CLIMATE CHANGE AND ITS IMPACT ON THE DETERMINANTS OF HEALTH

DR. HOMERO SILVA
PAHO/WHO ENVIRONMENTAL HEALTH ADVISOR

1. Introduction

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Until now the reports of the impact on Climate Change have been directed to the disease not to health. In this paper an analysis of Climate Change and its impact on health will be presented. But rather than conducting a simplistic approach (i.e. rainfall versus vector diseases), a holistic analysis of how climate change will impact on the determinants of health will be done.

Why are some persons healthy and others not? There is a growing body of evidence about what makes and keeps people healthy. In 1974 the landmark Health and Welfare Canada, Lalonde Report, described a framework of key factors that determine health status: lifestyle, environment, human biology and health services. Since that time, this simple framework has been refined and expanded. The population health approach builds on the Lalonde framework and recognizes that health depends on more than access to a good health care system. Excellent scientific research has established that factors such as living and working conditions and how we share wealth in our societies are crucially important for a healthy population.

Commonly referred to as the determinants of health, these broad factors impact on individual and population health. The determinants of health are each important in their own right, however, they interact to forcefully influence health and well being across the lifespan. Being the case, then it is obvious that in evaluating the impacts on health from climate change, the determinants of health should be used to adapt and mitigate thru the preparation of policies, plans and projects to minimize the adverse impacts on health.

Although the determinants of health can be described in many ways, in this paper it is proposed to use the twelve major determinants of health proposed by The Public Health Agency of Canada, as follows: 1) Income and Social Status; 2) Social Support Networks; 3) Education and Literacy; 4) Employment / Working Conditions; 5) Social Environments; 6) Physical Environments; 7) Personal Health Practices and Coping Skills; 8) Healthy Child Development; 9) Biology and Genetic Endowment; 10, Health Services; 11) Gender and 12) Culture.

1. Income and Social Status

Health status improves at each step up the income and social hierarchy. High income determines living conditions such as safe housing and ability to buy sufficient good food. The healthiest populations are those in societies which are prosperous and have an equitable distribution of wealth. Public health researchers and epidemiologists have long known that social status — wealth, educational attainment, occupational prestige and occupational status — is related to health and well-being. Figure No2 shows how health is improved with income.

If it were just a matter of the poorest and lowest status groups having poor health, the explanation could be things like poor living conditions. But the effect occurs all across the socio-economic spectrum. Considerable research indicates that the degree of control people have over life circumstances, especially stressful situations, and their discretion to act are the key influences. Higher income and status generally results in more control and discretion. And the biological pathways for how this could happen are becoming better understood. A number of recent studies show that limited options and poor coping skills for dealing with stress increase vulnerability to a range of diseases through pathways that involve the immune and hormonal systems.

Evidence. In this matter, there are several evidences, as follows:

- In Canada, only 47% of citizens in the lowest income bracket rate their health as very good or excellent, compared with 73% in the highest income group. Also, low-income citizens are more likely to die earlier and to suffer more illnesses than those with higher incomes, regardless of age,

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sex, race and place of residence. Finally, at each rung up the income ladder, citizens have less sickness, longer life expectancies and improved health.

- Studies suggest that the distribution of income in a given society may be a more important determinant of health than the total amount of income earned by society members. Large gaps in income distribution lead to increases in social problems and poorer health among the population as a whole.

- Social status is also linked to health (Figure No 2). A major British study of civil service employees found that, for most major categories of disease (cancer, coronary heart disease, stroke, etc.), health increased with job rank. Health increased at each step up the job hierarchy. For example, those one step down from the top (doctors, lawyers, etc.) had heart disease rates four times higher than those at the top (those at levels comparable to deputy ministers).

**Climate Change Impacts**

Climate change will have major repercussions for employment, incomes, poverty and social status. These impacts are being generated by the direct effects of global warming in climate-dependent sectors like agriculture as well as by the mitigation measures taken or being considered in order to slow and limit the extent of climate change. The impacts on employment, income, social status and poverty are likely to be significant, but are still poorly understood. They have been largely absent from the research agenda and from the debates about climate change and the measures needed to address it through adaptation and mitigation.

Impacts will not be evenly distributed and will fall disproportionately on the poor and persons less capable of coping with weather changes. For example, weather-related disasters in the 1990s averaged a reported 1,000 deaths per disaster in countries with low human development, while only 22 people died from weather-related disasters in countries with high human development. Deaths, dislocation, and economic devastation are some of the effects of weather changes do and will have in developing countries. The Intergovernmental Panel on Climate Change (IPCC) estimates that with a one meter rise in sea level, 80 percent of the population of Guyana will be displaced at a cost equivalent to 1,000 percent of the country’s gross domestic product (GDP). Economically, in 1998 Hurricane Mitch destroyed three quarters of Honduras’ GDP in a few days by destroying agricultural capability, homes, infrastructure, and industries. According to the New Economics Foundation, the development of the country was set back by two decades from the hurricane. As such, weather-related disasters can induce poverty or worsen it for the most vulnerable sectors of society. Figure No 3 Shows how GDP is related to health (Life expectancy).

Moreover, climate change will threaten the ability of poor people to gain access to financial capital. Financial capital refers to the financial resources available to people which subsequently provide them with different livelihood options. The IPCC stresses the impact of climatic change on access to financial capital for the poor. Under climatic change, severe losses in assets and income-generating capability due to the destruction of the resource base will discourage the financing and credit provisions that are vitally needed. As such, global warming not only threatens the United Nation’s Millennium Development Goals in the long-term, but it also threatens the capability of people to provide for their own livelihoods. Climate change will set back progress in human development with negative implications for social and economic arrangements. Some regions will suffer these negative consequences more than others; however, under conditions of climate change new structural social and economic changes are expected throughout the world.

Finally, the direct price effects of the emissions trading scheme will be regressive. The effects will fall heavily on low-income households.
2. **Social Support Networks**
A social support network is made up of friends, family and peers. It can play an important role in times of stress. A social support network is something you can develop when you're not under stress, providing the comfort of knowing that your friends are there for you if you need them. Support from families, friends and communities is associated with better health. Such social support networks could be very important in helping people solve problems and deal with adversity, as well as in maintaining a sense of mastery and control over life circumstances. The caring and respect that occurs in social relationships, and the resulting sense of satisfaction and well-being, seem to act as a buffer against health problems.

The positive effects of a support network include: **Sense of belonging.** Spending time with people helps ward off loneliness. Whether it's other new moms, dog lovers, fishing buddies or siblings, just knowing you're not alone can go a long way toward coping with stress. **Increased sense of self-worth.** Having people who call you a friend reinforces the idea that you're a good person to be around. **Feeling of security.** By reaching out and sharing yourself with others, you have the added security of knowing that if you start to show signs of depression or exhibit unhealthy lifestyle habits, your friends can help alert you to the problem.

**Evidences.** Some experts in the field have concluded that the health effect of social relationships may be as important as established risk factors such as smoking, physical activity, obesity and high blood pressure. Studies have shown the health effects of social support networks:
- For men and women, the more social contacts people have, the lower their premature death rates.
- Low availability of emotional support and low social participation were associated with all-cause mortality.
- Risk of angina pectoris decreased with increasing levels of emotional support in a study of male Israeli civil servants.

**Climate Change Impacts.** Global climate change is expected to increase the frequency and intensity of droughts, floods, extreme weather events, and food and water shortages creating large numbers of environmental refugees in many countries and exacerbating the divide between those who have resources and those who need them.
Sixteen of the world’s nineteen mega-cities are on coastlines. The IPCC estimates that with a one meter rise in sea level, the urban poor will be displaced and evacuation costs will be high. It is estimated with a one meter rise in sea levels, 6 million people in Shanghai will be displaced. As the sea level rises, countries such as Tuvalu are facing a future in which their countries may cease to exist, clearly an unsustainable predicament. In the Caribbean, 80 percent of the population of Guyana will be displaced. Likewise, flooding affects the homes of 50 million people a year, a situation which will worsen under rising sea levels. Dislocated families will be less capable of re-establishing their lives and gaining access to education for their children.

Moreover, estimates predict that climate change-induced famine may result in more than 150 million environmental refugees worldwide by 2050. The potential for increasing conflict in both developing and industrialized countries is tremendous. Examples exist throughout history of scarce resources causing conflict, but examples can also be found of disparate communities working together to conserve or restore a precious natural resource required for survival.

Environmental refugees will lose their social support networks of: sense of belonging, increased sense of self-worth and Feeling of security.

3. **Education and Literacy**
Health status improves with level of education. Education is closely tied to socioeconomic status, and effective education for children and lifelong learning for adults are key contributors to health and prosperity for individuals, and for the country. Education contributes to health and prosperity by equipping people with knowledge and skills for problem solving, and helps provide a sense of control and mastery over life circumstances. It increases opportunities for job and income security, and job satisfaction. And it improves people's ability to access and understand information to help keep them healthy.

**Evidence.** The following evidence exists:
- People with low literacy skills are more likely to be unemployed and poor, to suffer poorer health and to die earlier than people with high levels of literacy;
People with higher levels of education have better access to healthy physical environments and are better able to prepare their children for school than people with low levels of education. They also tend to smoke less, to be more physically active and to have access to healthier foods;

In a study only 19% of respondents with less than a high school education rated their health as "excellent" compared with 30% of university graduates;

The number of lost workdays decreases with increasing education. People with elementary schooling lose seven work days per year due to illness, injury or disability, while those with university education lose fewer than four days per year.

Utilizing two survey data sets of randomly selected American adults to support their arguments, Mirowsky and Ross contend that educational attainment and the skills and abilities learned and fostered during the educational experience in particular drives most of the relationship between social status and health. They identify a variety of causal routes by which education indirectly influences health. For example, they argue that education affects health because it develops the productive abilities that contribute to ‘learned effectiveness,’ i.e., habits and skills of self-direction, a form of personal control over life events. Learned effectiveness purportedly influences economic prosperity, enables the adoption of a healthy lifestyle (regular exercise, restricting caloric intake, etc.) and mitigates the ill effects of personal economic hardship and neighborhood disorder. Second, the authors contend that education facilitates the development of supportive and egalitarian interpersonal relationships. Well-educated Americans are more likely than others to be married, for example, and when married are more likely to be happily married and happy marriages are known to have positive effects on health. Third, better-educated people are thought to be more likely to find work that allows them to exercise productive creativity, another established determinant of health. Fourth, the authors argue that the health effects of education are often cumulative over the life course: small effects can be amplified over time, eventually making large contributions to well-being in later life.

People with doctorates live longer than those with Master's degrees. Figure No 4, presents the difference of probability of living form elementary and university level persons.

Climate Change Impacts.
Floods, hurricanes, droughts and other weather-related changes pose an indirect challenge to improving access to education. Most obviously, the destruction of schooling infrastructure during disasters eliminates local capacity to maintain the education of its youth. For example, more than one million classrooms across Latin America and the Caribbean are vulnerable to weather-related disasters. Under conditions of climatic change, the risk of losing these educational facilities is high. Likewise, flooding affects the homes of 50 million people a year, a situation which will worsen under rising sea levels. Dislocated families will be less capable of re-establishing their lives and gaining access to education for their children. Moreover, estimates predict that climate change-induced famine may result in more than 150 million environmental refugees worldwide by 2050. Under such conditions without housing or a permanent location, the ability for children to attend school will be undermined as global warming progresses. Moreover, persistent malnourishment of young children, which will worsen under climate change in the South, threatens the capacity of children to attend school.


Unemployment, underemployment, stressful or unsafe work are associated with poorer health. People who have more control over their work circumstances and fewer stress related demands of the job are healthier and often live longer than those in more stressful or riskier work and activities.

Evidence. Employment has a significant effect on a person's physical, mental and social health. Paid work provides not only money, but also a sense of identity and purpose, social contacts and opportunities for personal growth. When a person loses these benefits, the results can be devastating to both the health of the individual and his or her family. Unemployed people have a reduced life expectancy and suffer significantly more health problems than people who have a job. Conditions at work (both physical and psychosocial) can have a profound effect on people's health and emotional well-being. Participation in the wage economy, however, is only part of the picture. Many persons (especially women) spend almost as many hours engaged in unpaid work, such as doing housework and caring for children or...
older relatives. When these two workloads are combined on an ongoing basis and little or no support is offered, an individual's level of stress and job satisfaction is bound to suffer.

In Canada, between 1991 and 1995, the proportion of workers who were "very satisfied" with their work declined, and was more pronounced among female workers, dropping from 58% to 49%. Reported levels of work stress followed the same pattern. In the 1996/97 NPHS, more women reported high work stress levels than men in every age category. Women aged 20 to 24 were almost three times more likely to report high work stress than the average Canadian worker.

Evidence. The following evidence exists:

- A major review done for the World Health Organization found that high levels of unemployment and economic instability in a society cause significant mental health problems and adverse effects on the physical health of unemployed individuals, their families and their communities;
- Evidence shows that stress at work plays an important role in contributing to the large social status differences in health, sickness absence and premature death;
- Several European workplace studies show that health suffers when people have little opportunity to use their skills and low decision-making authority;
- Having little control over one's work is particularly strongly related to an increased risk of low back pain, sickness absence and cardiovascular disease. These risks have been found to be independent of the psychological characteristics of the people studied. In short, they seem to be related to the work environment;
- Studies have also examined the role of work demands. Some show an interaction between demands and control. Jobs with both high demand and low control carry special risk. Some evidence indicates that social support in the workplace may be protective;
- Further, receiving inadequate rewards for the effort put into work has been found to be associated with increased cardiovascular risk. Rewards can take the form of money, status and self-esteem.
- Current changes in the labour market may change the opportunity structure, and make it harder for people to get appropriate rewards. These results show that the psychosocial environment at work is an important determinant of health and contributor to the social gradient in ill health.

Climate Change Impacts. Poverty aggravates vulnerability to climate change: the poorer the country, the more workers and communities will suffer. Climate change and policies to address global warming will impact on livelihoods and employment: some sectors will decline, others disappear; new sectors will bring new job opportunities. Changes in climate ushers modifications to production and services:

1. Agriculture, fisheries and other commodities will be displaced because of weather changes, and demand for extractive industries will change;
2. The transition towards a low carbon economy will imply important changes in energy-intensive industries (steel, energy production, industry, transport, etc);
3. New jobs will be created and new sectors are being developed (i.e. building & construction, renewable energies)

Rising temperatures will have an impact on the working environments (inside and outside). Farmers will be working under higher temperatures and humidity and using more chemicals for the production of agricultural goods. Those working in offices will be forced to use air conditioning units, increasing the risk of “Sick Building Syndrome”. Sick building syndrome (SBS) is a combination of ailments associated with an individual's place of work or residence. A 1984 World Health Organization report into the syndrome suggested up to 30% of new and remodeled buildings worldwide may be linked to symptoms of SBS. Most of the sick building syndrome is related to poor indoor air quality. The following are the sick building symptoms: Burning and watering eyes and nose, Burning in trachea, Cancer, Chronic fatigue, Debilitating fibromyalgia (muscle cramps and joint pain), Dizziness, Dry, itchy skin, Exhaustion after normal activity, Headaches, Heart Palpitations, Hoarseness, cough, sore throat, Inability to concentrate, Itchy granulomous pimples, Miscarriages, Nausea, Nosebleeds, Pregnancy Problems, Sensitivity to odors, Serious edema.
(swelling of legs, trunk, ankles), Shortness of breath upon mild exertion (e.g. walking), Tremors and Wellness When Away From Building.

In summary, less employments, more work stress and lack of control and more stringent physical environments will be produced by climate change.

5. **Social Environments**

The importance of social support also extends to the broader community. Civic vitality refers to the strength of social networks within a community, region, province or country. It is reflected in the institutions, organizations and informal giving practices that people create to share resources and build attachments with others. The array of values and norms of a society influences in varying ways the health and well being of individuals and populations.

In addition, social stability, recognition of diversity, safety, good working relationships, and cohesive communities provide a supportive society that reduces or avoids many potential risks to good health. In schools, workplaces and other institutions, the quality of the social environment and material security are often as important to health as the physical environment (Figure No7). Institutions that can give people a sense of belonging, participating and being valued are likely to be healthier places than those where people feel excluded, disregarded and used. A healthy lifestyle can be thought of as a broad description of people's behavior in three inter-related dimensions: individuals; individuals within their social environments (e.g. family, peers, community, and workplace); and the relation between individuals and their social environment. Interventions to improve health through lifestyle choices can use comprehensive approaches that address health as a social or community (i.e. shared) issue. Social or community responses can add resources to an individual's repertoire of strategies to cope with changes and foster health.

**Evidence.** The following evidence exists

- In the U.S., high levels of trust and group membership were found to be associated with reduced mortality rates.
- Family violence has a devastating effect on the health of women and children in both the short and long term. In 1996, family members were accused in 24% of all assaults against children; among very young children, the proportion was much higher.
- Women who are assaulted often suffer severe physical and psychological health problems; some are even killed. In 1997, 80% of victims of spousal homicide were women, and another 19 women were killed by a boyfriend or ex-boyfriend.
- Since peaking in 1991, the national crime rate declined 19% by 1997. However, this national rate is still more than double what it was three decades ago.
- Social isolation and exclusion are associated with increased rates of premature death and poorer chances of survival after a heart attack. People who get less social and emotional support from others are more likely to experience less well-being, more depression, a greater risk of pregnancy complications and higher levels of disability from chronic diseases. In addition, bad close relationships can lead to poor mental and physical health.
- The amount of emotional and practical social support people get varies by social and economic status. Poverty can contribute to social exclusion and isolation.
- Social cohesion – defined as the quality of social relationships and the existence of trust, mutual obligations and respect in communities or in the wider society – helps to protect people and their health. Inequality is corrosive of good social relations. Societies with high levels of income inequality tend to have less social cohesion and more violent crime. High levels of mutual support will protect health while the breakdown of social relations, sometimes following greater inequality, reduces trust and increases levels of violence. A study of a community with initially high levels of social cohesion showed low rates of coronary heart disease. When social cohesion declined, heart disease rates rose.
Climate Change Impacts. Where humans live and how they generate a livelihood has been influenced by the ambient climate in all societies. All societies are susceptible to changes in climate. The unprecedented weather-related challenges to come under global climatic warming pose a serious threat to current social organization and the capacities of people to generate a livelihood. For no other group is this more relevant than poor communities which depend on their local environment for achieving a livelihood. Social capital is the set of social relationships upon which people draw in order to pursue their livelihood. This includes the range of contact networks, membership of groups and organizations, relationships of trust and their access to wider institutions of society that are important to the operation of livelihood activities. Weather-related disasters and rising sea levels threaten to displace millions of the poor and even entire states such as Tuvalu. Under such circumstances those that are displaced will have few opportunities to re-establish their lives, especially in urban areas where livelihood opportunities are limited without the skills, capital and contacts needed to cope with urban life. Moreover, famine, disease and death will threaten the livelihoods of many poor people. As such, global warming may seriously undermine the social capital people rely upon in pursuit of their livelihoods.

Similarly, climate change poses a serious risk to human capital as well. Human capital refers to the skills, knowledge, ability to labor, and good health which are a necessary foundation in the ability to pursue a livelihood. As noted earlier, access to education will be undermined by weather disasters. This will have serious consequences to the human capital available within a locale. Moreover, it is likely that environmental refugees from climate change will have little opportunity to acquire the skills and knowledge necessary to re-establish their human capital. International law provides no protection for environmental refugees to allow them the right of acquiring new skills once displaced. For example, during the drought which devastated Afghanistan from 1998-2001, around 80,000 Afghan fled to Pakistan. The Pakistan authorities successfully argued that they were not eligible for refugee status since they were fleeing a natural hazard. Without international legal protection for environmental refugees, acquiring access to skills will be seriously undermined.

6. Physical Environments
The physical environment is an important determinant of health. At certain levels of exposure, contaminants in our air, water, food and soil can cause a variety of adverse health effects, including cancer, birth defects, respiratory illness and gastrointestinal ailments. In the built environment, factors related to housing, indoor air quality, and the design of communities and transportation systems can significantly influence our physical and psychological well-being.

Evidence. The following evidence exists:
- The prevalence of childhood asthma, a respiratory disease that is highly sensitive to airborne contaminants, has increased sharply over the last two decades, especially among the age group 0 to 5. In Canada, during the period 1996 to 1997, it was estimated that some 13% of boys and 11% of girls aged 0 to 19 (more than 890,000 children and young people) suffered from asthma;
- Children and outdoor workers may be especially vulnerable to the health effects of a reduced ozone layer. Excessive exposure to UV-B radiation can cause sunburn, skin cancer, depression of the immune system and an increased risk of developing cataracts;
- Air pollution, including exposure to second hand tobacco smoke, has a significant association with health. A study in southern Ontario found a consistent link between hospital admissions for respiratory illness in the summer months and levels of sulphates and ozone in the air. However, it now seems that the risk from small particles such as dust and carbon particles that are by-products of burning fuel may be even greater than the risks from pollutants such as ozone. As well, research indicates that lung cancer risks from second hand tobacco smoke are greater than the risks from the hazardous air pollutants from all regulated industrial emissions combined.

Climate Change Impacts. Global warming poses a serious threat to the ecosystems of the world especially in regions vulnerable to climate change. Part of achieving sustainability is improving fresh water access of the 1.3 billion people who do not currently have access to safe drinking water. Under conditions of global warming these numbers will rise as the availability of safe water supplies decreases. According to the National Institute of Hydrology in India, the Tigris, Euphrates, Indus, and Brahmaputra rivers may shrink by one quarter under conditions of global warming. Likewise, improvement in the lives of slum dwellers will be undermined by climate change. As the planet warms, urban slums will become breeding grounds for disease, especially as more people turn to increasingly contaminated water sources. Moreover, coastal communities are seriously vulnerable to global warming and rising sea levels. Sixteen of the
world’s nineteen mega-cities are on coastlines. The urban poor will be displaced and evacuation costs will be high. It is estimated with a one meter rise in sea levels, 6 million people in Shanghai will be displaced. As the sea level rises, counties such as Tuvalu are facing a future in which their counties may cease to exist, clearly an unsustainable predicament.

Climate change and its associated ecological changes pose a threat to the viability of sustaining livelihoods. This is particularly true where climate change will destroy or reduce the quality of the local natural resource base upon which current livelihoods depend. Natural capital can be defined as the natural resource stock from which resource flows useful to livelihoods are derived. The actual resources available to a household reflect the characteristics of the local resource base and the extent to which the household is able to gain access to these resources. Natural resources are significant for poor people, who tend to be most dependent upon the environment and the direct use of natural resources. Today three quarters of the poor in developing countries living in rural areas derive their income from natural resources. Climatic change threatens ecosystem functionality and integrity, which in turn will undermine livelihood security for those dependent on the natural environment most. Sea level rises, flooding, changes to temperature and rainfall, extreme weather events, lower fishing yields, lower crop yields and pests will all threaten the natural resource bases on which livelihoods depend.

Also, physical capital is at danger under conditions of global warming. Physical capital is the basic infrastructure for transport, buildings, water management, energy, and communications and productive capital which enable people to pursue a livelihood. Natural disasters and extreme weather variability can undermine this resource base. For example, in the 1990s natural disasters destroyed US$300 billion worth of physical assets in developing nations. Destruction of infrastructure will undermine existing livelihood activities as well as new livelihood opportunities. For example, destruction of infrastructure will halt tourism activities on which livelihood diversification may depend.

7. **Personal Health Practices and Coping Skills**

Personal Health Practices and Coping Skills refer to those actions by which individuals can prevent diseases and promote self-care, cope with challenges, and develop self-reliance, solve problems and make choices that enhance health. Definitions of lifestyle include not only individual choices, but also the influence of social, economic, and environmental factors on the decisions people make about their health. There is a growing recognition that personal life "choices" are greatly influenced by the socioeconomic environments in which people live, learn, work and play. These influences impact lifestyle choice through at least five areas: personal life skills, stress, culture, social relationships and belonging, and a sense of control. Interventions that support the creation of supportive environments will enhance the capacity of individuals to make healthy lifestyle choices in a world where many choices are possible.

Through research in areas such as heart disease and disadvantaged childhood, there is more evidence that powerful biochemical and physiological pathways link the individual socio-economic experience to vascular conditions and other adverse health events.

However, there is a growing recognition that personal life "choices" are greatly influenced by the socioeconomic environments in which people live, learn, work and play.

**Evidences.** The following evidences exist:

- In Canada, smoking is estimated to be responsible for at least one-quarter of all deaths for adults between the ages of 35 and 84. Rates of smoking have increased substantially among adolescents and youth, particularly among young women, over the past five years and smoking rates among Aboriginal people are double the overall rate for Canada as a whole.
- Multiple risk-taking behaviors, including such hazardous combinations as alcohol, drug use and driving, and alcohol, drug use and unsafe sex, remain particularly high among young people, especially young men.
- Diet in general and the consumption of fat in particular are linked to some of the major causes of death, including cancer and coronary heart disease. The proportion of overweight men and women...
in Canada increased steadily between 1985 and 1997, from 22% to 34% among men and from 14% to 23% among women;

- Coping skills, which seem to be acquired primarily in the first few years of life, are also important in supporting healthy lifestyles. These are the skills people use to interact effectively with the world around them, to deal with the events, challenges and stress they encounter in their day to day lives. Effective coping skills enable people to be self-reliant, solve problems and make informed choices that enhance health. These skills help people face life's challenges in positive ways, without recourse to risky behaviors such as alcohol or drug abuse. Research tells us that people with a strong sense of their own effectiveness and ability to cope with circumstances in their lives are likely to be most successful in adopting and sustaining healthy behaviors and lifestyles.

**Climate Change Impacts.** The unprecedented weather-related challenges to come under global climatic warming pose a serious threat to current social organization and the capacities of people to generate a livelihood. For no other group is this more relevant than poor communities which depend on their local environment for achieving a livelihood. That is, climate change will impact on social capital, human capital, physical capital and financial capital. Therefore the socioeconomic environments in which people live, learn, work and play will be grossly affected and consequently time for Personal Health Practices and Coping Skills will be also affected.

## 8. Healthy Child Development

New evidence on the effects of early experiences on brain development, school readiness and health in later life has sparked a growing consensus about early child development as a powerful determinant of health in its own right. At the same time, we have been learning more about how all of the other determinants of health affect the physical, social, mental, emotional and spiritual development of children and youth. For example, a young person's development is greatly affected by his or her housing and neighborhood, family income and level of parents' education, access to nutritious foods and physical recreation, genetic makeup and access to dental and medical care.

**Evidence.** The following evidence exists:

- Experiences from conception to age six have the most important influence of any time in the life cycle on the connecting and sculpting of the brain's neurons. Positive stimulation early in life improves learning, behavior and health into adulthood.
- Tobacco and alcohol use during pregnancy can lead to poor birth outcomes. In the 199697 National Population Health Survey, about 36% of new mothers who were former or current smokers smoked during their last pregnancy (about 146,000 women). The vast majority of women reported that they did not drink alcohol during their pregnancy.
- A loving, secure attachment between parents/caregivers and babies in the first 18 months of life helps children to develop trust, self-esteem, emotional control and the ability to have positive relationships with others in later life.
- Infants and children who are neglected or abused are at higher risk for injuries, a number of behavioral, social and cognitive problems later in life, and death.
- A low weight at birth links with problems not just during childhood, but also in adulthood (Figure No 8). Research shows a strong relationship between income level of the mother and the baby's birth weight. The effect occurs not just for the most economically disadvantaged group. Mothers at each step up the income scale have babies with higher birth weights, on average, than those on the step below. This tells us the problems are not just a result of poor maternal nutrition and poor health practices associated with poverty, although the most serious problems occur in the lowest income group. It seems that factors such as coping skills and sense of control and mastery over life circumstances also come into play.
**Climate Change Impacts.** Children are at highest health risk from inadequate water supplies during drought, and also predicted changes in vector-borne diseases. They are also at highest risk of malnutrition, with long-term implications for overall development. Children may also be at risk of early entry into work and exploitation in order to cover lost income from agriculture. Moreover, disease outbreaks will also have serious impacts on the ability to reduce child mortality in countries with low human development. For example, currently Africa loses 1.8 million children a year to malaria, a situation likely to worsen under global warming and raising temperatures. Undernourished mothers, a likely consequence of decreased agricultural productivity in the South, will raise the susceptibility of children to disease and stillborn deaths. During the El Niño episodes children are at high risk of mortality. For example, during the 1982-1983 El Niño, infant mortality in Peru increased by 103 percent. There are legitimate concerns that infant and child mortality will worsen under conditions of global warming.

9. **Biology and Genetic Endowment.**

The basic biology and organic make-up of the human body are a fundamental determinant of health. Genetic endowment provides an inherited predisposition to a wide range of individual responses that affect health status. Although socio-economic and environmental factors are important determinants of overall health, in some circumstances genetic endowment appears to predispose certain individuals to particular diseases or health problems.

**Evidence.** The following evidences exist:

- Studies in neurobiology have confirmed that when optimal conditions for a child's development are provided in the investment phase (between conception and age 5), the brain develops in a way that has positive outcomes for a lifetime.
- Aging is not synonymous with poor health. Active living and the provision of opportunities for lifelong learning may be particularly important for maintaining health and cognitive capacity in old age. And studies on education level and dementia suggest that exposure to education and lifelong learning may create reserve capacity in the brain that compensates for cognitive losses that occur with biological aging.

**Climate Change Impacts.** Changes on precipitation, humidity, temperature raise and agriculture will bring impacts directly or indirectly on genetic endowment.

A study conducted in United States indicated that pesticide use is projected to increase for most crops studied and in most states, under the climate scenarios considered. Increased need for pesticide application on corn is generally in the range of 10-20%, on potatoes, 5-15%, and on soybeans and cotton, 2-5%. The results for wheat vary widely by state and climate scenario showing changes in pesticide application ranging from approximately -- 15 to +15%.

The main climate drivers for changing pesticide fate and behavior are thought to be changes in rainfall seasonality and intensity and increased temperatures, but the effect of climate change on pesticide fate and transport is likely to be very variable and difficult to predict. In the long-term, indirect impacts, such as land-use change driven by changes in climate, may have a more significant effect on pesticides in surface and groundwater than the direct impacts of climate change on pesticide fate and transport. The review focuses on climate change scenarios and case studies from the UK; however, the general conclusions can be applied more widely.

An increase to the exposure to heavy metals will be by two ways, increase in rainfall and increase in temperature. Heavy metals under glacial areas in high altitudes will be exposed after melting and carried away by melted water or later rains.

Pesticides and heavy metals, among others, are endocrine disrupters that have been defined as exogenous substances that alter function(s) of the endocrine system and consequently cause adverse health effects in an intact organism, or its progeny, or (sub)populations. Endocrine disrupters interfere with the functioning of the endocrine system, in at least three possible ways:

- by mimicking the action of a naturally-produced hormone, such as oestrogen or testosterone, and thereby setting off similar chemical reactions in the body;
- by blocking the receptors in cells receiving the hormones (hormone receptors), thereby preventing the action of normal hormones; or
- by affecting the synthesis, transport, metabolism and excretion of hormones, thus altering the concentrations of natural hormones.
A variety of human health concerns have been raised in relation to endocrine disruptors. Attention has focused on health endpoints considered to be potentially at risk because either their development or their later functioning in adult life are known or thought to be influenced by exposure to chemicals with endocrine activity. Four main health problems have been identified: reproduction, neurobehavior, immune function and cancer.

10. Health Services

Health services, particularly those designed to maintain and promote health, to prevent disease, and to restore health and function contribute to population health. The health services continuum of care includes treatment and secondary prevention.

Evidence. The following evidence exists:

- Disease and injury prevention activities in areas such as immunization and the use of mammography are showing positive results. These activities must continue if progress is to be maintained.
- There has been a substantial decline in the average length of stay in hospital. Shifting care into the community and the home raises concerns about the increased financial, physical and emotional burdens placed on families, especially women. The demand for home care has increased in several jurisdictions, and there is a concern about equitable access to these services.
- Access to universally insured care remains largely unrelated to income; however, many low- and moderate-income Canadians have limited or no access to health services such as eye care, dentistry, mental health counseling and prescription drugs.

Climate Change Impacts. Climate change will affect Health services in different ways: First an increase on Health care services is expected, both in terms of quantity and range of diseases. It is expected an increase of high cost diseases such as cardiovascular and cerebrovascular disease. Second, financial resources for health care will decrease because of the demand from other sectors and diminished revenues from Governments. And third, damages to infrastructure by heavy rains, hurricanes and heat waves. The health risks related to global warming are widespread and will seriously undermine the United Nations’ commitment to halting diseases. According to the IPCC anticipated health impacts include an increase in cardio-respiratory deaths and illness. In some very large cities (e.g., Atlanta, Shanghai) by about 2050. This would result in up to several thousand extra heat-related deaths annually. This heat-related mortality increase would be offset by fewer cold-related deaths in milder winters, albeit to an extent that was not yet adequately estimated and likely to vary between populations. Similarly, climate change can change the geographic distribution and biological behavior of vector organisms of vector-borne infectious and infective parasites would alter—usually increase—the potential transmission of such diseases. Warmer, wetter conditions will increase both the range and season of vector organisms such as mosquitoes and tsetse flies, which in turn spread diseases like malaria, dengue fever, yellow fever, and encephalitis. According to the IPCC, exposure to malaria under global warming will increase the number of people at risk to malaria by the tens of millions. Simulations with global/regional mathematical models indicated that, in the absence of demographic shifts, the proportion of the world's population living within the potential malaria transmission zone would increase from ~45% in the 1990s to ~60% by 2050. Some localized decreases in malaria transmissibility also may occur in response to climate change. Likewise, warmer temperatures, rising sea levels and floods are associated with outbreaks of cholera and Rift Valley Fever. Milder winters in the North will allow pathogens to persist. In the drier regions of the world, cases of meningitis are expected to increase. In drought-prone regions were clean water sources are under threat of evaporating there is serious risk that water-stressed populations will turn to polluted alternatives. This can lead to the spread of waterborne diseases such as typhoid, dysentery, and diarrhoeal disease. Thus, under conditions of global warming human health is likely to worsen rather than improve. Likewise, under conditions of global warming, rising health problems, such as the spread of vector- and water-borne disease, will particularly affect the poor. Health risks impact livelihoods since the contribution of key productive members of the household may be lost. Moreover, health care is costly and time-consuming for the poor. Likewise, declining food security, in consequence of climate change, will reduce nutrition and make many more poor people vulnerable to the effects of disease. As such, global warming poses multiple threats to the ability of poor people to maintain the human capital base on which their livelihood capability depends.
Heavy rains and hurricanes have impacted the health care infrastructure in the Caribbean. For example, Hurricane Ivan struck the small Caribbean nation of Grenada in the West Indies in September 2004. It was the strongest hurricane on record occurring this close to the equator. The second most important hospital in Grenada (the country has only two), the Princess Alice Hospital, lost most of its roof. Barely 10 days later, Tropical Storm Jeanne unleashed its fury on Haiti, the poorest country in the Western Hemisphere. The La Providence Hospital, which lies below sea level, is a 60-year-old facility and the only public hospital available to serve more than 250,000 people in the province of Artibonite. Jeanne’s torrential rains left the hospital under two meters of water and mud, killing some patients. No patient could be admitted or receive any surgical care until a 100-bed Red Cross field hospital was airlifted from Norway.

11. Gender
Gender refers to the array of society-determined roles, personality traits, attitudes, behaviors, values, relative power and influence that society ascribes to the two sexes on a differential basis. "Gendered" norms influence the health system's practices and priorities. Many health issues are a function of gender-based social status or roles.

Evidence. The following evidence exists:

- Men are more likely to die prematurely than women, largely as a result of heart disease, fatal unintentional injuries, cancer and suicide. Rates of potential years of life lost before age 70 are almost twice as high for men than women and approximately three times as high among men aged 20 to 34.
- While women live longer than men, they are more likely to suffer depression, stress overload (often due to efforts to balance work and family life), chronic conditions such as arthritis and allergies, and injuries and death resulting from family violence.
- While overall cancer death rates for men have declined, they have remained persistently stubborn among women, mainly due to increases in lung cancer mortality. Teenage girls are now more likely than adolescent boys to smoke. If increased rates of smoking among young women are not reversed, lung cancer rates among women will continue to climb.

Climate Change Impact. Climate change is not a gender neutral process. In general, women are more vulnerable to the effects of climate change, because they represent the majority of the world's poor and because they are more than proportionally dependent on natural resources that will be threatened under conditions of climatic change. Climate change will negatively affect agricultural yields of those regions most prone to famine and drought. In those regions, where women are typically engaged in farming activities, lower crop yields will increase the hardship on women. Moreover, under rising temperatures the tasks of farming, fishing, and supplying water and fuel will become more difficult. These tasks are typically and disproportionately the responsibility of women, and as such the hardships endured by women are likely to increase, in times of extreme weather conditions.

Men and women have distinct roles in water use and management, leading to different needs and priorities. Climate change will increase the time taken to collect water in rural areas, a task mainly done by women and girls, due to travelling greater distances to find water. In urban areas, water collection is also an issue as women and girls may spend hours queuing for intermittent water supplies.

12. Culture
Some persons or groups may face additional health risks due to a socio-economic environment, which is largely determined by dominant cultural values that contribute to the perpetuation of conditions such as marginalization, stigmatization, loss or devaluation of language and culture and lack of access to culturally appropriate health care and services.

- Despite major improvements, infant mortality rates among indigenous people is still twice as high as among the general population as a whole and the prevalence of major chronic diseases, including diabetes, heart problems, cancer hypertension and arthritis/rheumatism, is significantly higher in aboriginal communities and appears to be increasing.
- In a comparison of ethnic groups, the highest rate of suicide occurred among the Inuit, at 70 per 100,000, compared with 29 per 100,000 for the Dene and 15 per 100,000 for all other ethnic groups, comprised primarily of non-Aboriginal persons.
- The 1996/97 National Longitudinal Survey of Children and Youth found that many immigrant and refugee children were doing better emotionally and academically than their Canadian born peers, even though far more of the former lived in low-income households. The study suggests that "poverty among the Canadian-born population may have a different meaning than it has for newly arrived immigrants. The immigrant context of hope for a brighter future lessens poverty's blows; the hopelessness of majority-culture poverty accentuates its potency."

Climate Change Impacts.
The close relationship of some indigenous peoples and minorities with their natural environments makes them especially sensitive to the effects of global warming. In some cases, peoples’ ways of life and even their very existence are being threatened by climate change. Indigenous peoples tend to live close to nature, in relatively natural environments, rather than in cities, growing and making much of the food and other products that they need to survive. This gives them an extraordinarily intimate knowledge of local weather and plant and animal life. Traditional wisdom on matters such as when to plant crops or where to hunt for food has been accumulated over many generations, but now that the climate is shifting, some of those understandings are proving to be no longer valid. Climate change, and the rapidly increasing amount of land being converted into plantations of biofuel crops, threatens the very existence of some cultures. But the general failure to recognize and respond to minorities’ resulting problems greatly exacerbates their suffering. Disadvantage and discrimination affect them at every stage, including in the immediate aftermath of climate-related disasters and during official planning at local, national and international levels for coping with the current and future impacts of climate change.
Where minorities are mentioned in reports on climate change, it tends to be incidentally, during studies of particular countries. In addition, some academic, non-governmental organization (NGO) and media reporting of specific disasters has clearly acknowledged that minority communities have fared worse than others.

Minorities tend to live in the more marginal areas and exposed areas, that seem to be seeing more climate changes and are more susceptible to climate impacts because they have got less, and get less, from Governments. It is a characteristic of all the studies that have been prepared, that the ethnic communities are the people who suffer most from climate impacts and are the most vulnerable.

One of the most shocking examples of minorities’ greater exposure to climate change is in India, where some 170 million people known as Dalits are physically, socially and economically excluded from the rest of society. As a result they and two other minorities, Adivasis and Muslims, were worst hit by the unusually severe monsoon floods in 2007. Many Dalits lived in rickety homes in flood-prone areas outside main villages, leaving them especially exposed. They were often last to get emergency relief, if they received it at all, because relief workers did not realize that Dalits live outside the main villages, or because dominant groups took control of distribution or were given priority. A survey by Dalit organizations of 51 villages on 8–9 August 2007 found, among other things, that 60 per cent of the dead were Dalits, that none of the Dalit colonies (or tolas) attached to the main villages had been visited by government relief officials and that Dalits’ housing had suffered the worst damage because most was of poor quality and in low-lying areas.

Another example is the African-Americans living in New Orleans that were also disproportionately badly hit by the floods caused by Hurricane Katrina in 2005. A Brookings Institution report on the disaster found that ‘those areas hit hardest by the flood were disproportionately non-white. Overall, blacks and other minority residents made up 58 percent of those whose neighborhoods were flooded, though they encompassed just 45 percent of the metropolitan population. Within the city itself, 80 per cent of people who had lived in the flooded areas were non-white. Escaping the stricken city was harder for people in the flooded areas, because one in five of them had no access to a car, compared to one in ten without access in the dry areas.
In the Dominican Republic, Haitian migrants’ poverty leads them to live in the rural areas bordering the capital, Santo Domingo, where they work on sugar plantations. When Hurricane Georges struck in 1998, there were severe delays before they received any help from the civil defence authorities or local Red Cross. Dr Mark Pelling, chair of the Climate Change Research Group at the Royal Geographical Society, outlines how entrenched discrimination means that the unfair treatment is rarely questioned, or even noticed, by mainstream society. He says: ‘It is accepted [by the majority] that Haitians will be living in poorly paid jobs, in difficult conditions, and because they are poor, it’s also accepted that their losses will be higher after any sort of disaster.’

Climate change has also played havoc with the lives of indigenous people living on Nicaragua’s remote North Atlantic coast, where groups such as the Mayangna, Miskitu and Rama peoples live. Rainfall patterns have changed in line with what climate change scientists are predicting for the region and, as a result, people’s traditional knowledge about when to plant crops is no longer reliable. Their ability to correctly identify the rainy season has suffered, leading them to plant crops prematurely. Then, when the rain stops, they lose what they have planted and have to start all over again. Even when the main rainy season does arrive, it is shorter than before, inflicting further economic and psychological damage. In the middle of that [rainy] season, they see things rotting away, so collective confidence is being damaged. Without surplus crops to exchange with others for goods such as soap and cloth, indigenous peoples have become less prepared to take risks and try new methods. They are going to be even more prone to extinction because they are not going to survive in a changing environment when they are not changing themselves.

13. Conclusions and Recommendations:
   - Evaluating the impacts on disease are not helping on strengthening resilience public health to be prepared for the impacts of climate change (direct effects, adaptation and mitigation measures);
   - Evaluating impacts of climate change on determinants of health is a better approach than evaluating diseases;
   - Climate changes impacts negatively on each one of the determinants of health;
   - Impacts will vary disproportionately, being the poor, indigenous people, children and women the most affected;
   - Quantification of impacts on determinants of health is needed;
   - A methodology for the Impacts of Climate Change on the Determinants of Health is required;
   - Based on results policies, plans, projects and regulations should be prepared to strengthen the capacity of countries to minimize the impacts on health by climate change.