Sustainability and Health for the City of Calgary: A Discussion of Global Health Trends and Local Impacts

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Executive Summary

Health lies at the centre of the sustainability paradigm, the integrative component linking the social, economic and environmental systems. As a fundamental product of, and contributor to, human development, advances in health status are an essential contributor to sustainability. Although wide disparities remain, globally, health status has improved dramatically over the past century, driven by advances in public health and medical technology. In the developed world, the success of medicine in diagnosing and treating diseases has led to the development of a complex medical system requiring increasing resources to sustain and manage.

Current and emerging stresses on the health care system are leading to growing concern about the sustainability of this system. An ageing population, growing rates of chronic disease, fears of a pandemic and costs associated with technological innovation are expected to continue to drive up system costs in the long-term and consume increasing shares of Gross Domestic Product (GDP) and public expenditures. In response, there is renewed focus on population health, focusing on disease prevention to reduce future demands on the health system.

The population health paradigm fundamentally changes the understanding of health from a narrow focus on disease to an all-encompassing focus on wellness. Not only has this shift broadened our conceptual understanding of health, it has also changed the policy environment. As factors such as income, education, employment, gender and culture become recognized as important determinants of health, the policy responses and range of partners involved in the “health” system changes significantly.

In Calgary as elsewhere, an ageing population and increasing burden of chronic disease are driving changes in the health system. System restructuring, resulting in reductions in overall facility capacity, has resulted in the transfer of a growing share of the financial and caregiving needs of patients from the health system to individuals and the community. As such trends continue into the future, stresses resulting from social and economic inequities may deepen. At the same time, such inequities themselves have been growing as the income gap in Calgary widens, and a larger number of people are experiencing the stresses of inadequate income or the burden of effectively managing and balancing the stresses of employment and family life. Addressing these stresses will be critical to the long-term health of the population as they are, from a population health perspective, fundamental to health status.

As the focus of health care shifts from health to wellness, new partnerships are emerging to address population health holistically. This is placing increasing demands on employers, the municipality, the education system and the non-profit sectors. Opportunities for collaboration are faced with challenges in confronting varying mandates, jurisdictions and capacities. The success of such partnerships will require creative approaches, as well as the investment of new resources into these sectors. As the population ages and growing health system costs demand increasing public expenditures, consuming ever larger shares of provincial revenues, the competition for resources will increase. The challenge will be to balance the resource demands of the health system with the emerging resource needs of new partners to maintain not only the health of the population, but also its wellness.
1. Introduction

Current understandings of “sustainability” purport that current patterns of production and consumption are not capable of being maintained over the long-term. Originally, the concept focused on the environmental impacts of, and limits to, development, and posited a new paradigm of “sustainable development” wherein the current generation’s needs can be met without compromising the ability of future generations to meet their needs. As the concept has emerged, it has come to be understood that sustainability involves social and economic impacts and limits in addition to strictly environmental ones.

The social dimension of sustainability is perhaps the least well-defined. Most notions of social sustainability focus on the maintenance of human capital. Human capital concerns the well-being of the individual and the ability of the individual to meet their basic needs. To the extent that an individual’s physical health is both a product of such ability as well as a contributor to that ability, health is at the core of the concept of social sustainability, and central to sustainability itself.

This paper analyzes the relationship between health and sustainability and identifies “megatrends” in health that are expected to impact sustainability. As a discussion paper, it is intended to inform the imagineCalgary process which aims to develop a 100-year vision and plan for sustainability for the Calgary region. The trends identified herein form the basis for an understanding of the impacts of health on the Calgary community.

2. Health, Sustainability and the Medical Model

Concern with human development is one of the very foundations of the medical tradition in the western world as it sought to ameliorate the ravages of epidemics and other health risks that were exacting a heavy toll on European society. A product of the Enlightenment, medicine turned the focus of science to the understanding and treatment of disease. This represented a new understanding of health as a product of scientific laws that were amenable to human intervention. Based on this paradigm, advances in medical science in the 19th and early 20th centuries led to a widespread belief and optimism in the potential for medicine to sustain human health. Hayes and Glouberman (1999: 2) note:

The remarkable success of this approach in the first half of this century led to the post-war belief in “magic bullet” medicine, that is, the widespread expectation that medical science would eventually identify and conquer most illnesses.
Indeed, the record of medical science in this regard is remarkable. Over the past century, medical science and public health have together made substantial progress in enhancing the health of the world’s population. The World Health Organization (WHO) reports that, globally, average life expectancy at birth has increased by almost 20 years over the past half century, while child mortality has been cut by close to 50%. This has largely been the result of better control, diagnosis and treatment of communicable diseases, as well as advances in perinatal care and increases in overall nutrition (WHO, 2003).

**Current and Emerging Global Health Issues**

Although significant progress has been made in the state of global health, certain health issues remain while new ones are emerging.

**Perinatal Health**

One of the most important contributors to increasing global life expectancy is the reduction in child mortality rates, largely as the result of medical advances in neonatal care (WHO, 2003). As a result, issues of perinatal health have become of relatively less importance, especially in the developed world, due to both advances in perinatal care as well as overall reductions in the number of births. In Calgary, however, issues of perinatal health remain a concern and have assumed relatively greater importance for two reasons. First, one of the key features of the Calgary region is its rapid rate of growth over the past decade. While this growth has been in large part due to high levels of net migration, population growth due to natural increase has also been increasing steadily in the Calgary region as the number of births has grown. It is estimated that the number of children age 0-4 will increase by 33% between 2005 and 2010 (City of Calgary, 2005). This may be partly related to high levels of migration that result in the in-migration of people of child-bearing age.

Secondly, one of the key concerns with respect to perinatal health in Calgary is infant mortality and low birth-weight. While infant mortality has been reduced throughout the developed world, in Calgary, infant mortality rates are increasing. The region also has one of the highest rates of low-birth weight in Canada. In 2001, there were 7.05 low birth weight births/1,000 births, the highest rate among Canadian cities, and an increase from a rate of 6.2/1,000 in 1991 (Federation of Canadian Municipalities, 2004). This is of concern as low birth weight is often associated with increased risk of health problems later in life.
There is currently little understanding of the causes underlying this trend. It has been speculated that Calgary’s high labour force participation rate, particularly among females, may be resulting in women delaying childbirth, with the risk of complications of pregnancy increasing with age. While high labour force participation rates are generally viewed positively, a recent report by the Canada West Foundation questioned the underlying causes of such high rates. This report (Hirsch, 2005), speculated that a rapidly rising cost of living was driving the necessity for two-earner households, leading to above average participation rates. Given the ongoing strength of the local economy, coupled with the impacts of growing labour shortages, it may be expected that such pressures will continue to contribute to high labour force participation rates, including among women, in the future. If so, challenges with respect to perinatal health may likewise be expected to continue to be of concern.

**Population Ageing**

Population ageing is a second important emerging health issue. In the developed world, changes in birth and fertility rates following the “baby boom” of the post-war era have been largely responsible for the process of population ageing. Nationally, Statistics Canada estimates that the number of seniors (aged 65 and older) will exceed the number of children (age 15 and under) by 2031 (Statistics Canada, 2005a). Similar to the rest of Canada, Calgary’s population continues to age. Due to a strong economy which is driving high levels of migration, however, Calgary’s population remains relatively young compared to other major Canadian cities. Despite the relative youth of the population, it is still estimated that the proportion of the population over the age of 65 will increase from 9.5% in 2001 to 15% by 2033 (City of Calgary, 2002). As the population ages, the risk of disability and illness also increases, placing increasing demands on a broad range of health and social services.

As the population ages, there will be an increasing emphasis on health issues facing seniors. This may have the effect of diverting resources to the health care needs of this segment of the population. This ongoing competition for resources may produce intergenerational and intergroup conflicts. Intergenerational conflicts may emerge as senior focused services divert resources from those that may benefit youth and younger working-age adults. This may systemically disadvantage certain populations leading to heightened social tensions. In particular, populations such as the Aboriginal and immigrant populations, which have a significantly younger demographic, will be systematically disadvantaged by any shifting of resources from

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As the population ages, the risk of disability and illness increases, placing increasing demands on a broad range of health and social services.

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youth and adult to senior focused service. Future decisions concerning the allocation of resources based on age will require balance to ensure equity among a variety of social groups with competing interests and resource demands.

**Chronic Disease**

A third key health issue in the developed world is the emergence of non-communicable (chronic) disease as the primary health threat, accounting for close to three-quarters of deaths globally in 2002 (WHO, 2003). In Calgary, chronic diseases are the leading causes of death. In 2000, five of the leading 10 causes of potential years of life lost for both male and female adults were chronic diseases, including cancer, heart disease, cerebrovascular disease, liver disease, and respiratory diseases (Calgary Health Region, 2002). In 2005, cardiovascular diseases and cancer were the leading causes of death in the Calgary Health Region, with cancer predicted to be the leading cause of years of life lost by 2013 (Calgary Health Region, 2005a). Calgary’s situation mirrors that of the rest of Canada where chronic diseases are the leading cause of death and disability. Cardiovascular diseases, cancer, diabetes and chronic respiratory diseases are the most prevalent chronic diseases in Canada. The WHO projects that chronic diseases will account for 90% of all deaths in Canada in 2005, and will increase by 15% over the next 10 years (Conference Board of Canada, 2004; WHO, 2005).

The ageing population presents particular challenges with respect to chronic disease. The results of two studies conducted in the United States and Scandinavia predict that the proportion of Canadians aged 65 and over suffering from various forms of dementia is 8%, representing 252,600 seniors (1994) reaching a ratio of 2.9 women for every man in the oldest age group. The rate for dementia in general ranges from 2.4% for persons aged 65 to 74 to 34.5% for those aged 85 or older. Alzheimer’s disease, including presenile dementia, is currently the tenth leading cause of death in Canada, and the most common cause of dementia in North America and Europe, accounting for 50% to 60% of all cases of dementia found in the elderly (Ulysse, 1997).
Table 1. Leading Causes of Potential Years of Life Lost (Age Group 0-80) for Women and Men in Calgary Region in 2000

<table>
<thead>
<tr>
<th>Rank</th>
<th>Females</th>
<th>PYLL*</th>
<th>Cases</th>
<th>Avg. PYLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Malignant neoplasms</td>
<td>8,237</td>
<td>646</td>
<td>12.8</td>
</tr>
<tr>
<td>2</td>
<td>Disease of heart</td>
<td>2,586</td>
<td>610</td>
<td>4.2</td>
</tr>
<tr>
<td>3</td>
<td>Congenital malformations, deformations, and chromosomal abnormalities</td>
<td>1,209</td>
<td>17</td>
<td>71.1</td>
</tr>
<tr>
<td>4</td>
<td>Suicide (intentional self-harm)</td>
<td>1,193</td>
<td>31</td>
<td>38.5</td>
</tr>
<tr>
<td>5</td>
<td>Nontransport accidents</td>
<td>767</td>
<td>30</td>
<td>25.6</td>
</tr>
<tr>
<td>6</td>
<td>Transport accidents</td>
<td>755</td>
<td>19</td>
<td>39.7</td>
</tr>
<tr>
<td>7</td>
<td>Cerebrovascular diseases</td>
<td>550</td>
<td>191</td>
<td>2.9</td>
</tr>
<tr>
<td>8</td>
<td>Chronic liver disease and cirrhosis</td>
<td>518</td>
<td>27</td>
<td>19.2</td>
</tr>
<tr>
<td>9</td>
<td>Certain conditions originating in the perinatal period</td>
<td>400</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>Chronic lower respiratory diseases</td>
<td>335</td>
<td>89</td>
<td>3.8</td>
</tr>
</tbody>
</table>

**Males**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Females</th>
<th>PYLL*</th>
<th>Cases</th>
<th>Avg. PYLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Malignant neoplasms</td>
<td>8,316</td>
<td>703</td>
<td>11.8</td>
</tr>
<tr>
<td>2</td>
<td>Disease of heart</td>
<td>5,379</td>
<td>619</td>
<td>8.7</td>
</tr>
<tr>
<td>3</td>
<td>Suicide (intentional self-harm)</td>
<td>3,503</td>
<td>87</td>
<td>40.3</td>
</tr>
<tr>
<td>4</td>
<td>Nontransport accidents</td>
<td>2,260</td>
<td>87</td>
<td>26</td>
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<tr>
<td>5</td>
<td>Transport accidents</td>
<td>1,990</td>
<td>52</td>
<td>38.3</td>
</tr>
<tr>
<td>6</td>
<td>Certain conditions originating in the perinatal period</td>
<td>1,120</td>
<td>14</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
<td>Congenital malformations, deformations, and chromosomal abnormalities</td>
<td>1,077</td>
<td>18</td>
<td>59.8</td>
</tr>
<tr>
<td>8</td>
<td>Cerebrovascular diseases</td>
<td>831</td>
<td>123</td>
<td>6.8</td>
</tr>
<tr>
<td>9</td>
<td>Chronic liver disease and cirrhosis</td>
<td>796</td>
<td>40</td>
<td>19.9</td>
</tr>
<tr>
<td>10</td>
<td>Chronic lower respiratory diseases</td>
<td>543</td>
<td>105</td>
<td>5.2</td>
</tr>
</tbody>
</table>

* Potential Years of Life Lost (PYLL)

Source: Calgary Health Region (2002).
**Mental Health**

Mental health is a particular form of chronic disease that is of growing importance. WHO reports that unipolar depressive disorders are the leading cause of disease burden in adult females worldwide, and the fourth leading cause of disease in males. In Canada, the Canadian Community Health Survey (2002) found that 10% of Canadians reported symptoms consistent with one of the five mental disorders in the survey. The report cites the WHO’s findings that five of the 10 leading causes of disability worldwide are related to mental illness, and predicts that depression will be the second leading cause of disability in the world within 20 years (Statistics Canada, 2003).

Among Census Metropolitan Areas (CMAs) in Canada, Calgary reported the fourth highest rate of depression in 2000-01, with roughly 9% aged 12 and over reported to be suffering from depression (Gilmore, 2004). In 2000, the Calgary Health Region reported that 30% of males 18-34 and 32% of males age 35-64 reported being stressed always or most of the time at work, while 27% of females age 18-64 reported such levels of stress (Calgary Health Region, 2002). In the same year, Statistics Canada reported that 24% of those aged 18 and over were experiencing life stress, resulting in a ranking for Calgary of 17 out of 26 CMAs covered in the survey (Gilmore, 2004).

Mental health is of particular concern in the context of an ageing population, and depression and suicide are two of the major health issues for seniors. Depression in the elderly is widely under-diagnosed and under-treated. Austin, Hartley and Donahue (2002) reported that primary care physicians failed to recognize major depression in 50% to 70% of elderly patients with acute depression. The suicide rate, higher for elderly men than elderly women, has been continually rising since 1978. From 1977 to 1986, the suicide rate for Canadian seniors increased from 10% to 13% of all cases of suicide. Possible factors accounting for the high rate of suicide among seniors include widowhood/widower-hood, living alone, social isolation, physical illness, alcoholism, and feelings of rejection (Ulysse, 1997).
Injuries

Following chronic disease, injuries are the second leading cause of death globally, accounting for 10% of all adult deaths worldwide in 2002. In the Calgary Health Region, injuries were responsible for 6,782 hospitalizations and 61,178 Emergency Department visits in 2003-04, while in 2002, there were 350 injury related fatalities. Injuries are a particular risk factor for prime-aged males for whom traffic injuries, violence and self-inflicted injuries were the leading cause of injury. In developed countries, suicides account for the largest share of injuries (WHO, 2003). Health Canada estimated that in 1998, injuries cost the health care system $3.2 billion in direct health system costs (3.8% of total direct costs) and $9.5 billion in indirect costs (12.6% of total indirect costs) (Health Canada, 2002).

In general, injury-related hospitalization tends to increase with age (Calgary Health Region, 2005a). In 2001, the Interim Report Card on Seniors in Canada (Health Canada, 2001) noted the need for improvement in the health of seniors, particularly injury prevention, expressing concern about the persistently high rate of falls among older seniors. Falls can have a huge impact upon a senior’s life and this issue needs to be addressed more aggressively in the community so that seniors can continue to remain in their homes as they get older.

Communicable Disease

Another key contributor to advancing health status in the developed world is the reduction in the incidence of, and deaths resulting from, communicable diseases due to improved control, diagnosis and treatment. In Calgary, as elsewhere, rates of infectious diseases are declining. Although reduced, the health risk from communicable disease remains. In particular, HIV/AIDS has emerged over the past two decades as an important health threat. In 2002, HIV/AIDS was the leading cause of disease for males, the second leading cause of disease for females, and the leading cause of death for adults aged 15-59 worldwide (WHO, 2003). There is also growing concern with respect to the emergence of antibiotic resistant strains of bacteria. Although currently confined to outbreaks in medical facilities, there is a fear that such outbreaks may begin to impact communities. For example, in the United States, there is concern that outbreaks of Methicillin-resistant Staphylococcus Aureus (MRSA) skin infections among homeless populations may be spreading to the general population (Borchardt, 2005).

An emerging threat related to communicable disease is the growing concern about the possibility of a global pandemic resulting from new infectious diseases. In an era of increased international travel, such diseases can emerge and spread rapidly if not contained at the region of origin. In 2002, the outbreak of Severe Acute Respiratory Syndrome (SARS) provided an example of the potential for such a pandemic to originate and spread. In addition to new diseases, there is the continued risk of the spread of known diseases to new regions, such as the introduction of the West Nile Virus in North America in the early 1990s (Drager and Heymann, 2004).

The potential impact of a severe outbreak of an infectious disease, such as an influenza pandemic, is of growing concern to cities such as Calgary due to the potential for significant social and economic consequences. The recent outbreak of SARS, for example, was estimated to have cost the Ontario health care system $145 million in 2003, with additional unaccounted
costs to the economy in terms of lost revenue due to reduced tourism and hospitality business (CBC, 2003). Those at greatest risk of infection would be those most exposed to the public, in particular emergency workers. The potential impact on the health of emergency services workers may greatly impact emergency service capacity within a few weeks of an outbreak. In addition to emergency workers, a pandemic would affect those working in the service sector who are in direct contact with the public. This may result in a large proportion of this labour force being unavailable for work due to illness.

Economic forces may influence the development of a pandemic should it occur. In the context of pre-existing labour shortages, compounded by widespread illness within employees, service sector employers would initially face severe strain. One of the potential consequences of such a situation may be increased pressure on employees to report to work despite being symptomatic, which may aid the spread of an outbreak during its early stages. The structure of the economy may also contribute to the spread of an outbreak in other important ways. Currently, most families have both parents working due to the necessity for dual incomes in the context of stagnant real wages and increasing living costs. As a result, many children are not kept home from school when ill as the parents are not in a position to be home with a sick child. In the event of an outbreak, this might also greatly aid the spread of a pandemic during its early stages.

The outbreak of a pandemic may also be expected to have significant impacts on the social functioning of the community. Watkins (2003) cites a survey completed in Toronto during the SARS crisis, which found that 24% of Torontonians avoided public places during the outbreak, 16% avoided face-to-face conversations, and 12% avoided public transit. Not only may this have impacts on the social and cultural life of the city, a 12% reduction in transit use similar to that reported in Toronto would result in approximately 35,000 additional non-transit users with associated impacts on traffic flow.

A further impact of such an outbreak may be on the social fabric of the community. In the event of an outbreak, those at greatest risk of exposure would be the most marginalized, particularly homeless people, who would also be the most compromised in health status already. This has been observed elsewhere with, for example, the spread of MRSA which has been prevalent among homeless populations in the United States. An associated social impact is the risk of stigmatization that might accompany a pandemic, particularly if it was to originate in East Asia as is currently predicted (Rossi and Walker, 2005). Leung and Guan (2004) reported on the stigmatization of the East Asian community in Toronto during the SARS crisis, noting the prejudice and racism that resulted. This could have an important impact on Calgary where 10% of the population is of East and Southeast Asian origin. It is conceivable and likely that such stigmatization in Calgary would also extend to the Aboriginal community, as this population may be highly susceptible to a pandemic due to their compromised state of health. In particular, the overrepresentation of the Aboriginal population among the city’s homeless population both increases the risk for this population and continues to expose the whole population to stereotypes and prejudice which may find new expression in the event of a pandemic.
**Aboriginal Health**

An important emerging health issue, particularly for western Canada, is the state of health of Canada’s Aboriginal population. Although the previous health issues discussed have focused on health risks rather than populations, the dramatic disparity in health status between Canada’s Aboriginal and non-Aboriginal population is so stark that it bears discussion. The Canadian Institute for Health Information (CIHI) reports that the burden of both chronic and infectious diseases is significantly higher for Aboriginal people, as are rates of intentional and unintentional injuries, including suicide (CIHI, 2004). At the same time, life expectancy at birth for First Nations males was 7.4 years less than non-Aboriginal males, and 5.2 years less for First Nations females than non-Aboriginal females in 2000. During the same year, the death rate for injuries and poisonings among First Nations peoples was 2.9 times above the Canadian rate, while the tuberculosis rate was eight times that of the Canadian population, and the prevalence rate for diabetes is three to five times higher. While these figures are skewed toward the on-reserve population, the off-reserve population also reports significantly higher rates of diabetes, depression and “poor” self-rated health (Probert and Poirier, 2003).

As the urban Aboriginal population continues to increase in western Canadian cities, including Calgary, issues of Aboriginal health will become increasingly important over the next several decades. One of the distinctive features of the Aboriginal population is its relative youth. Consequently, while health care will be increasingly focused on the issues of an ageing population, the health issues facing the Aboriginal community will be primarily youth related. As a younger population, the Aboriginal population will be an increasingly important component of the labour force. Aboriginal health should therefore be of interest to employers, particularly in light of increasing benefit costs that are expected to impact employers as their workforce ages.

The health of the Aboriginal population is intimately related to issues of housing, education and other social factors, as well as environmental conditions on-reserve. Conditions on-reserve are of importance to urban areas because of ongoing urban migration; poor health conditions on reserves thus become urban issues as people leave the reserves with compromised physical, spiritual and mental health and migrate to urban areas, requiring medical attention in the city. Aboriginal health is also compromised by jurisdictional issues concerning differential benefits available to on-reserve and off-reserve Aboriginal people. Ensuring the health of the Aboriginal population will require attention to social factors such as adequate housing, income and diet, while focusing on barriers to accessing the health system that have been reported by many Aboriginal people (Pruegger, Hubac and Sawatzky, 2005).
**Immigrant Health**

In addition to the Aboriginal population, immigrant health issues will also become increasingly important. It is estimated that by 2026, immigrants will comprise 23% of Calgary’s population, and 25% of the labour force (City of Calgary, 2002). While there are concerns expressed that increased immigration may pose a burden to the health care system, in fact, research has shown that immigrants tend to be healthier than Canadian-born individuals, although immigrant health tends to deteriorate to Canadian standards in the years following immigration (Hyman, 2001). Given that a substantial portion of Calgary’s immigrants are secondary migrants, it is possible that the health benefit of the immigrant population may erode prior to settlement in Calgary. Similar to the Aboriginal population, therefore, it is critical to pay attention to social factors that may undermine immigrant health status. At the same time, changes in lifestyle in the developing world are resulting in a growing incidence of chronic disease mirroring the epidemiological transition that has already occurred in the developed world. Further, environmental degradation worldwide may result in general deteriorating health. As a result, immigrants in the future may more resemble non-immigrant Canadians in terms of health status.

**Current and Emerging Health System Issues**

While the health system faces challenges in addressing these emerging health issues and risks, ongoing and emerging issues within the health system itself are posing growing challenges in Canada, as well as the rest of the industrialized world.

**Health System Access**

One of the current pressing issues for the Canadian health care system is access. In 2001, almost one in five (18%) Canadians who accessed health care services reported some difficulty in doing so, particularly specialized services. Among those reporting difficulty accessing specialized services, the predominant reason was long wait times for non-emergency surgery, specialists, and diagnostic tests (Statistics Canada, 2002a).

Wait times are a significant factor in unmet health needs. In 1998-99, 6.6% of Canadians aged 18 and older reported having had unmet health care needs during the previous 12 months. Although a relatively small percentage, it is a significant increase from 4.4% in 1994-95 and 5.4% in 1996-97. One of the primary reasons cited for unmet needs was availability, largely related to wait times (Statistics Canada, 2002b).

A further factor relating to unmet health care needs is the availability of primary care physicians. In 2003, approximately 5% of Canadians reported that they could not find a family doctor, of whom 80% lived in urban areas. The percentage of persons in Alberta who were unable to find a regular doctor was less than the national average, at 3.4%. While this figure is virtually unchanged from 1994-95, the inability of a large segment of the population to find a family doctor has implications for the health care system, as such people are 3.5 times more likely to access hospital emergency rooms than those who have a regular doctor (Statistics Canada, 2004).
Access to services is partly related to the availability of health professionals. A perceived shortage of physicians is a growing concern throughout the industrialized world. A recent report by the Organisation for Economic Co-operation and Development (OECD) noted that there were large variations in the number of practicing doctors per capita across the OECD, and that Canada had a relatively low number of practicing doctors. Similarly, the number of nurses per capita varies across the OECD, with the number per capita beginning to decline in Canada (OECD, 2005). In Canada, the physician to population ratio has been falling since the early 1990s, after increasing for the previous two decades, bringing Canada roughly in line with other OECD countries. Canada remains below the OECD average with respect to the rate of specialists, however (Conference Board of Canada, 2004).

Access to health services therefore remains one of the important issues with which communities such as Calgary will continue to struggle. In Calgary, roughly 15% of the population aged 12 and over reported self-perceived unmet health care needs in 2000-01, the fifth highest of 25 major CMAs in Canada (Gilmore, 2004). Access is related, first of all to the primary care system. In Calgary, the number of adults who reported having a family physician in 2000-01 ranged from 69% among males aged 18-34, to 97% among males and females age 65 and over (Calgary Health Region, 2002). The Calgary Health Region estimates that, overall, roughly 20% of the population, do not currently have a regular family physician (Calgary Health Region, 2005b). In 2001, Calgary’s general practitioner rate was below the national average at 90.3/100,000, and the eighth lowest among Canadian CMAs (Gilmore, 2004).
Health Human Resources

Examining health human resources issues, the Romanow Report identified a variety of factors affecting the supply of physicians, specialists and nurses in the health care system. First, the rising cost of education is resulting in students choosing specialties with higher income potential, creating a systemic bias away from family medicine. At the same time changes in the delivery of primary care are having an impact, such as reduced on-call hours and increasing specialization within primary care, resulting in increasing numbers of primary care practices no longer accepting new patients (Fooks, Duvalko, and Schiff, 2002). When family physicians are accepting new patients, many prefer to accept healthier and higher income patients rather than lower-income patients with greater health issues. In the absence of a regular family doctor, people may rely on emergency facilities for primary care. As a result, such patients tend to rely on Emergency Medical Services (EMS) for primary health care when they have no other access to services.

The potential stress resulting from growing reliance on the emergency system for primary care exacerbates existing stresses resulting from the recent restructuring of the health system. Cost constraints in the mid-1990s led to the closure of a number of health care institutions within Calgary, resulting in the loss of emergency capacity in the system. Abrams (2001) reports a comparison between Calgary and several American cities of similar size with respect to emergency capacity, noting that while Calgary has four emergency departments, San Antonio and Dallas, cities of comparable population, had 20 and 23 emergency departments respectively.

The availability of health care is as much an economic as a social issue. On the one hand, the availability of health care is becoming an increasingly important factor in locational decisions among companies. At the same time, the shortage of physicians is resulting in increased competition among regions for health professionals. A recent report by the Health Council of Canada (2005) noted that the three richest provinces (British Columbia, Alberta and Ontario) gained 1,052 physicians between 1999 and 2003 at the expense of Newfoundland and Labrador, Quebec, Saskatchewan, Manitoba and Nova Scotia, which collectively lost 1,075 physicians. The competition for health professionals can only be expected to increase as skill shortages in all industries are expected to grow over the next decade.

Although the demand for health professionals is expected to grow, there are important constraints to the capacity of the medical profession to meet this demand. While recent increases in enrolments in Canadian medical schools may lead to growing numbers of physicians over the short-term, over the long-term, it is estimated that the number of physicians will not increase, due to increasing retirements and the increasing duration of post-graduate training. What cannot be assessed is the potential role of technology to change the demand for physicians through the introduction of system advances such as telehealth (Conference Board of Canada, 2004). In this environment, Calgary will need to be increasingly competitive for national and internationally trained health professionals.
Primary Care

As a result of challenges in the primary care system, there is widespread attention being paid to primary care renewal. Common features of primary care renewal include a focus on multidisciplinary care involving a team of health practitioners to provide a more integrated approach to care. Information technology is also of growing importance in new models of primary care. New information technologies such as the use of electronic health records and the Internet are offering the potential to transform the practice of medicine. Such technologies can speed the dissemination of new ideas, therapies and measurements, reducing the knowledge transfer time from research to practice, while enhancing the ability to provide individualized care.

On the consumer side, new information technologies such as telehealth, the Internet and e-mail can facilitate access to health information and advice via non-traditional media. PricewaterhouseCoopers estimated that “if patients could communicate with physicians or be monitored through the internet, more than 20% of in-office visits could be eliminated” (PricewaterhouseCoopers, 1999: 12). This may have particular benefits for Calgary which had the second highest Internet penetration rate among Canadian cities in 2004 (City of Calgary, 2005). At the same time, there is differential use of and access to the Internet based on age and income. Increased reliance on consumer-based health information technologies may have the effect of disadvantaging already marginalized populations.

Primary care renewal increasingly focuses on chronic disease management to provide support to patients to manage their diseases independently, reducing the need for institutionalization. This has been driven by advances in medical care that have reduced hospitalization time. While this benefits the health system and patients alike, it also presents challenges. As patients are released earlier, the burden of care is transferred to the individual and the community. As drugs and aids are only provided free of charge while in the hospital, early release increases the amount of money individuals are required to spend. In 2001, Calgary reported the highest average household expenditure on medical care, 38% above the national average, with the average household spending $2,017. For those without health benefits, such costs may be prohibitive and may compromise recovery.
Early patient release also often transfers caregiving support from the health system to the community. This responsibility may be burdensome on caregivers, particularly for seniors where the caregiver is often the spouse, usually themselves a senior. At the same time, adult children are often not present or, if so, the burden of care for ageing parents as well as, often, children, while maintaining employment can be stressful, and may in itself compromise the health of the caregiver (Higgins, 2004). This may be of particular importance in Calgary, which has both a high labour force participation rate and a high proportion of migrants, many of whom lack family connections in Calgary. As a result, there may be an increasing demand for formal support services.

The excessive workload of caregiving may negatively impact the quality of care that is provided within the home. Caregiving can be associated with many stresses and fatigue caused by lack of rest or vacation time, lack of socialization, and physical abuse of the elderly. Inadequate resource allocation, lack of available services and the accessibility of public support for informal caregivers also add to the burden. Unless there is a major reorientation of health care based on the need of an ageing population and a change in the professional culture of physicians who remain the “gatekeepers to health care,” vigorous home help policies cannot be developed (Ulysse, 1997).

Changes to the primary care system are having the effect of bringing new partners into the health care system. New models of primary care are emerging that aim to be more multidisciplinary, engaging a range of health care providers. In Calgary, the Calgary Health Region is establishing Primary Care Networks that bring together various health practitioners, as well as community organizations, to provide a holistic approach to health and chronic disease management. This may result in increased demands on community agencies, which may in turn increase demands on funders.
3. Health System Sustainability and the Medical Model

The current health care system that has developed over the past century is one that is based primarily on the diagnosis and treatment of disease using ever advancing and complex technologies. While this model has been very effective in reducing mortality rates and increasing life expectancies in the developed world, there is growing concern that this model may be unsustainable. For example, the percentage of GDP spent by OECD countries on health increased from 5% in 1970 to 7.1% in 1990, and to 8.8% in 2003 and public expenditures on health have increased faster than economic growth in all OECD countries since the mid- to late-1990s (OECD, 2005).

In Canada, it is estimated that total provincial and territorial health care expenditures will almost double from $55.9 billion in 2000 to $102.5 billion in 2020. Over the same period of time, total average public health costs are expected to more than double, increasing from $2,017 per household to $4,750 (Brimacombe, Antunes and McIntyre, 2001). Looked at another way, taking the projected fiscal prospects of governments into account, total health spending by the provinces and territories will increase from 36.6% of budgetary revenues in 2002-03 to 44% in 2019-20, accounting for 7.4% of GDP, up from 6.3% in 2001 (Conference Board of Canada, 2004).

Health System Cost Drivers

One of the key factors accounting for the growth in health care costs is the ageing of the population as the number of seniors will increase dramatically over the next two decades. Brimacombe et al. (2001) note that, starting with the age 45-54 cohort, health care expenditures nearly double for each successive cohort, while the Conference Board of Canada (2004) reports that hospital costs quadruple from middle age to senior ages. Exacerbating these increasing costs is the fact that life expectancy at age 65 is continuing to increase.

A related aspect of population ageing is the associated phenomenon of reduced population growth. Canada’s population growth rate has been slowing steadily over the past thirty years due primarily to reduced birth and fertility rates. Population growth is important as it both produces the economic resources required to finance the health care system, as well as the human resources necessary to operate it. Reduced population growth therefore in the context of an ageing population may be expected to significantly impact the human and financial capacity of the current health system.

A second factor driving the increase in health care costs is the increasing prevalence of chronic disease. The Conference Board of Canada (2004) reported that, in 1993, 40% of all direct costs for illness were attributable to cardiovascular diseases, diabetes, kidney disease, respiratory diseases and cancer, all chronic diseases. Combined, all chronic diseases were estimated to account for two-thirds of all direct health care costs, costs that will only grow as the risk of developing chronic disease increases with age.
The third factor driving increasing health care costs is the cost of pharmaceuticals which have been the fastest growing component of health care costs in Canada over the past 25 years. According to the OECD, Canada reported the third highest drug expenditures per person among OECD countries in 2005 (OECD, 2005). Although drug costs are primarily born by the private sector, they also constitute a growing proportion of public expenditures, primarily as a result of the public provision of drugs during hospital stays. It is estimated that drug costs will account for 15% of provincial/territorial health costs by 2020, double the 7% currently accounted for. Factors driving rising drug costs include increasing drug prices facilitated by legislative changes that discriminate against generic drugs, as well as increased rate of utilization due to population ageing and an increased scope of pharmacotherapy (Conference Board of Canada, 2004).

Finally, new medical technologies are a significant contributor to health care costs, and are estimated to account for roughly 25% of the increase in health care costs in the United States. Leading technological changes that have led to the growth in cost include new imaging technologies such as MRIs and CTs, spending on which was estimated to be $2.1 billion nationally in 2000. A second contributing factor is advances in surgery that reduce risk and thereby increase the rate of use of such procedures, driving up overall costs. A third factor is advances in genetics, particularly arising from the Human Genome Project, which may radically change the way in which medicine is practiced, likely at substantially increased costs. As new advances become available, consumers expect and demand that they be made available and provided through public medicare (Conference Board of Canada, 2004).

One emerging factor driving change in the health care system is an increasingly educated and demanding consumer population who are taking more control over the management of their health care needs. This is partly a result of challenges in the primary care system where physicians are spending less time with each patient. Partly, it is due to consumers spending a larger part of their own money on health care and increasing direct company to consumer advertising. Such changes have been facilitated by the Internet which is rapidly becoming a critical source of health information (PricewaterhouseCoopers, 1999).

**Fiscal and Economic Impacts of Growing Health System Costs**

As a result of these pressures on health care costs, public medicine is expected to exert increasing fiscal pressure on federal and provincial governments over the next 20 years. While it can be argued that economic growth may alleviate some of these pressures, it has been pointed out that revenue streams have become increasingly delinked from economic growth as a result of tax cuts and other fiscal measures undertaken over the past decade, particularly at the provincial level. At the same time, restructured federal/provincial transfer mechanisms have constrained provincial revenues due to the move from federal/provincial cost-sharing mechanisms to a block grant system.
As health costs increase in the context of constrained revenue growth, the competition for public funds will increase particularly between health and other sectors. Brimacombe et al. (2001: 21) note “… we can expect escalating tensions between those seeking more dollars for health care versus those seeking additional resources for all the other services funded by government.” In this environment, an increasing share of the cost of health care is being shifted to consumers, and thereby indirectly to employers through defined benefit plans.

This shift is impacting economic competitiveness. A recent survey by the Ontario Chamber of Commerce (2005) reported that close to half of the businesses surveyed identified increasing benefit costs as negatively impacting business competitiveness, and the larger the company, the greater a proportion of payroll costs devoted to health benefits. Benefit costs are also affected by retiree health benefits. With recent changes in public health care and an ageing workforce, such benefits are becoming increasingly expensive for businesses, prompting some to restructure benefit plans to limit their exposure, including strategies to shift a portion of costs to retirees. However, firms in the energy industry have typically been least likely to implement such strategies (Watson Wyatt Canada, 2003).

As a city with a substantial number of large employers and head offices, and a significant concentration of energy firms, health benefit costs may be expected to be a growing concern with respect to the competitiveness of local business. Strategies designed to limit exposure to growing health benefit costs may be difficult to implement. Calgary is expected to face an ongoing and growing labour supply shortage (City of Calgary, 2002). In this environment, strategies to attract and retain labour will likely include health benefits, particularly as the public health system is restructured.

As a consequence of ongoing benefit cost increases and cost reduction strategies, there may be a growing divergence between large enterprises with the ability to provide comprehensive health benefits, and smaller employers and sectors unable to provide increasingly expensive coverage. This may compromise the long-term health of both the employer and the employee, having particular impacts on marginalized populations who tend to work in lower-paid industries. Of particular concern is the long-term vulnerability of the non-profit sector, which may experience increasing difficulty in attracting and retaining professional staff due to funding challenges that limit the ability to provide competitive wages and benefits (Cherneski, 2005).

As a result of growing health care costs to both the public and private sectors, federal and provincial governments have been increasingly seeking new models for health care delivery. This has spawned a variety of commissions and reports, most notably the federal Romanow Commission and, in Alberta, the Mazankowski Report. One of the common elements between these two reports is a renewed interest in public health and a renewed emphasis on health promotion and disease prevention.
4. Health, Sustainability and the (Re-) Emergence of Population Health

As the sustainability of the current health system is called into question, a new health paradigm is emerging, that of “population health.” Population health focuses attention on the factors that contribute to health, rather than the diagnosis and treatment of disease. Although a relatively new concept to Canadian public policy, population health has a long history which has paralleled the development of the medical model. Population health traces its roots to the public health movements of the late 19th century, which grew out of a recognition of the links between the physical conditions of early industrial cities and the health of the population. During the industrial revolution, crowding and unsanitary conditions associated with rapid urbanization contributed to the spread of infectious diseases, leading to the development of measures to mitigate the adverse public health impacts of urban development and industrialization.

Despite this early attention to the social and environmental influences on the health of the population, the development of the medical profession with its emphasis on diagnosis and treatment predominated during the 20th century, accompanied by rapid advances in medical technologies and supportive medical infrastructures. In the mid-1970s, however, this paradigm was challenged with the release of *A New Perspective on the Health of Canadians*, also known as the Lalonde Report, which argued that greater improvements in health could be achieved through prevention strategies than through medical approaches on their own. This led to a major policy shift, resulting in the development of health promotion strategies to reduce illness and disease, and ultimately strain on the health care system, by influencing behaviour. This approach has resonated in Canadian public policy ever since, finding expression in the mid-1980s in the Epp Report and more recently in the federal Romanow Report and the Province of Alberta’s Mazankowski Report (Legowski and McKay, 2000; Fooks and Lewis, 2002).

This emerging policy has been built on the recognition that the causes of most injuries and non-communicable diseases are preventable and amenable to policy intervention. Obesity is a major risk factor for diabetes, cancer and cardiovascular diseases. Rates of obesity among Canadian adults have almost tripled from 5.6% in 1985, to 14.9% in 2000-01. Among children, the situation is even more alarming, where the percentage of children who are obese increased from 2% in both boys and girls in 1981, to 9% in boys and 10% in girls by 2000-01. Looking at children who are either obese or overweight, the percentage of children in 2000-01 was 36% (CIHI, 2004).
Physical inactivity is a major contributor to obesity and related illnesses such as diabetes, cardiovascular disease and cancer. Some factors contributing to reduced physical activity include the shift to less physically demanding work, urbanization and neighbourhood design, increasing use of automated transport, labour-saving technologies in the home and passive leisure. Taking action on these issues, it is argued, will result in substantial cost savings to the health care system in the future. The Conference Board of Canada (2004) suggests that an investment of only 6% of the total health care budget would be sufficient to prevent illness and maintain the health of the population.

In 2000-01, 56% of Canadians were reported to be physically inactive, while 82% of children were not active enough for optimal growth and development (CIHI, 2004). In Calgary, physical inactivity rates are relatively low as compared with other CMAs. In 2000-01, roughly 42% of Calgarians aged 12 and over were reported to be physically inactive, the fifth lowest rate among CMAs (Gilmore, 2004). Still, the Calgary Health Region attributed 9% of deaths among males and 14% of deaths among females to physical inactivity in 1999, the second highest risk factor in the region (Calgary Health Region, 2005a).

Although not entirely attributable, physical environment can play an important role in the level of physical activity of the population. In particular, urban design has been argued to exert a significant influence on levels of inactivity. Low-density suburban developments that promote automobile-dependence have been argued to negatively impact health due to the reduced levels of activity resulting from increased automobile usage. Stone and Gibbons (2002) note that western Canadian cities (with the exception of Vancouver) have population densities that are significantly lower than other major cities in central and eastern Canada, as well as the United States.

The continued strength of the Alberta economy has made Calgary the fastest growing city in Canada over the past decade. Population growth has been absorbed by new developments that spread in every direction from the downtown core. Consequently, in an area the size of New York City, Calgary houses one-tenth of New York’s population (Stone and Gibbons, 2002: 6).

One of the important contributions of this ongoing development of population health policy is the emergence of the concept of the social determinants of health which have emerged as a set of scientifically verifiable socio-economic factors that are found to have an influence on health status. Health Canada identifies the following determinants:

- Income and social status
- Personal health practices and coping skills
- Social support networks
- Health services
- Education
- Social environments
- Employment and working conditions
- Gender
- Physical environments
- Culture
- Biology and genetic endowment
-
**Population Health Influences and Sustainability**

The population health paradigm as expressed through the social determinants of health framework extends the relationship between health and sustainability. When health is viewed more broadly as a function of the relationship between the individual and their social, economic and physical environment, health becomes central to all of the dimensions of sustainability.

**Population Health and the Social System**

Health is central to human capital development both as a product of human capital as well as a contributor to it. Health is a product of other aspects of human capital development as it is influenced by the degree to which basic needs are being met. In the most direct sense, adequate nutrition is obviously critical to health status as are adequate housing conditions. A more complex relationship between health and human capital has been shown to exist, however, as research has identified the existence of “health gradients,” whereby levels of mortality and morbidity follow levels of socio-economic status. When considering the primary risk factors for chronic disease, income is associated with most. Rates of physical inactivity tend to be higher among lower-income households, as do rates of obesity, alcohol and tobacco consumption and reduced dietary intake.

While some of these may appear to be “lifestyle choices,” research has identified a complex set of factors that account for such differences. Statistics Canada (2005b) reports that children in low-income neighbourhoods are less likely to participate in organized physical activities and that parents in such neighbourhoods tend to feel that their neighbourhood parks were unsafe, leading to the conclusion that poorer children have fewer opportunities to be physically active. Diet is also related to socio-economic factors, as healthy foods often cost more than foods high in fat, sugar or starch. CIHI notes that “Canadian studies have reported that food costs are higher in lower-income neighbourhoods and that transportation to inexpensive food markets can be challenging for low-income families” (CIHI, 2004: 120).

In Calgary, income challenges persist despite a robust economy and the perception of general prosperity. According to TD Economics, 42% of Calgary’s population earned less than $20,000 in 2003 (Lavoie and Drummond, 2005). Calgary’s poverty rate has recently begun to increase following several years of decline. In 2003, Calgary reported the sixth highest poverty rate among Canadian CMAs (City of Calgary, 2005). The relationship between income and health is best exemplified by the fact that neighbourhoods in Calgary with lower median incomes exhibited greater years of life lost than the average in 2004 (Calgary Health Region, 2005a).

While income is an important determinant of health, Veenstra (2001) refers to research that demonstrates that income inequality is a stronger predictor of mortality than income. This relationship may be the result of a community’s social capital, that is, the bonds or norms and the network of social relationships that provide meaning and support to individuals (Koning, 2001). It is posited that in communities with high levels of inequality, social capital is weaker, and is reflected in decreased participation in public life and decreased levels of trust, both of which
influence health status. It is also suggested that societies which permit high levels of inequality also tend to under-invest in human, physical, cultural, civic and health resources, and this under-investment may affect health outcomes (Veenstra, 2001). A recent report by Statistics Canada (2005c) reports that self-perceived health status is positively related to the sense of community belonging. This suggests that marginalized populations may experience reduced levels of health as a consequence of the experience of marginalization. Addressing issues of exclusion based on factors such as culture, income, and ability are of significant health concern.

In Canada, income inequality has been increasing over the past ten years. CIHI (2004) reports that the average income of the top 20% of families rose by 24% between 1993 and 2001, while that of the bottom 20% rose by just under 10%. In addition, income inequality increased for all cities in Canada between 1980 and 1995, with declining average income in low-income neighbourhoods and increasing average income in high-income neighbourhoods. In Calgary, a recent report by TD Economics (Burleton, Curtis-Irving and Philipoff, 2003) expresses concern with growing levels of income inequality in Calgary.

As income challenges persist and increasingly impact health, the need for social supports to address the social determinants of health, will also increase. This may lead to an increased role for cities in the funding and support of community services, particularly through the Family and Community Support Services (FCSS) program. The growing homeless population in particular is impacting municipal services related to health. In Calgary, a growing homeless, mentally ill and substance population exists that doesn’t fit well within either the police, EMS or health systems. This is leading to a growing demand for alternative service delivery models that have a preventive focus and may be more community-based, working with other service providers. This may lead to increased demand on funding bodies such as FCSS to support agencies that may be called upon to provide such service.

While the direct effects of poverty and income inequality are most visibly observed with respect to the homeless population, income challenges have a significant impact on the broader lower-income population. Increasing costs for basic needs such as housing and non-insured health costs are reducing disposable income for preventive wellness. The City of Calgary currently provides a Recreation Fee Assistance program for low-income Calgarians and has recently introduced a low-income transit pass, both of which may help to increase access to wellness activities for the low-income population, but have important budgetary impacts.

Increasing living costs also have other related impacts. As low-income families face difficult budgetary choices due to the rising cost of housing, reliance on emergency food services from the food bank increases. This compromises overall health due to the quality of food typically available from food banks. Similarly, even for those who do not rely on food banks, healthy food choices tend to be more expensive, resulting in compromised diet. The cost of utilities also impacts health, as low-income families reduce utility consumption resulting in lowered hygiene due to reduced washing, and colder housing as families seek to reduce heating costs.
Population Health and the Economic System

To the extent that income and inequality are products of the economic system, patterns of economic development can exert a significant impact on the health status of the population. Economic development contributes to human capital development through the generation of income via employment. The degree and manner in which income is distributed is a function of the social and economic system, and influences income inequality and hence social capital development. Addressing issues of poverty and income inequality may require changes to the federal or provincial fiscal/tax regime that may have short-term implications for the local economy. For example, increases in the minimum wage may have positive long-term effects, but short-term negative impacts for smaller businesses (although growing labour supply pressures may serve to increase wages through the market). Addressing systemic patterns of economic exclusion, however, may prove more challenging. In particular, ensuring adequate incomes for those with challenges to paid employment such as persons with disabilities or those without adequate official language ability will be essential.

The nature of employment relationships also has an impact on health. CIHI (2004) reports that mortality rates decline as occupational level increases, and that this differential is explained by factors such as position in the occupational hierarchy, stress, control over work and coping skills. In Canada, economic restructuring over the past 15 years has resulted in increased “non-standard” employment, characterized by part-time or contract work of limited duration. Such work often lacks security and benefits, such as health, and provides workers little control.

Over the next decade, employers will face increasingly difficult choices. Increasing benefit costs associated with the restructuring of the public health care system, coupled with an ageing workforce, will place increasing cost pressures on businesses. At the same time, strategies designed to reduce costs such as outsourcing or limiting benefit coverage will be difficult to implement in the context of an emerging labour shortage resulting in increased competition for labour. Further, current research suggests that such measures will be counterproductive as they tend to compromise health and lead to increased health system costs in the long-term.

Population Health and the Natural and Built Environment

A further determinant of health that bears discussion is the influence of the natural environment on health but the health care system can also affect the environment. Jameton and Pierce (2001) note that health care services are significant generators of waste, including by-products such as infectious materials and bio-hazardous agents. Health facilities are also substantial consumers of energy resources. In addition, the production of medical supplies necessary for the system requires complex manufacturing processes which have environmental impacts. From a larger perspective, the existence of complex health systems is dependent upon wealthy societies to support them, the sustainability of which is being called into question. Jameton and Pierce (2001: 3-4) state:

Large scale health care systems such as those in Canada and the United States depend on wealthy economies to sustain them. But wealthy economies are unsustainable and must scale down their overall consumption of materials and energy. If wealthy industrialized societies as a whole are unsustainable, then so are the health care systems housed by these societies. And if the material scale of these economies is to be reduced, so must the scale of health care.
While the health care system affects the environment, the natural environmental reciprocally affects population health. Myers and Betke (2002) identify two ways by which the environment influences health. The first is through the direct pathological effects of chemical, physical and biological agents. The quality of the air, water, and exposure to toxins all have immediate and long-term health implications, contributing to the development of chronic diseases such as respiratory diseases, cancer and others. Of particular and growing concern is the use of chemicals in industry, agriculture and consumer products, and the health consequences of long-term exposure to low levels of chemicals. One of the consequences of increasing life expectancies and population ageing is that humans are exposed to the effects of the environment for longer periods of time and therefore may be exposed to increasing risk.

The second way in which the environment impacts human health is through the health effects of the broad physical environment (such as housing, patterns of urban development, land use and transportation). Low density suburban developments characterized by automobile dependence lead to increased air emissions, impacting air quality and health. In Calgary, the primary source of air pollution is the private automobile (Calgary Health Region, 2005a). As population growth continues to be accommodated by the development of low density suburbs that promote automobile dependence, there may be a resulting long-term deterioration of air quality and a corresponding impact on health.

What is still unknown, are the potential impacts of global climate change on health. One possible impact of climate change is reduced water quality. This may occur as a result of lower water levels and increased water temperatures which may increase contamination and reduce the level of high quality water available for human use. In addition, there may be an increase in waterborne diseases due to flooding that may compromise public water systems (Warren, 2004). Increasing challenges with respect to water quantity and quality may particularly impact Calgary, as water shortages are expected to emerge in the Calgary region over the next several decades. As water challenges grow, there may be a need to change water-costing systems, and this may jeopardize access to high quality water by marginalized populations.

Changes in temperature may also increase the severity and risk of forest fires. As Calgary lies in proximity to forest fire prone regions, the increased risk and severity of forest fires arising from climate change may impact the air quality of the region, leading to increased respiratory disease. Climate change is also expected to lead to increasing rates of mortality and morbidity due to extreme heat events. This may include increases in respiratory illnesses, heat exhaustion, heat stroke, and nervous system problems. In particular, increases in heat levels during the summer may have the effect of increasing air pollution, including smog. Of particular concern are the impacts of such severe temperature extremes on vulnerable populations such as the elderly, low-income individuals and those with compromised health. In Calgary, possible moderating of winter temperatures due to climate change may reduce cold-related mortality and morbidity, however, increases in the severity of heat waves during the summer may result in increases in heat-related mortality and morbidity during the summer months.
Population Health and Governance

As the “health care” system is reconceived as a “wellness system” based on a population health paradigm, governance structures will need to be redefined as the range of partners involved in the health system will grow. The emerging population health focus has resulted in important public service systems re-orienting themselves to a health focus. The public education system, for example, notes a change in emphasis in the physical education curriculum from a focus on developing sports skills, to a focus on active living and wellness. Similarly, health is redefining the core business of recreation. Consequently, the municipal and educational sectors are of growing importance in an expanded health system that is increasingly focused on wellness as opposed to the diagnosis and treatment of disease. In assessing the impact of the Mazankowski Report on municipalities, for example, the Alberta Urban Municipalities Association (AUMA) noted the potentially expanded role of municipalities in creating social and physical environments that contribute to population health. This includes an increasingly important role in the regulatory environment such as environmental management and developing policies and procedures that encourage healthy lifestyle choices, such as tobacco and alcohol restrictions (Stuart, 2002).

Municipalities are also a major provider of programs and facilities that promote active living through recreation and parks. An increasing societal focus on population health may lead to growing demands on the city to provide services and facilities, especially for those not well served by the private market (e.g. lower income families and communities). Further, people increasingly expect recreation facilities to be provided close to home and there is an increasing gap between facility locations and demand in Calgary, leading to growing capital demands. Consequently, an expanded role for municipalities may have important budget impacts for local governments.

One of the fundamental impacts of the shift to a population health model is, therefore, the emergence of new partnerships involving the public, private and non-profit sectors. Jones and McFarlane (2002) discuss the phenomenon of increasing regionalism in western Canada. Increasing regionalism has been most significant in the area of health care with the establishment of regional health authorities, but is also progressing to a lesser extent with social services and education. Jones (2002) notes that while increasing collaboration between municipal and regional health authorities is desirable, resource constraints and jurisdictional issues present challenges.

In Calgary, for example, the Calgary Health Region has an extensive geographical jurisdiction, while the jurisdiction of the City of Calgary and the Calgary Board of Education are more restricted. Collaboration therefore will involve a range of partners without an overarching regional governance structure to facilitate such collaboration. There may also be conflicts in mandate and authority that may limit collaboration and the development of local approaches. The Board of Education, for example, requires curriculum to be approved provincially, limiting the autonomy of the local board to develop curricula to respond to local needs. At the same time, limits on the eligibility for funding by Family and Community Support Services may constrain the ability of FCSS to support collaborative initiatives if they are deemed to be beyond the FCSS mandate.
Despite the challenges, collaborative initiatives are emerging. The Calgary Health Region and the Board of Education, for example, are finding common ground in the delivery of physical education and other health focused elements of the curriculum. The municipality is another emerging health system partner through its emergency services, recreation programs and facilities, and preventive social service funding. This emerging role is best illustrated by the Green Prescription pilot project currently underway between the Calgary Health Region and the City of Calgary whereby physicians can prescribe recreation for a patient, who then takes the prescription to a city recreational program or facility. The City of Calgary is currently seeking funding from Alberta Health and Wellness to offset the costs of this program.

As new partnerships emerge, particularly those that rely on community agencies, such partnerships are placing increasing demands on agency resources. Cherneski (2005) notes that Calgary’s voluntary sector is increasingly stressed by a lack of sustainable core funding, including a difficulty finding resources to manage relationships and partnerships with other organizations, funders and the community. At the same time, there is increasing competition for resources due in part to a growing number of public institutions competing with voluntary organizations for charitable donations (City of Calgary, 2005). As our concept of health increasingly shifts to one of wellness, it will be important to ensure adequate funding of the social infrastructure which provides long-term benefits and cost-savings to the system.
5. Summary and Conclusions

Health is at the intersection of the three dimensions of sustainability. As a product of the physical environment, human health is inextricably linked with environmental sustainability. As a fundamental condition of human well-being, human health is also central to human capital development, both as a product of such development as well as a contributor to its development. To the extent that population health is mediated by social factors such as income and income inequality, human health is also a product of the form and level of economic development of a society, while at the same time contributing to the economic development of society as a fundamental precondition of labour productivity.

The industrialization of the western world, particularly over the past century, has resulted in rapid advances in health and health care as a result of increasing standards of living as well as rapid advances in medical technologies. While such advances resulted in rapidly improving health status during the first half of the last century, continued gains are requiring increasingly complex technologies at increasing cost. This fact, coupled with a rapidly ageing population moving into age cohorts facing increasing health needs and costs, is challenging the sustainability of a health care system based on a medical model of disease diagnosis and treatment.

To address this challenge of health system sustainability, a population health paradigm has gained currency, which seeks to improve the health of the population and prevent the occurrence of disease, thus reducing the burden on the health care system. This paradigm recognizes that most of the diseases burdening the health care system are preventable and amenable to policy intervention. Chronic diseases are the most prevalent and represent the greatest burden on the health care system. The risk factors associated with such diseases are largely social and, in turn, are influenced by deeper social factors such as income, employment, social capital, urban design and the quality of the physical environment.

The shift to a population health paradigm thus moves beyond the issue of health system sustainability to the broader issue of community sustainability. Ensuring sustainability will necessarily therefore require a balanced approach with appropriate levels of investment in all of the dimensions of population health as emerging health trends present challenges to the sustainability of Calgary’s human, social, economic and environmental capital. These impacts are summarized in Appendix 1: Health Impact Assessment Framework.

Health and the Social System

Increasing rates and incidence of chronic disease, associated with both population ageing and changes in lifestyle are compromising individual health. The growing threat of renewed outbreaks of communicable diseases, as well as elevated rates of infant mortality and low birth weight births are further compromising the health status of the community. At the same time, the effects of environmental deterioration and climate change may have significant, but as yet undetermined, health impacts.
As Calgary becomes increasingly diverse, differences in health status among social groups will become more prominent and need to be addressed. In particular, the Aboriginal population experiences above average rates of chronic and communicable disease, as well as intentional and unintentional injuries. While the urban Aboriginal population tends to experience slightly better health status than the reserve population, reserve conditions are important due to the high level of urban migration from reserves.

A second factor related to diversity is the health of Calgary’s immigrant population. In general, immigrants tend to be in better health than Canadian-born persons. As immigration is projected to increase and become increasingly important to population and labour force growth, the positive health status of immigrants is a potential resource to the community. However, research indicates that immigrant health tends to deteriorate to Canadian standards within a few years of immigration. As many immigrants in Calgary are secondary migrants, often moving to Calgary several years after landing in other centres, it is possible that Calgary may not fully enjoy the benefits of this effect. At the same time, environmental deterioration in immigrant source countries as well as social transitions that are resulting in deteriorating health worldwide may in the long run reduce the health status of new immigrants.

A key factor contributing to challenges with the sustainability of Calgary’s human capital is the epidemiological transition from communicable disease to chronic disease as the predominant health risk factor in the developed world. This is largely due to lifestyle changes resulting in reduced physical activity and increased rates of obesity. As well, increasing rates of poverty and income inequality are resulting in compromised human capital, as families reduce expenditures on health supportive activities. At the same time, increasing challenges to accessing health care services are compromising health status. In particular, challenges in the primary care system are resulting in individuals without access to a physician, resulting in a growing strain on the emergency medical system.

Emerging health issues are similarly presenting challenges to the sustainability of Calgary’s social capital. As the risk of chronic disease is related to socio-economic status, the growing incidence of chronic diseases may exacerbate inequalities among individuals and social groups. At the same time, the costs of addressing chronic disease are falling increasingly on individuals and thereby indirectly on employers through defined benefit plans. The ability of employers to meet these costs and provide comprehensive benefits to employees will vary depending on the size of the firm and sector, leading to a growing rift between firms and potentially resulting in diminished competitiveness among certain sectors and the employees within them.

Stresses in the health system are also emerging as the result of systemic changes in the health care system in the context of growing income inequality. These two forces have the potential to jeopardize population health by restricting access to preventive wellness resources for marginalized populations who are at the greatest health risk.
While the risk of chronic disease is related to socio-economic status, the growing threat of new communicable diseases also disproportionately affects the more vulnerable groups in the community. Concern is growing about the potential for an influenza pandemic which could have significant consequences for the social functioning of the community resulting from reduced social interaction and increasing isolation of marginalized persons. Further, the potential for stigmatization of certain groups based on the profile of the pandemic is of concern.

As the population ages, the demands for resources to address seniors health issues will grow, and may lead to the diversion of resources to this sector. This may result in increased tension and competition among social groups. In particular, such a shifting of resources may systematically disadvantage population groups with a younger demographic profile, such as the Aboriginal population.

Addressing Aboriginal health issues requires attention to the social factors contributing to the compromised health status of this population. The provision of adequate housing, income and nutrition for both on- and off-reserve populations is paramount. At the same time, jurisdictional issues that present barriers to accessing appropriate health services for off-reserve populations must be resolved. Such resolution needs to occur in the context of a renewed commitment to full inclusion of Aboriginal peoples in the social, economic and political life of the community.

Similarly, immigrant health status requires a commitment to strengthening the community’s social capital through a commitment to inclusion. Although immigrants tend to have better health status than that of non-immigrants at the time of landing, the lack of social and economic inclusion compromises health status and results in deteriorating health within a few years of immigration. Ongoing misconceptions about the costs of immigration, particularly with respect to health, as well as the potential for stigmatization pose barriers to inclusion for immigrants, and the perception of exclusion itself has long-term health implications for the excluded population.

As the need to strengthen social capital as a health investment is recognized, demands will be placed on a variety of new partners who will increasingly be drawn into the “health” system. Also, the public, private and non-profit sectors will need to work together in a coordinated manner to collaboratively deliver services to promote health and well-being. This includes a growing role for municipalities and non-profit organizations in the delivery of wellness and preventive social services. Consequently, increasing resources will be demanded by these sectors, resulting in growing competition among sectors for funding and other resources. While this presents opportunities, funding and jurisdictional issues pose challenges to the realization of this potential, and may require new forms of governance to facilitate the required level of collaboration.
Health and the Economic System

The increasing incidence and rate of chronic disease, coupled with the process of population ageing, may have impacts on productivity. The associated growing burden on the health care system is expected to result in the shifting of a growing proportion of health care costs from the public system to the individual. These three factors are expected to result in rapidly increasing benefit costs for employers which will impact competitiveness. At the same time, the ability of employers to reduce such costs through restructuring or reductions in benefits will be constrained due to the increased competition for labour expected to result as a labour supply shortage deepens.

While the growing burden of chronic disease is of primary long-term concern, the risk of a communicable disease outbreak may have significant short-term implications. Direct costs to the health care system and indirect costs to the rest of the economy from a pandemic may be substantial. This includes impacts on the workforce, particularly in critical sectors such as the service sector that provide services essential to social and economic functioning.

While the health of the population impacts the local economy, the structure of the local economy reciprocally impacts health. One of the fundamental features of the Calgary economy is its reliance on migration for labour. As labour shortages emerge in regions which have traditionally supplied labour to Calgary, migration is expected to slow, leading to an ever deepening labour supply challenge for the city. This challenge itself may have a myriad of health impacts.

First, Calgary has traditionally experienced relatively high labour force participation rates, a fact that may be driven as much by the rising cost of living locally as well as the ongoing shortage of labour. High labour force participation is resulting in increased stress, ongoing challenges for workers in maintaining an appropriate work-life balance, and a reduced ability to provide adequate caregiving support to an ageing population at a time when the burden of care is being increasingly shifted from the health system to the community. High labour force participation has also been speculated to account for the increased risk of infant mortality and low birth weight births due to delayed childbirth among a female population increasingly tied to the labour market.

Secondly, as labour becomes increasingly scarce, the relative importance of the immigrant and Aboriginal population to the labour force will grow. Consequently, the health status of immigrants and Aboriginal peoples will become increasingly important. Addressing ongoing inequities that are resulting in systemic patterns of social and economic exclusion for these populations with associated health impacts will be increasingly important to the economic well-being of the community.

Addressing such patterns of disparity and exclusion may require fundamental changes to the federal and provincial fiscal regimes which may have short-term economic impacts. Locally, income inequality will be affected by the nature of the economic development strategy pursued. In order to meaningfully address such issues, collaboration between a range of partners will be essential. As new partners involve themselves in the health arena, broadly conceived, resources will need to be shifted as the budget impacts of new roles and responsibilities are felt. Such collaboration and realignment is expected to involve all sectors: public, private and non-profit.
As health expenditures continue to grow as a percentage of provincial budgets, the cost of health care may prove increasingly burdensome to federal and provincial governments. There is concern that such fiscal constraints could lead health to crowd out other important investments in areas such as education and social supports. However, given that the social determinants of health are as important as medicine to population health, such fiscal approaches may prove counterproductive in the long-term.

**Health and the Natural and Built Environment**

As the health needs of the population grow as a result of population ageing and other population health factors, pressure to expand the health system will also grow accordingly. This may have important environmental impacts due to the high level of resource consumption and waste associated with modern medicine. Further, the sustainability of the medical system is dependent in part upon the existence of a wealthy industrialized society with a large environmental footprint. If such a society itself is unsustainable, then the health system that it supports will need to be restructured in accordance with the broader restructuring of the society. This may pose important ethical questions for the medical profession as well as the broader community.

While the health system impacts the environment, the environment impacts health. Environmental impacts may be direct through exposure to harmful environmental agents such as air pollutants, toxins or bacteriological contaminants. Environmental impacts may also be indirect such as the impact of urban design on health that produces physical environments that are not supportive of physical activity and promote automobile dependence. Both direct and indirect effects are themselves mediated by social factors as access to positive environmental goods and exposure to negative environments tends to be related to socio-economic status. As a community, therefore, planners and decision-makers will need to be conscious of the health impacts of urban design, both in terms of the health enhancing aspects of design as well as the distributional aspects of exposure and access to environmental goods.

What remains unknown are the potential impacts of climate change. Reduced air quality related to higher temperatures and increased forest fires may jeopardize the health of vulnerable individuals. Changes in temperature may reduce cold-related mortality and morbidity, but may increase heat-related mortality and morbidity. Water quality may also be affected both through the immediate impacts on water systems due to flooding associated with severe weather events, as well as through reduced water quality associated with increased water temperatures. As water becomes scarce in the Calgary region, water conservation measures, including a new water costing regime, may be necessary. Such measures will need to be cognizant of the potential impact of such changes on vulnerable socio-economic groups.
Conclusion

Emerging health issues are placing stress on Calgary’s human, social, economic and environmental capital. This stress is related to changes in the city’s demographic composition and the emergence of new health risks. Responding to these changes will require new approaches to the question of health. As we increasingly define health more broadly as well-being, new challenges and opportunities present themselves. Realizing such opportunities will require new partnerships and new forms of governance. As the costs of health care escalate, achieving the appropriate mix of policies and investments that provide for long-term community and system sustainability will be critical to the well-being of the Calgary region.
Bibliography


CIHI [Canadian Institute for Health Information]. 2004. *Improving the Health of Canadians*. Ottawa: Canadian Institute for Health Information.


Appendix 1: Health Impact Assessment Framework

<table>
<thead>
<tr>
<th>Issue</th>
<th>The Social System</th>
<th>The Economic System</th>
<th>The Natural and Built Environment</th>
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<tbody>
<tr>
<td></td>
<td><strong>Human Capital</strong></td>
<td><strong>Social Capital</strong></td>
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<td><strong>Individual Health</strong></td>
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<tr>
<td>Increasing Rate and Incidence of Chronic Disease</td>
<td>Deteriorating human capital.</td>
<td>Exacerbated inequalities among individuals.</td>
<td>Reduced productivity.</td>
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<tr>
<td></td>
<td></td>
<td>Growing inequalities between firms and sectors.</td>
<td>Reduced competitiveness due to rising benefit costs.</td>
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<td></td>
<td>Growing social isolation.</td>
<td>Constrained ability to attract and retain labour.</td>
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<td>Downstream environmental effects of large scale health care.</td>
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<tr>
<td>Growing Threat and Concern with Risk of Communicable Disease Outbreak</td>
<td>Compromised human capital, particularly among the most vulnerable.</td>
<td>Disproportionate risk to most vulnerable populations.</td>
<td>Direct costs to the health system and indirect costs to service and other industries.</td>
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<td></td>
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<td>Reduced social interaction.</td>
<td>Workforce impacts particularly among emergency workers and workers in service industry.</td>
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<td>Stigmatization of certain populations.</td>
<td>Reduced transit usage may increase congestion and reduce mobility.</td>
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<td>Increased social isolation.</td>
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<td>Perinatal Health: High Rates of Infant Mortality and Low Birth Weight</td>
<td>Low birth weight children at increased risk of compromised health throughout their life.</td>
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<td>Increased health care costs associated with the care of preterm and low birth weight infants.</td>
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<td>Ongoing high labour force participation rates accompanied by a growing labour shortage may result in a growing incidence of low birth weight and infant mortality.</td>
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<td>Growing Age-Related Health Issues due to Population Ageing</td>
<td>Risk of chronic disease and disability increase with age.</td>
<td>Competition for resources may produce intergenerational and inter-group conflicts.</td>
<td>Growing caregiving demands on workers leading to increased stress, reduced productivity and increased benefit costs. Growing benefit costs for an ageing workforce and retirees.</td>
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<tr>
<td>Growing Aboriginal Population and Aboriginal Health Status</td>
<td>Aboriginal population experiencing elevated risk of communicable and chronic disease.</td>
<td>Adequate housing, income and diet on and off-reserve critical to Aboriginal health.</td>
<td>Aboriginal workers comprise growing share of workforce. Aboriginal health therefore of interest to employers, in light of labour shortages and increasing benefit costs.</td>
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<td>Higher rates of intentional and unintentional injuries off-reserve.</td>
<td>Jurisdictional issues concerning differential benefits available to on-reserve and off-reserve Aboriginal people.</td>
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<td></td>
<td>Aboriginal health issues largely youth-related and therefore distinct.</td>
<td>Possible stigmatization associated with outbreak of infectious disease.</td>
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<td></td>
<td>On-reserve social and environmental conditions affect urban communities due to migration.</td>
<td>Lack of inclusion compromises health status.</td>
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<td></td>
<td>Ongoing barriers to accessing the health system must be addressed.</td>
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<tr>
<td><strong>Increasing Immigrant Population and Immigrant Health Status</strong></td>
<td>Immigrants healthier than Canadian-born individuals. Health deteriorates following immigration. Introduction of new diseases that medical system may not have sufficient expertise to diagnose and treat.</td>
<td>Misconceptions of immigrants as a “burden” on health systems. Lack of inclusion compromises health status. Epidemiological transition in developing world may impact health of new immigrants locally. Possible stigmatization associated with outbreak of infectious disease.</td>
<td>Health of immigrants critical to labour productivity given growing importance of immigrants to Calgary’s labour force. Health benefits of the immigrant population may erode prior to settlement in Calgary.</td>
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<td><strong>Population Health</strong></td>
<td><strong>Increasing Obesity and Physical Inactivity</strong></td>
<td>Increased risk of chronic disease associated with physical inactivity and obesity will compromise human capital.</td>
<td>Risk associated with income and income inequality may exacerbate social tensions due to differential impact on population groups. Addressing problem of obesity and physical inactivity is requiring various public systems to change orientation. New partnerships emerging to address this issue.</td>
</tr>
</tbody>
</table>
### Growing Poverty and Income Inequality

Growing reliance on emergency food services from the food bank due to increasing costs.
- Healthy food choices more expensive, resulting in compromised diet.
- Cost of utilities impacts health, due to reduced utility consumption resulting in compromised living conditions.
- Communities with lower median household incomes exhibit greater years of life lost than the average.

Growing need for social supports to address the social determinants of health.
- Growing role for municipalities and voluntary sector in the provision, funding and support of community services.
- Increased demand on funding bodies to support agencies that may be called upon to provide social services.
- Income challenges reducing disposable income for preventive wellness.

Required changes to the federal or provincial fiscal/tax regime to address growing and persistent income inequality.
- Economic development strategies will have positive or negative effects on income inequality.
- Necessity to address systemic patterns of economic exclusion.

Poorer neighbourhoods experience greater exposure to negative environmental conditions and reduced access to positive environmental goods.

### Changes in the Bio-Physical and Built Environment and Impacts of Climate Change

Reduced air quality due to higher temperatures and increased forest fire risk.
- Reduced cold-related mortality and morbidity.
- Increased heat-related mortality and morbidity.
- Patterns of low-density development result in long-term deterioration of air quality and reduced levels of physical activity.

Differential access and exposure to environmental goods and risks may exacerbate health and social inequalities.
- Impacts of climate change affect the most vulnerable – seniors, children with compromised health, homeless population, Aboriginal peoples.
- Compromised environments and health arising from global climate change may result in growth of “environmental refugees” and result in more immigrants with compromised health arriving in Calgary.

Compromised human capital resulting from climate change may have adverse economic impacts in terms of health system costs, benefit costs, and lost productivity.
- Addressing physical inactivity and obesity may require changes to urban design that will have positive environmental impacts.
| Health System Cost | Reduced hospitalization time transfers burden of care to the individual with associated economic costs that may compromise recovery for those unable to afford them. | Early patient release transfers caregiving support from the health system to the community. Increased burden on caregivers (seniors or working adults) may compromise the health of the caregiver. | Reduced system capacity resulting from system restructuring having budget and productivity impacts on EMS. Transfer of burden of care from system to community may reduce productivity due to increased caregiving demands and may increase demand for formal support services. Large scale health systems require wealthy economies to sustain them. If wealthy industrialized societies are unsustainable, health systems need to be reduced as economies are reduced. This will pose ethical questions. |
| Governance | Expanded role of municipalities in creating social and physical environments that contribute to health.  
New partnerships placing increasing demands on community resources.  
Emerging conflicts and jurisdictional issues among new partners.  
Potential growing politicization of health authorities. | Increasing role of employers in provision of wellness services to employees due to costs of an unhealthy workforce.  
Growing capital and budget demands on municipality to provide wellness facilities and programs. |  |
|---|---|---|
| Growing Barriers to Health System Access and Health Human Resource Challenges | Increasing use of emergency rooms as primary care centres.  
Growing use of e-health technology may exacerbate inequalities due to digital divide. | Economic competitiveness related to access to health care for employees.  
Increasing intermunicipal and interprovincial competition for health professionals.  
Primary care renewal bringing new partners into the health care system, with budget impacts and increasing demands on funders to support. |  |
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- Department of Education
- Department of Environment and Labour

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