomic, cultural and other environmental parameters (41).

3.1 Contextual Factors

Rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development and market globalization have accelerated over the past decades. These are having a significant impact on the

health and nutritional status of populations, particularly in developing countries and in countries in transition. While standards of living have improved, food availability has expanded and become more diversified, and access to services has increased, there have also been significant negative consequences in terms of inappropriate dietary patterns, decreased physical activities and increased tobacco use, and a corresponding increase in diet-related chronic diseases, especially among poor people (41).

Food and food products have become commodities produced and traded in a market that has expanded from an essentially local base to an increasingly global one. Changes in the world food economy are reflected in shifting dietary patterns, for example, increased consumption of energy-dense diets high in fat, particularly saturated fat, and low in unrefined carbohydrates. These patterns are combined with a decline in energy expenditure that is associated with a sedentary lifestyle -- motorized transport, labour-saving devices in the home, the phasing out of physically demanding manual tasks in the workplace, and leisure time that is preponderantly devoted to physically undemanding pastimes such as watching television and working on the computer (61).

Because of these changes in dietary and lifestyle patterns, chronic NCDs - including obesity, diabetes mellitus, cardiovascular disease (CVD), hypertension and stroke, and some types of cancer - are becoming increasingly significant causes of disability and premature death in both developing and newly

developed countries, placing additional burdens on already overstretched national health budgets (61).

3.2 High Blood Pressure

Blood pressure is a measure of the force that the circulating blood exerts on the walls of the main arteries. The pressure wave transmitted along the arteries with each heartbeat is easily felt as the pulse – the highest (systolic) pressure is created by the heart contracting and the lowest (diastolic) pressure is measured as the heart fills. Raised blood pressure is almost always without symptoms. However, elevated blood pressure levels produce a variety of structural changes in the arteries that supply blood to the brain, heart, kidneys and elsewhere (62,63,64).

The main modifiable causes of high blood pressure are diet, especially salt intake, levels of exercise, obesity, and excessive alcohol intake. As a result of the cumulative effects of these factors blood pressure usually rises steadily with age, except in societies in which salt intake is comparatively low, physical activity high and obesity largely absent. Most adults have blood pressure levels that are suboptimal for health. This is true for both economically developing and developed countries. Globally, about 62% of cerebrovascular disease and 49% of ischaemic heart disease are attributable to suboptimal blood pressure (systolic >115 mmHg), with little variation by sex. High blood pressure is estimated to cause 7.1 million deaths, about 13% of the total (41) worldwide.

3.3 High Cholesterol

Cholesterol is a fat-like substance, found in the bloodstream as well as in bodily organs and nerve fibres. Most cholesterol in the body is made by the liver from a wide variety of foods, especially from saturated fats, such as those found in animal products. A diet high in saturated fat content, heredity, and various metabolic conditions such as diabetes mellitus influence an individual's level of cholesterol. Cholesterol levels usually rise steadily with age, more steeply in women, and stabilize after middle age (41).

When lipid levels in the bloodstream are too high or low, this condition is called *dyslipidemia*. The most common types of dyslipidemia are:

- high levels of low-density lipoprotein (LDL or “bad”) cholesterol
- low levels of high-density lipoprotein (HDL or “good”) cholesterol and
- high levels of triglycerides

Cholesterol is manufactured mainly in the liver but it is also present in saturated fats. It is found in meat and dairy products and many processed foods. Dairy fat and meat are major sources of cholesterol. Egg yolk is particularly rich in cholesterol but unlike dairy and meat does not provide saturated fatty acids. Excess saturated fat in the diet increases blood cholesterol. The upper limit for dietary cholesterol intake has been prescribed, in most guidelines, to be 300 mg/d. However, there is no requirement for dietary cholesterol and it is advisable to keep the intake as low as possible.

Cholesterol is a key component in the development of atherosclerosis, the accumulation of fatty deposits on the inner lining of arteries. Mainly as a result of this, cholesterol increases the risks of ischaemic heart disease, ischaemic stroke and other vascular diseases (41).

High cholesterol is estimated to cause 18% of global cerebrovascular disease (mostly nonfatal events) and 56% of global ischaemic heart disease. Overall this amounts to about 4.4 million deaths (7.9% of total) (41).

3.4 Obesity, overweight, and high Body Mass

The prevalence of overweight and obesity is commonly assessed using body mass index (BMI), a height/weight formula with a strong correlation to body fat content. WHO criteria define overweight as a BMI of at least 25 kg/m² and obesity as a BMI of at least 30 kg/m². These markers provide common benchmarks for assessment, but the risks of disease in all populations increase progressively starting from BMI levels of 20–22 kg/m² (41).

Adult mean BMI levels of 20–23 kg/m² are found in Africa and Asia, while levels are 25–27 kg/m² across North America and Europe. BMI increases among middle-aged and elderly people, who are at greatest risk of health complications. Increases in free sugar and saturated fats, combined with reduced physical activity, have led to the rise in obesity rates in many parts of the world. A new demographic transition in developing countries is producing rapid increases in BMI, particularly among the young (65).

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischaemic stroke and type 2 diabetes mellitus increase steadily with increasing BMI. Type 2 diabetes mellitus – confined to older adults for most of the 20th century – now affects obese children even before puberty. Modest weight reduction reduces blood pressure and abnormal blood cholesterol and substantially lowers risk of type 2 diabetes. Raised BMI also increases the risks of cancer of the breast, colon, prostate, endometrium, kidney and gallbladder. Chronic overweight and obesity contribute significantly to osteoarthritis, a major cause of disability in adults (41).

It is to be noted that the most commonly used measure of adiposity; body mass index varies across populations has necessitated introducing other indices including abdominal circumference, waist-to-hip ratio and waist-to-height ratios the applicability of which is yet to be evaluated in many settings.

3.5 Low Fruit and Vegetable Intake

Fruit and vegetables are important components of a healthy diet. Accumulating evidence suggests that they could help prevent such major diseases as cardiovascular diseases (66) and certain cancers principally of the digestive system (67). There are several mechanisms by which these protective effects may be mediated, involving antioxidants and other micronutrients, such as flavonoids, carotenoids, vitamin C and folic acid, as well as dietary fibre. These

and other substances block or suppress the action of carcinogens and, as antioxidants, prevent oxidative DNA damage (41).

Low intake of fruit and vegetables is estimated to cause about 19% of gastrointestinal cancer, and about 31% of ischemic heart disease and 11% of stroke worldwide (41).

3.6 Physical Inactivity

Opportunities for people to be physically active exist in the four major domains of their day-to-day lives: at work (especially if the job involves manual labour); transport (for example, walking or cycling to work); in domestic duties (for example, housework or gathering fuel); or in leisure time (for example, participating in sports or recreational activities). Physical inactivity is defined as doing very little or no physical activity in any of these domains (41).

Physical activity reduces the risk of cardiovascular disease, some cancers and type 2 diabetes. These benefits are mediated through a number of mechanisms (68). In general, physical activity improves glucose metabolism, reduces body fat and lowers blood pressure; these are the main ways in which it is thought to reduce the risk of cardiovascular diseases and diabetes. Physical activity is also associated with lower risk of breast cancer. Physical activity can improve musculoskeletal health, such as osteoarthritis and low back pain, osteoporosis and falls, control body weight, and reduce symptoms of depression, anxiety and stress (41).

For better health, people of all ages should include a minimum of 30 minutes of physical activity of moderate intensity (such as brisk walking) on most, if not all, days of the week. For most people greater health benefits can be obtained by engaging in physical activity of more vigorous intensity or of longer duration (41).

The global estimate for prevalence of physical inactivity among adults 15 years and over is 17%, ranging from 11% to 24% across subregions. (41).

Overall physical inactivity was estimated to cause 1.9 million deaths globally. Physical inactivity is estimated to cause, globally, about 10–16% of cases each of breast cancer, colon and rectal cancers and diabetes mellitus, and about 22% of ischemic heart disease (41).

3.7 Smoking and Oral Tobacco Use

Smoking causes substantially increased risk of mortality from lung cancer, several other cancers, heart disease, stroke, chronic respiratory disease and a range of other medical causes. As a result, in populations where smoking has been common for many decades, tobacco use accounts for a considerable proportion of mortality (71). Smoking also harms others – there are definite health risks from passive smoking and smoking during pregnancy adversely affects fetal development. While cigarette smoking causes the majority of the

adverse health effects of tobacco, chewing is also hazardous, causing oral cancer in particular, as does tobacco smoking via cigars or pipes (41).

While prevalence of tobacco use has declined in some high income countries, it is increasing in some low and middle income countries, especially among young people and women (69, 70).

Among industrialized countries, where smoking has been common, so far smoking is estimated to cause over 90% of lung cancer in men and about 70% of lung cancer among women. In addition, smoking contributes to 56–80% of chronic respiratory disease and 22% of cardiovascular disease. Worldwide, it is estimated that tobacco causes about 8.8% of deaths (4.9 million) (41).

3.8 Alcohol Use

Alcohol consumption has health and social consequences via intoxication (drunkenness), dependence (habitual, compulsive, long-term heavy drinking) and other biochemical effects (41).

Intoxication contributes to car accidents and domestic violence, and can also cause chronic health and social problems. Alcohol dependence is a disorder in itself. There is increasing evidence that patterns of drinking are relevant to health. The volume of alcohol consumed, binge drinking is hazardous (41).

Overall, there are causal relationships between average volume of alcohol consumption and more than 60 types of disease and injury. Most of these

relationships are detrimental, but there are beneficial relationships with coronary heart disease, stroke and diabetes mellitus, provided low-to-moderate average volume of consumption is combined with non-binge patterns of drinking (41).

Worldwide, alcohol causes 3.2% of deaths (1.8 million). This proportion is much higher in males (5.6% of deaths) than females (0.6% of deaths). Alcohol is also thought to cause about 20–30% of each of the following worldwide: oesophageal cancer, liver cancer, and cirrhosis of the liver, homicide, epilepsy, and motor vehicle accidents (41).

4. Non Communicable Disease and Their Risk Factors - The Ethiopian Situation

4.1 The Burden of No communicable Diseases in Ethiopia

Ethiopia, like many developing countries, is a country in transition, facing the consequences of epidemiologic, demographic, economic and nutrition transitions which continue to favour the chronic diseases epidemic. Current projections indicate that the proportion of people living in to older ages and in the urban areas will significantly increase over the coming two decades. For example, life expectancy is expected to rise from the current 53 for males and 56 years for females to 65 and 68 years for males and females respectively in the years 2025 - 2030. The proportion of the population living in urban areas is expected to reach 23 percent from the current 15 percent during the same period (78).

Some of the available data also indicate that chronic diseases and their risk factors in Ethiopia tend to occur at younger age groups and result in higher mortality compared to the developed world. The following section is a summary of the evidence on the growing importance of chronic diseases particularly among urban residents of the country.

4.1.1 Cardiovascular diseases (CVD) and stroke

In Ethiopia, there is a lack of reliable CVD mortality and morbidity data which is partly due to the nature of the diseases (for instance silent myocardial

infarction or asymptomatic coronary heart disease) and the less attention given to chronic diseases in general.

There is a growing consensus among clinicians and public health officials that the magnitude of CVDs and contributing conditions including obesity and diabetes has increased in the past couple of decades. Alternative explanations for the apparent increase include increased awareness and service utilization among the general public, improved diagnostic capacity in health facilities, and rapid population growth which should be carefully investigated to establish the extent of the increase with reasonable accuracy.

Since under nutrition rather than dietary excess continues to be a pressing problem in much of rural Ethiopia, low birth weight and sub-optimal development may also be an important determinant of cardiovascular diseases in later age for people moving to towns and cities and adopting western lifestyles.

Available evidence from some of the hospital based analyses of causes of death as early as 1984 indicate that cardiovascular diseases have been among the list of the ten most top causes of mortality in hospitals (79, 80, 81, 82) in Ethiopia.

Studies also show that the hospital burden of stroke has increased over the past three decades, hemorrhagic stroke being the most common type. Major risk factors for stroke include hypertension followed by cardiac diseases. The same study also found that the majority of hypertensive patients were either

on no form of treatment (28.9%) or erratic and irregular treatments (38.3%) (83).

In contrast to the disease pattern in the west, Ethiopian patients with cerebrovascular disease tend to be younger. Worth mentioning is the study by Bekele et al which reported that a substantial percentage of stroke patients are young adults (28 percent) with hypertension and rheumatic heart disease being the commonest risk factors (84).

4.1.2 Hypertension

High blood pressure, also known as hypertension, is the most common cardiovascular disease and it is the leading cause of stroke and a major cause of heart attack.

A population based study in Addis in the year 2006 found that the prevalence high blood pressure, defined as systolic blood pressure (SBP) \geq 140 mmHg (millimeters of mercury) or diastolic blood pressure (DBP) \geq 90 mmHg or reported use of anti-hypertensive medication, was around 32 percent among males and 29 percent among females. This is in contrast to the relatively low prevalence of hypertension in rural areas (10 percent among males and 5 percent among females in rural Butajira) for example.

Among adults with high BP, less than 6 % of those in Butajira and about 33 % in Addis are aware of their BP. Similarly, less than 5 % in Butajira and 15 % in

Addis were receiving anti-hypertensive treatment. Females in Addis had better awareness and access to treatment compared to males, while the difference between males and females in Butajira was not marked (85).

A more recent study among working adults in Addis Ababa found a slightly lower prevalence of hypertension of 22 percent and 19 percent among men and women respectively (86).

4.1.3 Type II diabetes mellitus

Diabetes represents a considerable health problem and is a growing cause of death in Ethiopia. It is one of the chronic illnesses that require continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complications.

Classification of diabetes is not always clear. Data from Ethiopia suggest that majority of insulin-requiring diabetes differ from what is typically classified as type 1 diabetes in the western world. According to findings from some of the local studies, the clinical features of many of insulin requiring patients in Ethiopia resemble what has been described as malnutrition related diabetes, a category which is not recognized in the current WHO classification. In general, the insulin requiring diabetes in Ethiopian patients occurs at a relatively older age (peak 25-29 years), with male predominance and often in the background of malnutrition and poverty. This is in contrast to type 1 diabetes in the west

which usually occurs at a younger age among the privileged with a similar incidence among boys and girls (87).

Available estimates on the prevalence of diabetes vary considerably from 0.3% for Gondar region in northwest Ethiopia to 1.9 for the whole country (88, 89).

Type 2 diabetes is more common among urban residents, 71 percent among urban residents compared to 23 percent in rural areas (88). This is in agreement with the global trends in many developing countries which are undergoing economic and nutrition transitions. The fact that more and more people are living in urban areas and are leading a sedentary life coupled with the existing culture of consuming fatty foods and related meat products seems to have contributed to the growing disease burden in recent years. Increasing harmful use of alcohol and tobacco are also risk factors associated overweight and obesity which are the main drivers of type-2 diabetes.

Anecdotal evidence from a private clinic caring for patients with diabetes in Addis Ababa indicates that the majority of patients with type2 diabetes belong to what may be regarded the middle socioeconomic class who are usually traders or office workers with sedentary work routines.

According to a study from Gondar, the median age for presentation for type-2 diabetes is around 50 years for both sexes. Females tend to have higher body mass index (BMI) than their male counterparts (with a mean BMI of 25.0 and 23.3 respectively) (90).

Existing data show that the common causes of morbidity among diabetics are infections with prevalence as high as 44 percent among hospitalized patients while cardiovascular diseases and end stage renal diseases contribute more to mortality. Common infections among diabetics include diabetic foot infection, pulmonary tuberculosis, urinary tract infection, pneumonia, and skin and subcutaneous infections (91).

Consistent with the global literature, Ethiopian patients with diabetes have significant dislipidemia (higher triglycerides and low density lipoprotein) compared to non-diabetics (92).

In addition to its significant impact on health and wellbeing of individuals, diabetes imposes a considerable economic burden on communities and the health system. A study on the cost of hospitalization indicates that patients with diabetes generally spend significantly higher amount of money on treatment of acute and long-term complications compared to non-diabetic patients (93).

Furthermore, interviews with key informants in selected referral hospitals indicate that a significant amount budget of public hospitals (for drugs) goes to the procurement of insulin and other drugs for chronic illnesses which has been increasing from time to time.

4.1.4 Cancers

Burden and pattern

The majority of the global cancer burden is now found in low- and medium-resource countries like Ethiopia. Although, there are indications that cancers are becoming important public health challenges, there is no solid evidence on the incidence and pattern of cancers in Ethiopia as there is no population based cancer registry. Available data from the only radiotherapy centre in the country at Tikur Anbessa specialized referral hospital show that cervical cancer, followed by breast cancer and other cancers of above the neck are the three commonest forms of cancers among patients visiting the centre.

Since cervical cancer is exclusively cancer of women and breast cancer is much more common among women than men, women represent more than 70 percent of cancer patients at Tikur Anbessa hospital. Regarding place of residence close to half of patients (around 45 percent) getting treatments for cancers come from Addis Ababa.

The fact that awareness and access to cancer treatment and care is very much limited particularly in the rural areas makes it difficult to generalize if the same disease pattern exists in the general population. Recently, effort is being made to establish a population based cancer registry in Addis Ababa (as a pilot project) with the idea of gradual scale up for the whole country. When implemented, this initiative is hoped to generate reliable data on cancer

incidence and prevalence and associated risk factors this is key to plan population based prevention and control measures.

Contributory factors and screening

Cervical cancer which is the most common cancer in Ethiopia is often preceded by Human papillomavirus infection (HPV), a sexually transmitted infection found in almost all patients and hence recognized as the necessary cause for cervical cancer. A study from southwest Ethiopia showed that as high as two-third of patients with cervical dysplasia (a pre-cancerous form of the disease) has HPV infection (94).

There are four basic components of cancer control – prevention, early detection, diagnosis and treatment, and palliative care. With only one dedicated cancer treatment facility and only handful oncologists for the whole population, it is understandable that Ethiopia has been lagging behind in cancer prevention and control efforts.

To date there is no routine screening program for cancers in Ethiopia. For instance, a study conducted in the year 2001 showed that only 0.6 percent of women in Ethiopia has undergone cervical cancer screening (95).

Since pathology services are readily available in the capital Addis Ababa, relatively higher number of women get screening for cervical cancer on a demand basis.

Awareness and treatment seeking behaviour

Studies show that patients in Ethiopia have limited or no awareness about cancers which partly contributes to delayed health seeking and higher mortality. In many instances patients are unaware of the signs and symptoms of cancers and, consequently, present too late for effective treatment. And when they are aware of their disease, a sense of hopelessness and fatalism is common which contributes to the delay in health seeking (96).

Left without clear guidance on where to go for what kind of symptoms and signs, many patients waste significant part of their resources and time before they reach effective treatment centers and get the services they need (97, 98).

4.1.5 Chronic kidney disease and chronic respiratory diseases

Although there is limited information about the pattern of chronic renal and respiratory diseases in the country there is consensus among experts that both conditions are occurring at increasing frequency.

Chronic kidney disease

Contributing factors to chronic renal disease include diabetes and hypertension which have become more and more important in recent years. This is in contrast to observations a decade or earlier where infectious causes (mainly malaria and sepsis) and abortion complication were much more common and used to cause acute renal failure. Such indications for dialyses for cases of acute renal failure are now seen very occasionally. Instead, dialyses is now

commonly required for patients with chronic renal failure resulting from hypertension or diabetes.

Chronic respiratory disease

The most common chronic respiratory disease in Ethiopia is Bronchial Asthma which appears to increase from year to year. Asthma affects all socioeconomic groups and the major challenge is getting the expensive drugs which are required for a lifetime. Chronic obstructive pulmonary disease is less common as smoking prevalence is generally low in the population. For instance a study conducted in Tikur Anbessa hospital indicated that chronic persistent asthma is a frequent underlying cause of chronic obstructive pulmonary disease and chronic cor-pulmonale compared to smoking related chronic bronchitis/emphysema in Ethiopia (99). There are, however, significant numbers of patients with lung cancer although the prevalence is much lower compared to the western world.

4.1.6 Road Traffic Injuries (RTI)

Ethiopia is facing a huge burden of RTI. According to the most recent 2009 global status report, there were 2517 road traffic fatalities and 24,792 non-fatal injuries reported in the years 2006 and 2007 respectively in Ethiopia. Majority of deaths are among pedestrians (55 percent), followed by passengers (37 percent). Trends in road traffic deaths show a steady increase until 2006 following which there is some decline (100).

Ethiopia has one of the highest fatality rates per vehicle in Africa, with 180 fatalities per 10 000 cars per year. In Addis Ababa approximately 28% of emergency room visits are related to trauma or injury associated accidents. In 2003 over 1800 persons died in Ethiopia due to road traffic injury, 7000 were disabled and property worth US\$ 56 million were lost, due to road traffic crashes. Most victims in the city are vulnerable road users and pedestrians. Pre-hospital care system is inadequate and there are not enough nurses and doctors trained in emergency care. Supplies are also scarce. There is an increase in the number of vehicles, so these figures are expected to rise unless something is being done (101).

In Addis Ababa there is a strong commitment for action from the Traffic Police Department and Road Authorities. There are also ongoing activities on awareness raising amongst schoolchildren and training of school traffic police, and this training has recently been adopted as an integrated part of the existing training curricula at the Addis Ababa Regional Education Bureau. In relation to the World Health Day 2004 on Road Traffic Injuries, the Ethiopian government also assured the public that all efforts will be made to promote road safety in the country (102).

There is currently no national policy on the prevention of road traffic accidents; however, there are draft strategies on road safety. Road traffic accidents are a huge public health and development problem in Ethiopia. Its current situation requires a high level political commitment, immediate decisions and actions in

order to curb the growing problem. Otherwise, it is likely to get worse from day-to-day as the level of motorization and population increase rapidly (103).

Road traffic deaths and serious injuries are to a great extent preventable, since the risk of incurring injury in a crash is largely predictable and many countermeasures, proven to be effective, exist. Road traffic injury needs to be considered alongside heart disease, cancer and stroke as a preventable public health problem that responds well to targeted interventions (104).

The provision of safe, sustainable and affordable means of travel is a key objective in the planning and design of road traffic systems. Achieving it requires firm political will, and an integrated approach involving close collaboration of many sectors, in which the health sector plays a full and active role. In such a systems-based approach, it is possible at the same time to tackle other major problems associated with road traffic, such as congestion, noise emission, air pollution and lack of physical exercise (104).

Data from the burial surveillance in Addis Ababa indicate that of the burials with reported lay causes of death between 2001 and 2008, 6 percent of the deaths were attributable to accidental injuries in Addis Ababa out of which one-third (34.5%) of them were due to RTIs. The trend analysis showed a continuous increase in RTI from 301 (9.2%) in 2001 to 455 (13.9%) in 2008 with atypical peak in 2006 (496, 15.1%). The same study revealed that deaths from RTI are generally more common among the young (19 percent among those 20-29 years of age) and males (77 percent) (105).

A more recent study on the magnitude, causes and possible interventions in Ethiopia indicated that poor road network; absence of knowledge on road traffic safety; mixed traffic flow system; poor legislation and failure of enforcement; poor conditions of vehicles; poor emergency medical services; and absence of traffic accident compulsory insurance law are the key determinants of the problem (106).

In Ethiopia, the National Road Safety Committee is the main institutional body leading the prevention efforts. Cognizant of the seriousness of the problem, the government of Ethiopia, though at sub-national level, has taken effective preventive measures. In particular, the Addis Ababa City Council introduced new Road Traffic Safety Regulations including enforcing seatbelt laws, and prohibiting mobile phones while driving. The newly issued Road Traffic Safety Regulations also prohibits pedestrians from jumping over the ring road barriers, walking on the thoroughfares and mandates crossing the streets using the white lined "zebra crossings".

4.2 Risk factors of NCDs in Ethiopia

Many chronic non-communicable diseases share risk factors that are largely preventable and can be addressed through social, environmental and structural policies, programmes interventions. A large percentage of NCDs are preventable through the reduction of their four main behavioural risk factors: tobacco use, physical inactivity, harmful use of alcohol and unhealthy diet.

4.21 .Tobacco use and khat consumption

Available evidence shows that smoking, regular khat chewing, and binge drinking of alcohol are important NCD risk factors particularly among males in urban areas of Ethiopia.

A population based study in Addis Ababa in the year 2006 found prevalence of current daily smoking and khat chewing among adult men at 11 percent and 18 percent respectively. The figures for current daily smoking and khat chewing in Butajira (in the year 2003) were 7 and 15 percent, respectively (107).

In a school-based survey of students aged 13–15 years in Addis Ababa, a smoking prevalence of 4.5 % in males and 1 % in females was reported with a median age at start of smoking of 20 years.

The same study identified being a male and having one or both smoking parents were associated with smoking while a perception that smoking is harmful was protective. Young people generally had poor knowledge and attitude about smoking; about 30 percent of boys and 25 percent of girls think that those who smoke have more friends while 18.6 percent of boys and 16 percent of believe that girls who smoke look more attractive (108).

Environmental exposure to second hand smoke is also unacceptably high; almost 2 in 10 students live in homes where others smoke in their presence; over 4 in 10 are exposed to smoke in public places, while 1 in10 have parents who smoke (109).

The prevalence of current smoking was much higher among college students (9.5% males, 3.4% females) and high school students (9% males, 2.4 females) in the years 2007 and 2008 respectively, which underlines the need to target this group of young people (110).

4.2.2. Harmful use of alcohol

In many parts of the Ethiopia, drinking alcoholic beverages is a common feature of social gatherings. Nevertheless, the consumption of alcohol carries a risk of adverse health and social consequences related to its intoxicating, toxic and dependence-producing properties.

As in many countries, men drink more frequently, and drink larger volumes per occasion (i.e. to intoxication), compared to women. Consequently men predominate among harmful drinkers.

The population based study done in Addis Ababa and Butajira showed that 69 percent of males and 57 percent of females in Addis Ababa, and 23 percent of men and 19 percent of females in Butajira reported alcohol consumption in the 12 months preceding the survey. The proportion of males who reported binge drinking at least for a day during the 12 months preceding the survey were 33 percent in Addis Ababa and 17 percent in Butajira. Binge drinking prevalence among females was about 7 percent in Addis Ababa and 5 percent in Butajira (107).

4.2.3. Physical inactivity

Urbanization influences are apparent in the cities and towns of Ethiopia with an increasing use of motorized transport and sedentary types of occupation such as trade and office work. This is accompanied by shifting dietary and lifestyle behaviours, which are yet to be characterized adequately.

According to one of the studies cited above (107), over a quarter of the adult population in Addis Ababa has a sedentary lifestyle in marked contrast to the rural population in Butajira where 80 percent of the population are engaged in occupations requiring high physical activity.

To date, sports related activities have not received much importance in the daily life of the urban population, particularly for women in Ethiopia. Access to sport facilities, public parks and playgrounds is very limited and progressively shrinking with increasing cost of urban land. School compounds are not spared from the pressure exerted by mounting costs of land mainly in urban areas. Schools constructed more recently appear to be distinctly different from older ones in that they have taller buildings and narrow compounds.

On the other hand, encouraging initiatives have been observed in Addis and many urban centres of the country with greater numbers of men and women participating in long distance races. The country is endowed with world-renowned men and women athletes, who are paving the way and, possibly, leading a cultural revolution towards an active and healthy lifestyle. To this effect, the annual events of the Great Ethiopian Run (111) which has enrolled a

rapidly growing number of participants every year, has demonstrated a great potential in motivating people to take part in the race, consequently building a culture of exercise and sports. Such initiatives can be exploited further if emphasis is given on the need for a more frequent and regular exercise and its health and social benefits. In this regard, the school environment should also play a vital role by laying the necessary ground for building the spirit and culture of competitive and other sports in the young population.

Dietary habits – fruit and vegetable and salt consumption

Inadequate intake of fruit and vegetables were universal in both Addis and Butajira populations with about 100 % prevalence in the study conducted in the years 2006 and 2003 respectively (Fikru, 2008). There are no studies that tried to quantify salt consumption in the Ethiopian population. In general cereals are the major sources of calorie in both urban (52 percent) and rural (63 percent) Ethiopia (112).

Overweight and obesity

The STEPS survey in Addis revealed a strikingly high prevalence of overweight among adults in Addis. Over 40 percent of adults in rural Butajira have low BMI, while close to 30 percent in Addis had overweight or obesity. About 2 percent of males and 11 percent of females in Addis were obese with a mean BMI of 22.2 in males and 24.0 in Females (107).

This is in contrast to the 2005 Ethiopia Demographic and Health Survey (EDHS 2005) that indicated women in Addis had the highest prevalence of overweight

in the country. However, the level (17.5 percent) was much lower than the 30 percent reported by the STEPS survey in Addis.

A more recent study in Addis Ababa among working adults indicated that approximately a quarter of the study population was overweight (25 percent among females and 23 percent among males) with significantly higher prevalence of obesity among females than males (9 versus 2 percent) (113).

It is evident from the findings that the prevalence of overweight in adults in Addis is exceeding that of underweight or chronic energy deficiency. The large contrast between urban (overweight) and rural (underweight) populations signifies the rising burden of overweight in urban populations, and the double burden that countries like Ethiopia are faced with.

4.3 Policy and Strategy for Prevention of NCD

Ethiopia's health system, like many countries in transition, is not yet well equipped to address the challenges of chronic diseases. The majority of chronic disease care is presently being provided by secondary and tertiary institutions, such as regional and teaching hospitals, which are often located in urban areas and major cities. Primary healthcare facilities – the core service providers at community level - often lack trained health workers, medical products and technologies to detect, treat and manage common chronic diseases.

More recently, there has been a growing recognition among public health officials and relevant stakeholders about the challenges presented by the worrying trends in the magnitude of chronic diseases and their risk factors. This is evident from the development of a strategy document focusing on NCDs which is hoped to be instrumental to reorient the overall health response in a way that addresses chronic diseases.

More specifically, the past 3-4 years have witnessed major strategic initiatives which are clear signs of the growing international and national political commitment towards NCD prevention and control. Major landmarks in this include:

4.3.1 Policy and strategy

- The recent publication of a report on situation analyses of NCDs in the country in the year 2008 and the launch of a strategic framework which was informed by the same in the year 2010.
- The main policy document guiding health interventions in Ethiopia, the Health Sector Development Program–IV (2010/11 – 2014/15) has for the first time included NCDs as one of the priority health challenges that the health system has to deal with.
- The Federal Ministry of Health in collaboration with relevant stakeholders has drafted a Framework Convention to Control Tobacco which is the first treaty ever negotiated under the auspices of WHO. The convention has

been ratified or accessed 39 out of the 46 countries in the African region and Ethiopia is expected to follow suit soon.

4.3.2 Human resources strengthening

- Some progress is being made in this field too. For instance, the School of Medicine at Addis Ababa University (AAU) has recently launched a subspecialty program in cardiology (paediatric and adult) and curriculum is also approved for a fellowship program on hematologic oncology. Effort is also being made to build capacity of health workers in the regions and rural areas so that they can do their share in prevention as well as early detection and referral of patients with chronic diseases.

4.3.3, Development of clinical guidelines for chronic diseases

- Clinical guidelines have been developed for regional and primary health care (PHC) levels for specific NCDs namely Hypertension, Stroke and Diabetes. Similarly, preparation of a clinical guideline on NCDs to standardize treatment is underway for Tikur Anbessa hospital.

4.3.4. More Committed and active Civic societies

- The Ethiopian Public Health Association has been working with all relevant stakeholders to advocate for the prioritization of NCDs by the Ministry of Health through organizing informative panel discussions and selecting NCDs as major themes of the annual conferences (Road traffic Injuries in the year 2009 and Tobacco, Alcohol and Substance use in the year 2011).

EPHA also uses the media (TV and radio) to get across relevant messages to the larger public.

- EPHA has organized a series of awareness raising meetings with parliament members to facilitate the accession of the Framework convention for tobacco control which is hoped materialise soon.
- The Mathios Wondu YeEthiopia Cancer Society has been active in awareness raising activities as well as mobilization of resources to support patients and families who could not afford to get treatment and care for cancer. The society has also hosted the consortium on non-communicable diseases and convened several meetings which helped to coordinate the fragmented efforts of individual societies.

5. Major Challenges in NCD prevention and control for Ethiopia

Data from interviews with public health officials, clinicians, professional societies, and managers in selected public and private hospitals indicate that there are a multitude of challenges that need to be addressed in order to effectively implement NCD control and prevention activities.

The few population based studies of chronic diseases risk factors in Ethiopia show substantial sex and regional differences (higher risk among males in urban areas), which are important to identify so as to be able to plan suitable intervention programs.

Although some of the NCDs (particularly hypertension and coronary heart disease) appear in the ten top causes of mortality in hospitals, many health facilities are short of basic equipments and supplies required for chronic disease care and treatment and when they have, regular maintenance is a major challenge. This has resulted in unnecessary delay and referral of patients from facility to facility which also contributes to increasing economic burden on patients and families.

Research and training institutes are limited in the country. There are only a handful of specialists/subspecialists even in the biggest tertiary hospital (Tikur Anbessa hospital) that has the dual burden of providing service and training competent health professionals.

Record keeping and reporting is generally poor in many facilities which have made it difficult to make a compelling argument about the burden of NCDs to the health system and the nation at large. Proper examination of risk factors and trend analyses of NCDs is also limited by the unavailability and incompleteness of the health information systems.

5.1 .Way Forward: the Public Health Response to NCDs

There is evidence that inexpensive and cost-effective interventions can prevent 80% of heart disease, stroke, type 2 diabetes and 40% of cancers (114). To achieve this, a primary-care strategy has been proposed for NCDs with three key elements: (i) identifying and addressing modifiable risk factors; (ii)

screening for common NCDs; and (iii) diagnosis, treatment, follow-up and, when necessary, referral of patients with common NCDs using standard protocols. The following are key action items that need to be taken by the health sector and partners in order to tackle the present challenges in NCD prevention and control.

5.2.1.1. Improve Training Programs and consider task shifting

Feedback from key informants on the performance of health workers in facilitating early detection and referral for NCDs indicate that there are gaps in this regard. There are also few or no professionals who can deal with the long term dietary management of many of the chronic diseases. This underlines the need to do a thorough needs assessment and curriculum revision of undergraduate and graduate training programs of health sciences (including medicine, nursing, health officers and other allied sciences) to reflect the new reality.

In view of the extreme shortage of specialists and subspecialists working on NCDs which will take some time to address, it might also be wise to build the capacity of non-specialists ('task shifting') so that service access can be improved in the short to medium term. The local experiences from Gondar and Jimma indicate that this can be done as long as there is regular supervision and continuous training to avoid gaps created by frequent turnover of staffs in rural health facilities.

The rapid assessment done in the preparation of this booklet and previous reports indicate the urgent need to train the current and new generation of health professionals in both clinical care and leadership in health management. This will require upgrading the facilities and training capacity of the medical school at Addis Ababa University and also considering the launch of similar capacity building of other Universities in the regions.

5.1.2 .Improve the Information System on NCDs

Lack of reliable data is a cross-cutting challenge that has hampered informed decision making on all forms of NCDs at different levels of the health system. The current attempt to start a cancer registry in Addis Ababa is a step in the right direction that should be supported and implemented throughout the country. There is a need to deploy properly trained data managers in facilities involved in providing service to chronic diseases as accurate data is the starting point for any good health plan and strategy.

The health system is also in urgent need of a program of building more practical guidelines, standards and regulatory mechanisms to assist the ongoing efforts to address NCDs in a holistic manner.

A functional and efficient health management information system will allow defining clear health goals relevant to NCDs and design specific intervention activities in measurable terms. Without clear benchmarks agreed upon by all relevant stakeholders to be reached in a specified period of time, it is difficult

to provide guidance for all actors in the health sector and measure performance of the health system.

5.1.3 .Learning from local experiences

5.1.3.1. Improving access to chronic illness care for rural communities – experience from Gondar and Jimma University hospitals

The health system should look for ways to learn from and scale up valuable local experiences which have tried to take chronic disease care to communities. In this regard, Gondar and Jimma University hospitals' outreach projects to selected woredas of the respective regions are worth mentioning (88).

Gondar College of Health Sciences has established an outreach program that targeted four major chronic diseases; namely, Diabetes, hypertension, asthma and epilepsy since 1997 through external donor support. The project does not address mental diseases and cancers mainly due to perceived significance of the problems and available resources. The project operates by building capacity of health workers in rural health centers through a comprehensive 1 week training and regular supervision. The training is conducted every year to minimize gaps created as a result of the frequent turnover of staffs. Trainees include health officers, nurses, laboratory technologists and occasionally pharmacy technicians.

Currently, there are 9 health centers closely working with Gondar hospital on the management and care of patients with the selected chronic illnesses. The 5 health centers became part of the project very recently (in the year 2010/11) while the others have been there since its inception. In general the project encourages each health facility to cover its drug related costs through income generating and cost recovery mechanisms and provides free drugs only to the poorest of the poor who have no financial means.

Although, it's believed that the project has improved access to treatment and care for chronic illness, there is no research evidence showing its impact on survival and quality of life of the beneficiary communities. The project has a relatively complete database that allows the hospital to trace all patients enrolled in the follow up program. In addition to improving access, the project is also believed to have contributed to better drug adherence as many patients have recognized the importance of caring for their own illnesses.

Jimma University Hospital (JUH) in south west Ethiopia has been running a similar integrated rural chronic disease programme since 1999, focusing on treatment of epilepsy, diabetes and heart disease. Like Gondar hospital, the programme allows treatment to be provided away from the main hospital so that those who cannot afford to travel can access care near their homes (115).

Effort must be made to do a rigorous operational research with the aim of establishing the effectiveness and sustainability of such community based approaches to chronic disease care so that the good lessons can be replicated and become a standard practice throughout the country.

5.2 A pilot Programme on Breast Cancer in Tikur Anbessa Hospital

Recently (in the year 2005), Tikur Anbessa established a partnership with Axios International, Hammersmith Hospital, London and AstraZeneca which aimed at creating a centre of reference for breast cancer treatment in Ethiopia and, in doing so, validate a model for how to build capacity for breast cancer treatment in a developing country setting.

The project has resulted in effective capacity building at Tikur Anbessa Hospital, including purchases of important diagnostic equipment, training programmes and the establishment of new patient management systems. The project has initiated and established a multidisciplinary approach to breast cancer management where specialists from oncology, radiology, pathology and surgery meet every month to discuss specific patients with cancer which has significantly improved the quality of treatment and care for the patients, including reducing the waiting time from surgery to radiotherapy to less than 2 months compared with more than 1 year before the start of the project (116).

5.3. Drawing More Resources to NCDs

NCDs received less attention both nationally and internationally (partly because they are not among the diseases targeted in the MDG goals). A consequence of this has been very low financial commitment, only 3% of development assistance is going to NCDs (117). This is despite important declarations (such as Abuja declaration) which advocate for increased financial commitment. There is a need to continue working for more financial allocation

at the national and regional levels in a way that matches the magnitude of the problem.

5.4 Supportive Environment - the role of Civic Societies, and NGOs

Civil society and nongovernmental organizations have an important role to play in influencing both individual behaviour, and the organizations and institutions involved in providing guidance to prevention and control of NCDs.

References

1. http://www.who.int/topics/emerging_diseases/en/ (accessed on Aug 2011).
2. <http://www.cdc.gov/ncidod/diseases/eid/index.htm/> (accessed on Aug 2011).
3. Preventing Emerging Infectious Diseases: A Strategy for the 21st Century Overview of the Updated CDC Plan. September 11, 1998 / 47(RR15);1-14
4. http://en.wikipedia.org/wiki/Emerging_infectious_diseases
5. Weiss, R. A. and McMichael, A. J. (2004) Social and environmental risk factors in the emergence of infectious diseases. *Nature Medicine*, 10, S70–S76.
6. Bryce, J., Boschi-Pinto, C., Shibuya, K., Black, R. E., and WHO Child Health Epidemiology Reference Group. (2005) WHO estimates of the causes of death in children. *Lancet*, 365, 1147–1152.
7. Horton, R. (2004) UNICEF leadership 2005–2015: a call for strategic change. *Lancet*, 364, 2071–2074.
8. <http://www.medterms.com/script/main/art.asp?articlekey=22684> (accessed on Aug 2011).
9. http://www.medicinenet.com/swine_flu/article.htm (accessed on Aug 2011).
10. <http://www.medterms.com/script/main/art.asp?articlekey=104298> (accessed on Aug 2011).

11. <http://www.medterms.com/script/main/art.asp?articlekey=6518> (accessed on Aug 2011).
12. Federal MOH and HAPCO. Single point HIV prevalence estimate. 2007.
13. Federal HIV/AIDS Prevention and Control Office (HAPCO), Federal Ministry of Health (FMOH) Strategic plan for intensifying multisectoral HIV and AIDS response in Ethiopia II (SPM II) 2010 – 2014. Addis Ababa, Ethiopia.
14. Federal Ministry of Health, Ethiopia. Tuberculosis and Leprosy (TBL) Strategic Plan (SPM) 2011-2015. June 2010. Addis Ababa.
15. Federal Ministry of Health, Ethiopia. Annual TB report 2008/09. Addis Ababa.
16. The World Bank Group. World Development Report 2006: Equity and Development. September 2005. Oxford University Press.
17. WHO. Global tuberculosis control: Epidemiology, strategy, financing. WHO Report 2009.
18. WHO. Multidrug and extensively drug-resistant TB (M/XDR-TB): 2010 global report on surveillance and response. WHO Global Report 2010.
19. Federal Ministry of Health, Ethiopia. Annual Malaria report 2004/05. Addis Ababa.
20. Federal Ministry of Health, Ethiopia. Ethiopian National Malaria Indicator Survey (ENMIS) 2007.
21. Federal Ministry of Health, Ethiopia. Malaria Strategic Plan of the Government of Ethiopia (2010-2015).
22. <http://www.afro.who.int/en/clusters-a-programmes/dpc/neglected-tropical-diseases.html/> (accessed on Aug 2011).

23. World Health Organization (WHO). WHO Country Coordination Strategy (CCS). 2011 Addis Ababa.
24. National Blindness, low vision and Trachoma Survey in Ethiopia 2005-6, The Ethiopian Journal Of Health Development, Volume 21, special Issue, 2007, 183-215.
25. WHO Report of the Fifth Consultative Meeting on Leishmania/HIV co-infection, 22-27 March 2007, Addis Ababa, Ethiopia
26. S. W. Lindsay and C. J. Thomas. Mapping and estimating the population at risk from lymphatic filariasis in Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene. 94 (1) January-February 2000, Pages 37-45.
27. Davey G, Tekola F, Newport MJ. Podoconiosis: non-infectious geochemical elephantiasis. Trans R Soc Trop Med Hyg. 2007 Dec;101(12):1175-80. Epub 2007 Oct 31.
28. <http://www.medterms.com/> (accessed on Aug 2011).
29. Kopits E, Cropper M. Traffic fatalities and economic growth. Washington, DC, The World Bank, 2003 (Policy Research Working Paper No. 3035).
30. Murray CJL, Lopez AD, eds. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Boston, MA, Harvard School of Public Health, 1996.
31. (http://www.who.int/violence_injury_prevention/injury/chartbook/chartbook/en/). (accessed on Aug 2011).

32. WHO. World report on road traffic injury prevention. Edited by Margie Peden, Richard Scurfield, David Sleet, Dinesh Mohan, Adnan A. Hyder, Eva Jarawan and Colin Mathers World Health Organization Geneva 2004.
33. Peden M, McGee K, Sharma G. The injury chart book: a graphical overview of the global burden of injuries. Geneva, World Health Organization, 2002
34. Peden M, McGee K, Krug E, eds. Injury: a leading cause of the global burden of disease, 2000. Geneva, World Health Organization, 2002.
35. World report on child injury prevention. Geneva: World Health Organization & United Nations Children's Fund; 2008.
36. Alison Harvey et al. Injury prevention and the attainment of child and adolescent health. Bull World Health Organ 2009;87:390–394
37. Murray CJL et al. The Global Burden of Disease 2000 project: aims, methods and data sources [revised]. Geneva, World Health Organization, 2001 (GPE Discussion Paper No. 36).
38. World report on child injury prevention. Geneva: World Health Organization & United Nations Children's Fund; 2008.
39. <http://www.cdc.gov/climatechange/> (accessed on Aug 2011).
40. Parry MC, Rosenzweig C, Iglesias A, Fischer G, Livermore M. Climate change and world food security: A new assessment. Global Environmental Change – Human and Policy Dimensions 1999; 9: S51-S67.
41. WHO. Quantifying selected major Risks to Health. The World Health Report 2002. Reducing Risk Promoting Healthy Life.
42. <http://www.climate.org/topics/health.html> (accessed on Aug 2011).

43. Robine JM et al. Death toll exceeded 70,000 in Europe during the summer of 2003. *Les Comptes Rendus/Série Biologies*, 2008, 331:171–78.
44. Arnell NW. Climate change and global water resources: SRES emissions and socio-economic scenarios. *Global Environmental Change – Human and Policy Dimensions*, 2004, 14:31–52.
45. Climate change 2007. Impacts, adaptation and vulnerability. Geneva, Intergovernmental Panel on Climate Change, 2007 (Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
46. Zhou XN et al. Potential impact of climate change on Schistosomiasis transmission in China. *American Journal of Tropical Medicine and Hygiene*, 2008, 78:188–194.
47. Hales S et al. Potential effect of population and climate changes on global distribution of dengue fever: an empirical model. *The Lancet*, 2002, 360:830–834.
48. <http://www.who.int/mediacentre/factsheets/fs266/en/index.html> (accessed on Aug 2011).
49. <http://en.wikipedia.org/wiki/Chronic> (accessed on Aug 2011).
50. WHO. 2008-2013 action plan for the global strategy for the prevention and control of NCDs: prevent and control cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. WHO 2008.
51. http://www.who.int/cardiovascular_diseases/en/ (accessed on Aug 2011).
52. <http://www.who.int/diabetes/en/> (accessed on Aug 2011).
53. <http://www.who.int/cancer/en/> (accessed on Aug 2011).

54. <http://www.who.int/respiratory/en/> (accessed on Aug 2011).
55. <http://www.who.int/respiratory/copd/en/> (accessed on Aug 2011).
56. <http://www.who.int/respiratory/asthma/en/> (accessed on Aug 2011).
57. <http://www.kidney.org.uk/Medical-Info/ckd-info/> (accessed on Aug 2011).
58. http://en.wikipedia.org/wiki/Chronic_kidney_disease/ (accessed on Aug 2011).
59. http://en.wikipedia.org/wiki/Non-communicable_disease#CKD (accessed on Aug 2011).
60. Choi BCK, Bonita R, McQueen DV. The need for global risk factor surveillance. *Journal of Epidemiology and Community Health*, 2001, 55:370.
61. WHO/FAO Expert Consultation. Diet, nutrition and the prevention of chronic diseases. WHO Technical Report Series 916. WHO Geneva 2003.
62. Prospective Studies Collaboration. Cholesterol, diastolic blood pressure, and stroke: 13 000 strokes in 45 000 people in 45 prospective cohorts. *Lancet* 1995; 346:1647-53.
63. Eastern Stroke and Coronary Heart Disease Collaborative Group. Blood pressure, cholesterol and stroke in eastern Asia. *Lancet* 1998; 352:1801-07.
64. Law MR, Wald NJ. Risk factor thresholds: their existence under scrutiny. *BMJ* 2002; 324:1570-6.
65. Obesity: preventing and managing the global epidemic. Geneva: World Health Organization; 2000. WHO Technical Report Series, No. 894.
66. Ness AR, Powles JW. Fruit and vegetables, and cardiovascular disease: a review. *International Journal of Epidemiology* 1997; 26:1-13.

67. World Cancer Research Fund and American Institute for Cancer Research. Food, nutrition and the prevention of cancer: a global perspective. Washington (DC): American Institute for Cancer Research; 1997.
68. Physical activity and health: a report of the Surgeon General. Atlanta (GA): US Department of Health and Human Services, Centers for Disease Control and Prevention; 1996.
69. Corrao MA, Guindon GE, Sharma N, Shokoohi DF, editors. Tobacco control: country profiles. Atlanta (GA): American Cancer Society; 2000.
70. World Health Organization. Tobacco or health: a global status report. Geneva: World Health Organization; 1997.
71. Peto R, Lopez AD, Boreham J, Thun M, Heath CW. Mortality from tobacco in developed countries: indirect estimates from national vital statistics. *Lancet* 1992; 339:1268-78.
72. Liu BQ, Peto R, Chen ZM, Boreham J, Wu YP, Li JY, et al. Emerging tobacco hazards in China. 1. Retrospective proportional mortality study of one million deaths. *BMJ* 1998; 317:1411-22.
73. Niu SR, Yang GH, Chen ZM, Wang JL, Wang GH, He XZ, et al. Emerging tobacco hazards in China. 2. Early mortality results from a prospective study. *BMJ* 1998; 317:1423-4.
74. Dikshit RP, Kanhere S. Tobacco habits and risk of lung, oropharyngeal and oral cavity cancer: a population-based case-control study in Bhopal, India. *International Journal of Epidemiology* 2000; 29:609-14.

75. Gupta PC, Mehta HC. Cohort study of all-cause mortality among tobacco users in Mumbai, India. *Bulletin of the World Health Organization* 2000; 78:877-83.
76. English DR, Holman CDJ, Milne E, Winter MJ, Hulse GK, Codde G, et al. The quantification of drugcaused morbidity and mortality in Australia 1995. Canberra: Commonwealth Department of Human Services and Health; 1995.
77. Rehm J, Gutjahr E, Gmel G. Alcohol and all-cause mortality: Australia pooled analysis. *Contemporary Drug Problems* 2001c; 28:337-61.
78. Central Statistical Authority, Ethiopia. Population estimates, 2007.
79. M Maru, Coronary atherosclerosis and myocardial infarction in autopsied patients in Gondar, Ethiopia. *Journal of the Royal Society of Medicine* Volume 82 July 1989.
80. Mamo Y, Oli K. Trends of acute myocardial infarction admissions over a decade, Tikur Anbessa Hospital. *Ethiop Med J.* 2001 Jul; 39(3):193-202.
81. Melaku Z, Alemayehu M, Oli K, Tizazu G. Pattern of admissions to the medical intensive care unit of Addis Ababa University Teaching Hospital. *Ethiop Med J.* 2006 Jan; 44(1):33-42.
82. World Health Statistics, 2006.
83. Zenebe G, Alemayehu M, Asmera J. Characteristics and outcomes of stroke at Tikur Anbessa Teaching Hospital, Ethiopia. *Ethiop Med J.* 2005 Oct; 43(4):251-9.

84. Bekele Alemayehu, Kebede Oli. Stroke admission to Tikur Anbassa Teaching Hospital: With Emphasis on stroke in the Young. *Ethiop.J.Health Dev.* 2002; 16(3):309-315].
85. Fikru Tesfaye, Peter Byass and Stig Wall. Population based prevalence of high blood pressure among adults in Addis Ababa: uncovering a silent epidemic. *BMC Cardiovascular Disorders* 2009, 9:39.
86. A. Tran, B. Gelaye, B. Girma, S. Lemma, Y. Berhane, T. Bekele, A. Khali, and M. A. Williams. Prevalence of metabolic syndrome among working adults in Ethiopia. *International Journal of Hypertension* Volume 2011, Article ID 193719, 8 pages.
87. S Fekadu, M Yigzaw, S Alemu, A Dessie, H Fieldhouse, T Girma, ER Trimble, DIW Phillips and EHO Parry. Insulin-requiring diabetes in Ethiopia: associations with poverty, early undernutrition and anthropometric disproportion. *European Journal of Clinical Nutrition* (2010) 64, 1192–1198.
88. Watkins P, Alemu S. Delivery of diabetes care in rural Ethiopia: an experience from Gondar. *Ethiopian Medical Journal* 2003; 41: 9-17.
89. G. V. Gill & J.-C. Mbanya & K. L. Ramaiya & S. Tesfaye. A sub-Saharan African perspective of diabetes. *Diabetologia* (2009) 52:8–16.
90. S. Alemu & A. Dessie & E. Seid & E. Bard & P. T. Lee & E. R. Trimble & D. I. W. Phillips & E. H. O. Parry. Insulin-requiring diabetes in rural Ethiopia: should we reopen the case for malnutrition-related diabetes? *Short Communication, Diabetologia* (2009) 52:1842–1845

91. Feleke Y, Mengistu Y, Enquesslassie F. Diabetic infections: clinical and bacteriological study at Tikur Anbessa Specialized University Hospital, Addis Ababa, Ethiopia. *Ethiop Med J.* 2007 Apr; 45(2):171-9.
92. Elias S. Siraj, Berhane Seyoum,T, Christopher Saenz, Jemal Abdulkadir. Lipid and lipoprotein profiles in Ethiopian patients with diabetes mellitus. *Metabolism Clinical and Experimental* 55 (2006) 706– 710.
93. Feleke Y, Enquesslassie F. Cost of hospitalization of diabetic patients admitted at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *Ethiop Med J.* 2007 Jul; 45(3):275-82.
94. A. Bekele, M. Baay, Z. Mekonnen, S. Suleman and S. Chatterjee. Human papillomavirus type distribution among women with cervical pathology – a study over 4 years at Jimma Hospital, southwest Ethiopia. Short Communication, *Tropical Medicine and International Health* volume 15 no 8 pp 890–893 August 2010.
95. WHO, World Health Survey, Ethiopia, 2003.
96. Timothy D. Dye, Solomon Bogale, Claire Hobden; Yared Tilahun, Vanessa Hechter, Teshome Deressa, Marion Bize, and Anne Reeler. A mixed-method assessment of beliefs and practice around breast cancer in Ethiopia: Implications for public health programming and cancer control. *Global Public Health* 2010, 1_13.
97. Gebremedhin A, Shemebo M. Clinical profile of Ethiopian patients with breast cancer. *East Afr Med J.* 1998; 75:640-643.
98. Timothy D. Dye, Solomon Bogale, Claire Hobden; Yared Tilahun, Vanessa Hechter, Teshome Deressa, Marion Bize, and Anne Reeler. Complex care

- systems in developing countries Breast cancer Patient Navigation in Ethiopia. *Cancer* 2010; 116:577–85.
99. Aderaye G. Causes and clinical characteristics of chronic cor-pulmonale in Ethiopia. *East Afr Med J.* 2004 Apr; 81(4):202-6.
100. Global status report on Road Saftey – Time for Action; WHO, Department of Violence and Injury Prevention, 2009.
101.
<http://www.who.int/countries/eth/areas/violence/about/en/index.html>
102. A. Persson. Road traffic accidents in Ethiopia: magnitude, causes and possible interventions. *Advances in Transportation Studies an international Journal Section A* 15 (2008).
103. Bolen J et al. Overview of efforts to prevent motor vehicle-related injury. In: Bolen J, Sleet DA, Johnson V, eds. *Prevention of motor vehicle-related injuries: a compendium of articles from the Morbidity and Mortality Weekly Report, 1985–1996.*, Centers for Disease Control and Prevention, 1997, Atlanta, GA
104. Dora C, Phillips M, eds. *Transport, environment and health.* Copenhagen, World Health Organization Regional Office for Europe, 2000 (European Series No. 89).
105. Tekebash Araya, Tolcha Kebebew, Biruk Tensou, Daniel S. Telake. Road Traffic accidents in Addis Ababa (2001-2008): Evidence from Burial surveillance. abstracts for Oral Presentation at the 20th annual Public Health Conference of the Ethiopian Public Health Association: Oct 26-28, Addis Ababa, Ethiopia.

106. A. Persson. Road traffic accidents in Ethiopia: Magnitude, causes and possible interventions; *Advances in Transportation Studies an international Journal Section A* 15 (2008).
107. Fikru Tesfaye. Epidemiology of Cardiovascular Disease Risk Factors in Ethiopia: The rural-urban gradient. PhD Dissertation, Epidemiology and Public Health Sciences Department of Public Health and Clinical Medicine Umeå University, 2008.
108. Emmanuel Rudatsikira, Abdurahman Abdo and Adamson S Muula. Prevalence and determinants of adolescent tobacco smoking in Addis Ababa, Ethiopia. *BMC Public Health* 2007, 7:176.
109. A Report On Global Youth Tobacco Survey (GYTS) Conducted in Secondary Schools in Addis Ababa-Ethiopia. Drug Administration and Control Authority (DACA) of Ethiopia, 2005.
110. Lemma S, Tesfaye F. Cardiovascular disease risk factors among college students in Addis Ababa. Masters Thesis. School of Public Health, Addis Ababa University 2007. (Unpublished).
111. The Great Ethiopian Run, 2010. <http://www.ethiopianrun.org/>.
112. Central Statistical Agency, Federal Democratic Republic of Ethiopia. Household Income, Consumption, and Expenditure Survey 2004/5. Analytical Report. Volume I. Statistical Bulletin 394. Addis Ababa 2007.
113. Wint S. Wai, Ranjodh S. Dhami, Bizu Gelaye, Belaineh Girma, Seblewengel Lemma, Yemane Berhane, Tamrat Bekele, Atsede Khali and Michelle A. Williams. Comparison of measures of mdiposity in identifying

cardiovascular disease risk among Ethiopian adults. *obesity* (2011)
doi:10.1038/oby.2011.103.

114. Preventing chronic diseases: a vital investment. Geneva, World Health Organization, 2005.
115. Yoseph Mamo, Etalem Seid, Sarah Adams, Amy Gardiner and Eldryd Parry. A primary healthcare approach to the management of chronic disease in Ethiopia: An example for other countries. *Clinical Medicine* Vol 7 No 3 June 2007.
116. A. V. Reeler, K. Sikorayz, B. Solomon. Overcoming Challenges of Cancer Treatment programmes in developing countries: A Sustainable breast cancer initiative in Ethiopia. Personal view. *Clinical Oncology* (2008) 20: 191-198.
117. (Nugent R, Feigl A. Scarce donor funding for non-communicable diseases: will it contribute to a health crisis? Washington: Center for Global Development; 2010.).

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