PREVENTION THAT WORKS

A Review of the Evidence Regarding the Causation and Prevention of Chronic Disease

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Executive Summary

This paper is a companion piece and sequel to the first paper in the series – "A Framework for a Provincial Chronic Disease Prevention Initiative". Like the first piece, and consistent with the work of the Chronic Disease Prevention Alliance of Canada, the BC Chronic Disease Prevention Alliance and the emerging Pan-Canadian Healthy Living Strategy, it focuses primarily on a selected set of physical diseases (cardiovascular disease, some of the principal cancers, chronic respiratory disease and diabetes) that share a common set of risk behaviours (smoking, unhealthy eating patterns, physical inactivity).

Three priority non-communicable conditions between them account for almost three-quarters of the burden of disease in British Columbia and in Canada. These conditions are:

- selected chronic diseases (heart disease, cancer, chronic respiratory disease, and diabetes) that share three principal common risk factors (smoking, unhealthy eating patterns and physical inactivity)
- injuries, both unintentional and intentional
- mental health problems and addictions disorders.

The four categories of chronic disease noted above are the focus of this report and the provincial chronic disease prevention initiative. Together they accounted for almost half (48.6%) of the burden of disease in BC in 1998.

The economic cost of these chronic diseases in British Columbia is very high. In 1998, cardiovascular disease cost $873m in direct costs (7.4% of the total direct costs) and an additional $1,632m (14.7% of the total) in indirect costs. Comparable figures for cancer are $383m (3.2%) in direct costs and $843m (7.6%) in indirect costs; for respiratory disease (acute and chronic combined) $453m (3.8%) and $767m (6.9%) and for endocrine disease (mainly diabetes) $196m (1.7%) in direct and $271m (2.4%) in indirect costs. In total, their direct costs were approximately $1.7 billion and their indirect costs were some $3.5 billion, a total in excess of $5 billion.

The various societal conditions that affect the development of chronic disease appear to exert their effect on health through two main pathways: either their effects contribute to or result from differential access to the determinants of health - a process that has been referred to as social programming - or their effect on the psyche and on the body directly alters biochemistry, physiology and cellular and organ functioning – biological programming.

In both cases, these changes interact with the genetic and acquired biological programming of the individual and their impact - whether positive or negative - accumulates over the course of an individual's life, affecting their psychological and physiological resilience to challenges to their health, a process that has been referred to as the 'biological embedding' of life experience.

The concept of causal chains or webs is used to explain the complexity of the interactions over the life course of the multiple risk factors - genetic, biological, behavioural, psychological, environmental, social, economic, cultural - that ultimately determine health status. There is seldom if ever a simple 'single cause, single effect' relationship in chronic disease.

Our behaviours are the result of the interaction of our inherent psychological makeup with the knowledge, attitudes, values and behaviour that we acquire, and the ways in which our psychology is influenced by family habits and dynamics, peer pressure, and community, societal and cultural influences. The result is a lifestyle which is not freely chosen but rather is a reflection of the family, community, societal and cultural lifestyle, values and norms in which we are immersed and by which we are influenced. The evidence shows that some 25-30 percent of the burden of disease in Canada can be attributed to the following four risk factors: [1]

- smoking
- physical inactivity
- unhealthy eating patternsimmoderate use of alcoholIt is important to note that while these factors are not unimportant, together they explain at most less than half of the 87% of the total burden of disease attributed to the top 10 categories of diseases and conditions in BC. Tobacco use, alcohol use and physical inactivity (diet and obesity were not included) account for 26.8 percent of the burden of disease in BC.

Social, economic and cultural conditions contribute in a general way to the overall burden of disease. They do so in part by shaping the behaviour of societies, communities, families and individuals, in part by affecting access to resources needed for good health and in part through influencing the individual's physiological and biochemical functioning, acting mainly through the psycho-neuro-immune system. Unlike the proximate risk factors, these societal conditions appear to affect all aspects of the burden of disease, in particular mental health problems as well as other important chronic disease conditions, resulting in marked inequalities in health. Such inequalities are found everywhere, from the global to the local level, and BC is no exception. There is a clear relationship between regional ranking of health status and regional ranking of determinants of health in BC.

Among the key societal conditions that have been shown to affect health are:

- early child development
- educational attainment and social-emotional competence

[1] Obesity is not included here as a separate risk factor since it is really an intermediate outcome that results primarily from a combination of genetic factors, unhealthy eating patterns and physical inactivity, and contributes in turn to a number of major chronic diseases including heart disease, cancer, diabetes, arthritis and other musculo-skeletal disorders.

- unemployment
- social status, social hierarchy and relative deprivation
- poverty and absolute deprivation.

But while there is a good deal of research, there is as yet little data on the population attributable risk of these societal conditions for specific diseases and conditions, although Wilkinson (1999) maintains that "something between 1/3 and 2/3 of the differences in measures of the social environment, in mortality and in violence may be attributable to the extent of income inequality alone."

Summarising the evidence on the determinants of chronic disease

What, then can we say about the relative contribution to chronic diseases of the wide variety of determinants reviewed here? First, of course, there is no simple relationship among the various determinants, no single factor or even a set of factors that predominates – it all depends. Nonetheless, the evidence summarized here indicates that:

- genetic factors contribute to some extent to these chronic diseases, as do other biological factors;
- a set of specific behaviours smoking, physical inactivity, poor nutrition and obesity, themselves determined by a wide variety of factors - may account for a quarter to a third of the burden of disease resulting from cardiovascular disease, cancer, chronic respiratory disease and diabetes;
- psychosocial factors in settings such as the home, the school, the workplace and the community have an effect that interacts with and influences behaviour; the physical environment contributes to some extent, particularly with respect to both indoor and outdoor air quality and the health impacts of urban design;
- societal factors, including relative deprivation, may account for another one third to one half of the overall burden of disease.

Second, it follows from the evidence presented here that there is no single intervention, and no simple remedy, that can reduce the burden of chronic diseases. As we have learned from our experience with tobacco, it requires a prolonged commitment of skills and resources in a multi-setting, multi-factor, multi-strategy approach.

Third, a full understanding of the precise contribution to the burden of disease of the various risk factors, behaviours, environments and conditions that are the subject of this report is quite likely not possible, and is certainly not available today. But we cannot postpone action until we have perfect information. Instead, we need to recognise that in the face of uncertainty, we have to use the best information we have and apply the precautionary principle of environmental science to public health.

Evidence in public health

What is taken as evidence in public health differs in some respects from the understanding of evidence in biomedical science, while the extent of evidence that is available is also problematic. There are a number of reasons for this:

- First, the amount of funding devoted to public health services, and to research on population and public health issues, is eclipsed many times over by the amount spent on clinical services and clinical and basic research. Public health receives some 2.5 – 3 percent of the health care budget, and funding for research is similarly inadequate.
- Second, the type of research that is carried out tends to be more concerned with infectious diseases and with biological risk factors and behavioural change.
- Third, the long time frame and large sample size needed to pursue intervention studies in public health present a challenge.
- Fourth, the type of research that is required for population health intervention studies is different from the 'gold standard' randomized controlled trial of clinical medicine.

The economics of prevention

While the principal focus of this report is on the health benefits of prevention, a brief review of some of the economic evaluations of primary prevention that are available is provided here.

When the ratio of indirect to direct costs is high, there is "a major opportunity for prevention and disease management programs to greatly impact the cost-economics of health care services" (Musich, Burton and Edington, 1999). In BC, the ratio of indirect to direct costs is high - greater than 1.5 - for the following categories of disease:

- Musculoskeletal 6.22
- Cancer 4.87
- Injuries 3.45
- Nervous system 2.22
- Infectious diseases 1.99
- Respiratory diseases 1.88
- Cardiovascular diseases 1.68

This suggests that prevention of these diseases is likely to have a significant impact on the costs of health care in BC.

However, the overwhelming majority of economic evaluations of primary prevention have focused on bio-medical and behavioral risk factors, and clinical and behavioral interventions. There have been few studies that have looked at broader socio-environmental conditions or the strengthening of community action (and none that have looked at healthy public policy), at the school setting, or at health problems such as mental health, alcohol and drug abuse, nutrition or physical activity. Thus there is a dearth of evidence with respect to the economics of some of the more important public health issues and health promotion strategies of our day; this makes it important to recall that absence of proof of economic impact is not proof of absence of economic impact.

But despite the gaps in our knowledge, there is evidence of the effectiveness - or ineffectiveness - of a wide range of strategies for the prevention of chronic diseases. That evidence is summarized in the 37 page section that follows this executive summary: here, only the key points can be extracted.

Changing social, economic and cultural conditions

- A recent US Institute of Medicine report (2001) discussed health-related interventions at the individual, family, organization, community and societal levels. Among the key findings of the report are the following:

    - "Interventions must recognize that people live in social, political and economic systems that shape behaviours and access to the resources they need to maintain good health."

    and

    - "While biological interventions and exhortations to individuals to change their behaviours are easier to administer, changes in social factors, policies, and norms are necessary for improvement and maintenance of population health."

- In another recent IOM Committee report, Smedley and Syme (2000) conclude that such factors as "stress, insufficient financial and social supports, poor diet, environmental exposures, community factors and characteristics, and many other health risks", which contribute significantly to the risk of disease and death, are probably more effectively addressed at the level of community and environmental interventions than through individual-level interventions.

- The UK's Independent Inquiry into Inequalities in Health (1998) notes that the scientific evidence indicates that "health inequalities are the outcome of causal chains which run back into and derive from the basic structure of society". Thus policies need to be broad-based and to be both "upstream" and "downstream". They address a number of key policy areas where they feel interventions are most justified, based on a combination of "the scale of their potential impact on health inequalities, and the weight of evidence". These policy areas include:

- poverty, income, tax and benefits
- education
- employment
- housing and environment
- mobility, transport and pollution
- nutrition.

Changing environmental and psycho-social living conditions

Settings such as homes, schools, workplaces and communities are both physical spaces and social spaces. Making these settings healthier means focusing on both the physical and psycho-social aspects of their environments.

Healthy Schools

- The evidence suggests that effective school health programs address a combination of the curriculum, the environment, health services, community partnerships and school policies. The Centers for Disease Control and Prevention (2003) note that "rigorous studies in the 1990's showed that health education in schools can reduce the prevalence of health-risk behaviors among young people", including smoking, obesity, alcohol and marijuana use.

Healthy workplaces

- There are three broad areas of focus for a comprehensive workplace health promotion program: workplace behaviour change, health-promoting job and organizational design and internal communication and marketing/policy development. there is strong evidence for the health effectiveness of both behavioural and structural approaches and for the importance of combining them in a comprehensive program of workplace health promotion. Benefits move beyond positive health effects to improve productivity and the quality of both product and process in the work site, making workplace health promotion a positive competitive factor. However, there is little evidence that workplace-based health risk appraisal alone can produce sustainable changes in individual health behavior or risk status.

Healthy communities – the built environment

- Many of the health impacts of the urban built environment are related to the relationship between the built environment and land use and transportation decisions, which has been the topic of growing concern in health policy circles, because of the

growing evidence of the relationship between air pollution, car dependency and physical inactivity and a wide variety of health impacts.

Strengthening community action

There is general agreement that comprehensive, community-based approaches are needed that combine several different risk factors in a single 'healthy living' package in the settings in which people lead their lives. Studies that have taken a broad , integrated approach have shown some success, most notably in the North Karelia project in Finland. Thus in recent years there has been considerable interest in developing community-based coalitions to address a variety of chronic disease-related issues, as well as injuries and other important public health concerns.

Building social-emotional competence and resilience

The development of social-emotional competence , resilience and other positive attributes depends to a significant extent on what happens to people during their infancy and childhood, and the psycho-social and physical environments in which they develop. However, short-term, poorly implemented prevention programs that focus solely on the individual and do not pay attention to the social context do not produce lasting behaviour change, while comprehensive programs that focus on family support, early childhood education and a comprehensive, school-based approach to the promotion of social competence do have long term effects.

Supporting healthy living and behavioural change

There is a wide range of promotive, protective and preventive behaviours that contribute to healthy living. Common to all of them is the widespread and well-accepted evidence that behaviour is significantly influenced by a wide variety of psychological, social, environmental, cultural and other factors, and that this requires a comprehensive approach to changing behaviour.

The results of integrated behavioural strategies have often been disappointing, as in the case of the MRFIT program in the USA., which deployed significant resources in an attempt to change the risk behaviours of a group of 6,000 men who were at high risk because of their high rates of cigarette smoking, hypertension and hyperlipidaemia. In commenting on this, Smedley and Syme (2000) note that:

> "It is clear that behaviour change is a difficult and complex challenge. It is unreasonable to expect that people will change their behaviour easily when so many forces in the social, cultural, and physical environment conspire against such change."

The focus here is on a set of three particular behaviours that are significantly associated with the four categories of disease (cardiovascular disease, cancer, chronic respiratory disease, diabetes) that are the focus of current national and provincial chronic disease prevention initiatives. These three behaviours are not smoking, eating healthily, and being physically active; the latter two are strongly related to maintaining an ideal body weight.

Non-smoking

Based on the evidence in the published literature and the experience of the two best state programs in the US - Massachusetts and California – there are nine best practice components of comprehensive tobacco control programs, according to the Centers for Disease Control:

- Community programs to reduce tobacco use
- Chronic disease programs to reduce the burden of tobacco-related diseases
- School programs
- Enforcement
- Statewide programs
- Counter-marketing
- Cessation programs
- Surveillance and evaluation
- Administration and management

Healthy eating

Schuit (2000) reviewed the evidence with respect to proven effective health promotion and disease prevention strategies related to nutrition and found that because of the many opposing forces in people's daily lives (time pressures, economic constraints, food advertising, limited access - economically or socially - to healthy foods, etc.) an integrated approach is needed that combines education with structural measures, environmental and social changes that reinforce behavioural change, and involvement of the food industry. A community coalition may be a useful strategy to apply.

Physical activity

The Community Guide to Preventive Services has reviewed the evidence for the effectiveness of interventions to promote physical activity. The following were recommended on the basis of strong evidence

- Social support in community contexts, including the creating, strengthening and maintaining of social networks, the use of 'buddy' systems, contracting, and walking groups

- Individually adapted health behaviour change, including goal setting and self-monitoring, building social support, behavioural reinforcement, structured problem-solving, and relapse prevention.

- Community-wide campaigns, involving large scale, high intensity, high visibility programs; the use of TV, radio, newspaper and information sites; and multi-component, multi-site, "combined package" interventions.

- Modified physical education in school, including modified curricula and policies, modified amounts of physical activity during physical education and modified, more active activities and games

- Creating or enhancing access to places for physical activity, including trails and/or facilities access, reduced safety and affordability barriers, training and incentives, and site-specific programs.

Maintaining an ideal body weight

The UK's Health Development Agency (2001) has recently reviewed the evidence with respect to obesity and concluded that effective strategies to reduce obesity include:

- reduce sedentary behaviour (or promote active living) in obese children

- use diet, physical activity and behavioural strategies for adults, in combination where possible

- use maintenance strategies such as continued therapist contact

- use a gradual, incremental stepwise approach

- integrate lifestyle changes over a long period of time

- family therapy is essential in treatment with younger children

- habitual physical activity is important both for losing weight and for keeping weight off.

Chemoprevention

The U.S. Preventive Services Task Force in 2002 strongly recommended that "clinicians discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD)." With respect to cancer, however, while interest is high, at present (2003) the U.S. Preventive Services Task Force concludes that "the evidence is insufficient to recommend for or against the use of supplements of vitamins A, C, or E; multivitamins with folic acid; or antioxidant combinations for the prevention of cancer or cardiovascular disease" and specifically "recommends against the use of beta-carotene supplements, either alone or in combination" for these purposes.

Clinical prevention

For a number of years, the Canadian Taskforce on Preventive Health Care (formerly the Task Force on the Periodic Health Examination) has been developing and publishing systematic reviews and recommendations of preventive actions that should be included (or not included) in the periodic health examination. Their recommendations for the primary and early secondary preventive services pertaining to chronic diseases include six “A” recommendations for which there is good evidence and nineteen "B" recommendations for which there is fair evidence to include the service in the periodic health exam. These positive recommendations are outweighed by thirty-four ”C” recommendations (where evidence is conflicting) and sixteen “D” recommendations, where there is fair evidence to exclude the service from the periodic health exam.

Coffield et al (2001) undertook a systematic assessment of the value of clinical preventive services recommended for average-risk patients by the U.S. Preventive Services Task Force. Based on a combination of the burden of disease prevented by each service and the cost-effectiveness of the intervention, they identified the following priority interventions relevant to chronic disease prevention- those ranked highest in priority (seven or more out of 10) and yet having the lowest delivery rates (less than 50 percent in the U.S.) are:

- tobacco cessation counselling for adults
- screening older adults for undetected vision impairment
- offering adolescents an anti-tobacco message or advice to quit
- counselling adolescents on alcohol and drug abstinence
- screening adults for colorectal cancer
- screening adults for problem drinking

Challenges in implementing clinical prevention

Five key elements of a formal system for delivering preventive services which increases their delivery in the clinical setting are identified by the US “Put Prevention Into Practice” program. They are:

- Establish preventive care protocols
- Define staff roles for delivering and monitoring preventive care
- Determine patient and material flow
- Audit the delivery of preventive care continually
- Readjust and refine your delivery system and standards.

Genetic screening and family history

Yoon et al (2002) point out that "DNA-based testing is limited for the most part to analysis of highly penetrant single gene disorders that account for approximately 5 percent of the total disease burden in the population" and that therefore we should not look to such tests contributing much for some years to our ability to predict the onset of common diseases and treat them appropriately. Instead, they suggest that family history can be used with some degree of reliability to detect people at high risk, making them a natural focus for disease prevention, screening and early intervention.

Preventive treatment early in the disease process

While all treatment is a form of secondary prevention, some forms of treatment are really primary prevention for other conditions. In chronic disease prevention, two forms of treatment are of particular importance: the treatment of tobacco dependence, which prevents a wide range of chronic diseases, and the prevention of hypertension, which prevents cardiovascular and renal disease.

- With respect to tobacco cessation, perhaps the most important finding of a recent US Guideline on tobacco cessation is that "tobacco dependence treatments are both clinically effective and cost-effective relative to other medical and disease prevention interventions" and this leads to the key recommendation that health insurance programs, whether public or private, should cover effective tobacco cessation therapies and that clinicians be "reimbursed for providing tobacco dependence treatment just as they are reimbursed for treating other chronic conditions".

- Hypertension is the most common reason in Canada for visits by adults to doctors; the successful treatment of hypertension has been shown to reduce mortality, cardiovascular events, stroke and stroke recurrence, myocardial infarction, Alzheimer's dementia, renal complications and renal failure, and incidence of diabetes . Yet only 50% of Canadians with hypertension are aware of their diagnosis, and only 16% of Canadians with hypertension have adequate blood pressure control. Clearly, this is an area where effective detection and treatment can have a significant impact on health.

The potential for prevention

The potential for prevention can be understood by examining the health and economic costs of chronic diseases to BC, the evidence that prevention has already worked in BC, and the remaining gap between our rates of chronic disease mortality and of risk behaviours and the best rates that have been attained by comparable countries such as those in the OECD. Closing this prevention gap is the principal challenge we face.

Recent estimates of the contribution of tobacco use, physical inactivity and obesity to both deaths and to economic costs reveals the burden these factors place on the people of BC and its economy:

- Tobacco use contributes to 5,600 premature deaths annually in BC, $381 m in direct health costs and $1,720 m in indirect costs, a total of $2.1 billion.

- Physical inactivity contributed to 1,727 premature deaths annually in BC in 1998, $185.7m in direct health costs and $236m in indirect costs, a total of $421 million.

- Obesity contributed to approximately 2,000 premature deaths annually in BC in 1998, $380m in direct health costs and $350 - 450m in indirect costs, a total of $730 – 830 million.

It is not possible to completely avoid all these costs, both because not all these diseases can be completely prevented and because, even if they were, we would develop other diseases and die of other causes in their place that would have their own costs. Nonetheless, a proportion of these diseases are preventable and a (probably somewhat smaller) proportion of the costs should be avoidable, or at least postponable.

It is worth considering the considerable evidence we already have in BC that prevention can and indeed does work, and that the potential of further benefits from prevention is considerable. The effectiveness of prevention can be seen in evidence from B.C. with respect to smoking, lung cancer and cardiovascular disease.

- smoking rates among men in B.C. have declined from more than 50 percent in the 1960's to less than 30% in the late 1990's, while the rates for women have declined from more than 30% to less than 20% in that same period.

- The impact of this decline in smoking rates on lung cancer cases and deaths is clear; new cases of lung cancer in B.C. continued to increase among men until the late 1980's, since when both deaths and new cases have declined. Among women, both in new cases and deaths continue to increase, reflecting the fact that the decline in smoking among women did not really begin until the late 1970's.

- There has been a dramatic and continuing decline in cardiovascular disease death rates in B.C, which have fallen by more than 50 percent for both men and women between 1950 and 1997.

When compared with citizens of leading OECD countries, British Columbians have the second highest life expectancy in the world, according to a recent report prepared for the Ministry of Health Planning (Bearing Point and Conference Board of Canada, 2003), with Icelandic males and Japanese females being the only ones to surpass life expectancy for BC males and females respectively. However, for the 12 OECD countries for which data on disability-free life expectancy (DFLE) was available, BC's DFLE was exceeded by Japan, Austria, Germany and Switzerland for both males and females. And when age-standardised mortality rates for major chronic diseases in BC and some of the main countries in the OECD are compared, while BC compares favourably in many cases, there are nonetheless significant gaps between the

mortality rates in BC and the best rates attained in some of these other countries. These gaps suggest the potential for prevention that remains.

Reducing the burden of chronic diseases and promoting the health of the people of BC is one of the most important tasks that we face as a society today, not only because of the economic and social benefits, but because it is the right thing to do. Thus we should act in the face of uncertainty, applying what evidence we have, with due regard for both the strength of the association and the weight of the evidence. Indeed, we should undertake prevention even if it were to cost money - as indeed it might, under some forms of economic analysis - for the same reasons that we treat disease; not for economic gain, but because it is the hallmark of a civilised, humane, caring and compassionate society.

Summary of evidence

Evidence regarding the determinants of chronic diseases (especially heart disease, cancer, chronic respiratory disease, and diabetes)

The various societal conditions that affect the development of chronic disease appear to exert their effect on health through two main pathways: either their effects contribute to or result from differential access to the determinants of health - a process that has been referred to as social programming - or their effect on the psyche and on the body directly alters biochemistry, physiology and cellular and organ functioning – biological programming.

In both cases, these changes interact with the genetic and acquired biological programming of the individual and their impact - whether positive or negative - accumulates over the course of an individual's life, affecting their psychological and physiological resilience to challenges to their health, a process that has been referred to as the 'biological embedding' of life experience.

The concept of causal chains or webs is used to explain the complexity of the interactions over the life course of the multiple risk factors - genetic, biological, behavioural, psychological, environmental, social, economic, cultural - that ultimately determine health status. There is seldom if ever a simple 'single cause, single effect' relationship in chronic disease.

Biological and psychological factors

Biological and psychological risk or protective factors may be either inherited or acquired over the life-course; usually it is a combination of both, with the expression of the inherited tendency influenced by life events and conditions. Individual susceptibility to disease varies as a result of each individual's inherent or acquired biological and psychological condition; some will be particularly susceptible, others particularly resilient, while the bulk of the population is distributed normally between these two extremes.

- For example, our immune competence is inherent but it is also influenced by our exposure in infancy and childhood to infectious diseases, to immunisation, to chemicals or psycho-social stress that can impair immune competence and so on. Our immune competence in turn may affect the way in which we cope with and respond to infection not only with the conventional infectious diseases, but with 'new' infectious agents that we are now recognising are related to a variety of chronic diseases. The immune system also plays a role in the development of cancer, allergies such as asthma, and auto-immune diseases.

- While there is considerable interest in the genetic contribution to cancer, heart disease and other chronic conditions, the actual contribution of our knowledge of the human genome to the prevention of chronic diseases may be less - and certainly less dramatic - than some might hope. This is because, while a single gene may be sufficient

to cause a chronic disease like cancer or cardiovascular disease on its own, they are rare; much more common are genes that, in the presence of specific environmental exposures, increase our risk of the disease. These 'susceptibility' genes may alter the way that individuals metabolize carcinogens or other substances or repair DNA damage, and in turn may be influenced by hormones, infections, vitamins or immune factors.

- In Canada, life expectancy for males has been less than that of females throughout the 20th century. By 1997 the gap had narrowed to 5.6 years, with female expectancy at 81.4 years and male life expectancy at 75.8 years. This gap in life expectancy between males and females is even larger than the gap in life expectancy between high and low income Canadians, which was 4.6 years in 1971 and 3.2 years in 1996. Men are far more likely than women to die before age 70, with most of these differences attributable to differences in mortality rates due to heart disease, cancer, suicide and unintentional injuries. In terms of the burden of disease in BC, males accounted for 53.8% of the DALYs, while women accounted for the remaining 46.2%.

- But while men live shorter lives and have a lower disability-free life expectancy, women suffer from a variety of health problems that are unique to their sex (disease of the breast, ovaries, uterus and cervix) and as well a wide range of diseases that are in part or in whole the result of - or worsened by - gender bias in society.

- Cancer cells are generated from normal cells by the accumulation of multiple genetic alterations which are produced by carcinogenic agents. Carcinogenesis has three or four main stages (depending on who is classifying them):

    - o initiation, with DNA damage (mutagenesis) resulting from exogenous or endogenous carcinogens

    - o promotion, with resultant proliferation of these initiated cells

    - o progression, in which additional genetic changes or damage and progressive genomic instability result in pre-neoplastic cells developing into invasive tumours.

  Each of the stages in the process of carcinogenesis is in turn a multi-stage process, and thus each of these stages provides potential sites for preventive intervention, preferably as early as possible.

In recent years, infections have been linked to a number of chronic diseases that have not normally been thought of as being infectious in origin. While the evidence is clearest with respect to some forms of cancer, other chronic conditions in which infection may play an important role include atherosclerosis, gastric ulcers and perhaps even Alzheimer's disease.

- With respect to cancer, a growing number of infectious organisms such as the human papilloma virus (HPV), HIV, Epstein-Barr virus (EBV), hepatitis B and hepatitis C virus

(HBV, HCV), and other pathogens such as H pylori and schistosomiasis are known to be oncogenic.

- In recent years, there has been growing evidence that atherosclerosis, which is the "primary pathologic process in coronary artery disease, carotid artery disease, abdominal aortic aneurysm and peripheral vascular disease" is at least in part the result of a low-grade inflammatory process (Ismail, Khosravi and Olson, 1999) "in which infections are incriminated as possible contributors" (Mayr et al, 2000).

Behavioural factors

Our behaviours are the result of the interaction of our inherent psychological makeup with the knowledge, attitudes, values and behaviour that we acquire, and the ways in which our psychology is influenced by family habits and dynamics, peer pressure, and community, societal and cultural influences. The result is a lifestyle which is not freely chosen but rather is a reflection of the family, community, societal and cultural lifestyle, values and norms in which we are immersed and by which we are influenced. Unfortunately, there is as yet no comprehensive assessment of the contribution of the various risk factors to the burden of disease in Canada, never mind in BC. However, in recent years, estimates of the population attributable fraction of some key proximate risk factors that are common to a number of different diseases that constitute the major burden of chronic disease in Canada and in BC have been carried out.

The evidence shows that some 25-30 percent of the burden of disease in Canada can be attributed to the following four risk factors: [2]

- smoking
- physical inactivity
- unhealthy eating patternsimmoderate use of alcoholIt is important to note that while these factors are not unimportant, together they explain at most less than half of the 87% of the total burden of disease attributed to the top 10 categories of diseases and conditions in BC. Tobacco use, alcohol use and physical inactivity (diet and obesity were not included) account for 26.8 percent of the burden of disease in BC.

While our behaviours may put us at risk, there are a range of behaviours and skills that can be acquired and that serve to protect us from developing chronic diseases. At their simplest, these behaviours are just the opposite of the risk behaviours noted above; not smoking, being physically active, eating healthily and drinking moderately. Another set of protective behaviours involves seeking out regular and effective preventive and screening services such

[2] Obesity is not included here as a separate risk factor since it is really an intermediate outcome that results primarily from a combination of genetic factors, unhealthy eating patterns and physical inactivity, and contributes in turn to a number of major chronic diseases including heart disease, cancer, diabetes, arthritis and other musculo-skeletal disorders.

as blood pressure screening, immunization, preventive medications and supplements, cancer screening etc.

There are in addition a set of coping skills and a sense of self-esteem, self-worth and self-efficacy - collectively, social-emotional competence - that develop to a greater or lesser extent in young people. While resilience - "the ability to experience adverse circumstances and to overcome them" (Mangham et al, 1995) has particular relevance to mental health – it has a broader application, given our modern understanding of the relationship between the psyche and physical health. Risk and protective factors that contribute to or undermine resilience include poor parenting, genetic factors, the extent of adversity experienced, and protective factors that include personality factors such as autonomy, self-esteem, and a socially positive orientation; family cohesion, warmth and an absence of discord; and external positive or reinforcing social support

Community and societal protective and risk conditions

Humans are both biological and social animals and we live both in physical places and in social spaces - what in health promotion are called settings. These settings include the homes, neighbourhoods, communities and cities in which we are born, live and die, and the schools, workplaces, institutional, recreational and other settings in which we live, learn, work and play.

Much of the variation in protective and risk factors in a society is related to income, with low income populations more likely to have unhealthy living and working conditions that may contribute in a wide variety of ways to higher rates of disease and death. These can be thought of as 'risk conditions'.

- Psychosocial factors are important as determinants of health because "most behaviours are not randomly distributed in the population, but are socially patterned and often occur together" (Institute of Medicine, 2001). The social environment influences behaviour in a number of ways including
    - shaping norms
    - enforcing patterns of social control
    - providing (or failing to provide) environmental conditions that encourage particular behaviours
    - reducing or producing stress
    - placing constraints on individual choice (Institute of Medicine, 2001).
- The home and the family constitute a key setting; after all, Canadians spend almost 2/3 of their time at home. Of greatest importance, the home provides a physical shelter from the elements, but at the same time, if improperly constructed or maintained, may actually contribute to ill health, including chronic disease. The home

also provides a social setting that can contribute greatly to a healthier or less healthy way of life, and a haven from the wider society.

- Work is one of our most important social roles, and the indoor workplace is a site where adults on average spend 10 percent of their time. [3]The workplace can be a source of both adverse and promotive health conditions. Work-related disease is a significant contributor to the overall burden of disease. In one study, psychosocial work characteristics (such as low control, low use of skills, low support at work and a slow pace of work) was responsible for about 25 percent of the gradient of sickness absence between high and low grade employment among men and about 35 percent of the gradient among women.

- The built environment is now the 'natural' – or at least usual – human environment; not only do we spend 90 percent of our time indoors - and a further 5 percent in our cars - we are also 80 percent urbanised. Physical conditions in our homes, schools, workplaces and communities may contribute to – or help to protect us from – chronic diseases in a variety of ways.

    - The health effects of homelessness are well documented, and are significant. People without homes are at risk for a wide variety of health problems including respiratory and cardiovascular diseases, and many other problems.

    - The relationship between poor quality housing and poor health is also well documented. Badly built, damp and poorly heated housing contributes to respiratory diseases, including asthma that is associated with the molds and fungi that are found in such housing.

    - Poorly designed and maintained housing contributes to accidents.

    - A fourth important aspect of the indoor environment is air quality. In addition to dampness and mould, environmental or second-hand tobacco smoke contributes to lung cancer, asthma and other serious health problems in the spouses and children of smokers, while pet dander, dust mites, cockroaches and moulds (which can all be part of 'house dust') both cause asthma in the first place and can trigger asthma attacks.

- The physical environment of the community affects health and contributes to chronic disease in a number of ways. Chief among them is the contribution of air pollution (chiefly arising from fossil fuel energy use) to cardiovascular disease, chronic respiratory disease, asthma and cancer. Urban design, especially urban sprawl, also contributes through its emphasis on energy-intensive transportation systems, which

[3] This is for all adults; for those in the labour force, a 40 hour work week for 47 weeks of the year is 21% of their time.

not only contribute to air pollution, but to an inactive way of life, to injuries and unsafe environments, and to stress and other mental and social health problems.

Social, economic and cultural conditions contribute in a general way to the overall burden of disease. They do so in part by shaping the behaviour of societies, communities, families and individuals, in part by affecting access to resources needed for good health and in part through influencing the individual's physiological and biochemical functioning, acting mainly through the psycho-neuro-immune system. Unlike the proximate risk factors, these societal conditions appear to affect all aspects of the burden of disease, in particular mental health problems as well as other important chronic disease conditions, resulting in marked inequalities in health. Such inequalities are found everywhere, from the global to the local level, and BC is no exception. There is a clear relationship between regional ranking of health status and regional ranking of determinants of health in BC. As the Provincial Health Officer (2000) noted:

> ". . . regions that score well on living and working conditions, early childhood experiences, personal health practices, the physical environment, and health services have a higher level of health."

Among the key societal conditions that have been shown to affect health are:

- early child development
- educational attainment and social-emotional competence
- unemployment
- social status, social hierarchy and relative deprivation
- poverty and absolute deprivation.

- An important Canadian review of early child development examined recent research that showed that "the first few years of life can have a lifelong impact on health, mental ability and coping skills" (Guy, 1997). Among the most important factors are early stimulation as a result of good parenting, good early childhood education and child care, all of which stimulate brain development, with important implications for intellectual, emotional and social development; caring and supportive relationships with parents and other close family members; a supportive community that protects children from harm and neglect and provides them with opportunity and hope.

- Education is one of the most important determinants of health, affecting such factors as income level and job security, as well as providing people with a sense of control over their life circumstances. Educational attainment is strongly and consistently associated with higher health status: Higher levels of education not only confer a more sophisticated level of knowledge but increase the likelihood of attaining a well-paying job and higher levels of social status, all important predictors of health.

- Unemployment results in poorer health because of
    - increased poverty and hardship
    - social exclusion
    - changes in health-related behaviour
    - disruption of future work careers.

  Moreover, not only are unemployed people affected, so too are their spouses and children.

The causes of inequalities in health are due to both material deprivation and to psychosocial factors related to social gradient or relative deprivation. Among the key psychosocial factors that are related to inequalities in health are the following:

- lower levels of social support or integration
- low level of control in the work place
- low overall perceived level of control or mastery in society
- hostility levels at both the personal and community level.

- Evidence suggests that subordinate status in itself has adverse health effects, while low social status is associated with lack of control over life and health, high levels of anxiety, depression, shame and insecurity, lower levels of trust and group membership, and higher levels of hostility which manifest as racism, classism, sexism and violence. Physiological effects include a state of chronic arousal with increased basal cortisol levels, increased fibrinogen levels, unfavourable HDL/LDL ratios, insulin resistance and other effects (e.g., on the immune system) which increase the individual's risk of disease.

- The most obvious and most dramatic societal condition that adversely affects health is poverty, which is not merely a matter of how much income people have but is a complex set of issues that include level of education, location of housing, type of work, likelihood of employment and quality of working conditions, availability of and access to basic needs and a wide range of societal resources and services, sense of powerlessness and other attributes. In addition to influencing the settings in which people lead their lives, these broad psycho-social and socio-economic factors influence the behavioural patterns of groups and individuals, establishing norms of behaviour that in turn establish patterns of risk. The interaction of these risk environments, risk conditions and risk behaviours ultimately impact upon the individual's physiological and psychological functioning, thus influencing their level of health.

- Material deprivation involves an inability to acquire the basic prerequisites for good health such as food and water, shelter, adequate clothing, safe living and working conditions, education and income. It is hardly surprising that homelessness, hunger, illiteracy, absolute poverty and dangerous living and working conditions have direct physical effects on people. In addition, there is also an inability - because of lack of income and personal and family resources - to access and benefit from a variety of societal resources, including in particular education, health services, recreation, arts and culture and so on.

But while there is a good deal of research, there is as yet little data on the population attributable risk of these societal conditions for specific diseases and conditions, although Wilkinson (1999) maintains that "something between 1/3 and 2/3 of the differences in measures of the social environment, in mortality and in violence may be attributable to the extent of income inequality alone."

Summarising the evidence on the determinants of chronic disease

What, then can we say about the relative contribution to chronic diseases of the wide variety of determinants reviewed here? First, of course, there is no simple relationship among the various determinants, no single factor or even a set of factors that predominates – it all depends. Nonetheless, the evidence summarized here indicates that:

- genetic factors contribute to some extent to these chronic diseases, as do other biological factors;

- a set of specific behaviours smoking, physical inactivity, poor nutrition and obesity, themselves determined by a wide variety of factors - may account for a quarter to a third of the burden of disease resulting from cardiovascular disease, cancer, chronic respiratory disease and diabetes;

- psychosocial factors in settings such as the home, the school, the workplace and the community have an effect that interacts with and influences behaviour; the physical environment contributes to some extent, particularly with respect to both indoor and outdoor air quality and the health impacts of urban design;

- societal factors, including relative deprivation, may account for another one third to one half of the overall burden of disease.

Second, it follows from the evidence presented here that there is no single intervention, and no simple remedy, that can reduce the burden of chronic diseases. As we have learned from our experience with tobacco, it requires a prolonged commitment of skills and resources in a multi-setting, multi-factor, multi-strategy approach.

Third, a full understanding of the precise contribution to the burden of disease of the various risk factors, behaviours, environments and conditions that are the subject of this report is quite likely not possible, and is certainly not available today. But we cannot postpone action

until we have perfect information. Instead, we need to recognise that in the face of uncertainty, we have to use the best information we have and apply the precautionary principle of environmental science to public health.

Effective Chronic Disease Prevention - The Evidence

What is taken as evidence in public health differs in some respects from the understanding of evidence in biomedical science, while the extent of evidence that is available is also problematic. There are a number of reasons for this:

- First, the amount of funding devoted to public health services, and to research on population and public health issues, is eclipsed many times over by the amount spent on clinical services and clinical and basic research. Public health receives some 2.5 – 3 percent of the health care budget, and funding for research is similarly inadequate.

- Second, the type of research that is carried out tends to be more concerned with infectious diseases and with biological risk factors and behavioural change.

- Third, the long time frame and large sample size needed to pursue intervention studies in public health present a challenge.

- Fourth, the type of research that is required for population health intervention studies is different from the 'gold standard' randomized controlled trial of clinical medicine.

Thus while we have comparatively good evidence about risk factors such as tobacco, alcohol, physical inactivity or diet, for which such large long-term studies have been undertaken, we have little firm data about the population attributable risk from societal or risk conditions to the burden of disease, be it heart disease or depression. Nor do we have much hard scientific evidence about the effectiveness of specific environmental, psycho-social, socio-economic or cultural interventions as a means of reducing the burden of disease.

The economics of prevention

While the principal focus of this report is on the health benefits of prevention, a brief review of some of the economic evaluations of primary prevention that are available is provided here.

- Musich, Burton and Edington (1999) point out that "nearly all measures of direct cost savings, cost-benefit and cost-effectiveness are biased against prevention". However, when indirect costs or quality of life and health status are included, "prevention measures generally exceed those savings associated with disease treatments". Thus when the ratio of indirect to direct costs is high, there is "a major opportunity for prevention and disease management programs to greatly impact the cost-economics of health care services". In BC, the ratio of indirect to direct costs is high - greater than 1.5 - for the following categories of disease:

    - Musculoskeletal 6.22

- Cancer 4.87
- Injuries 3.45
- Nervous system 2.22
- Infectious diseases 1.99
- Respiratory diseases 1.88
- Cardiovascular diseases 1.68

This suggests that prevention of these diseases is likely to have a significant impact on the costs of health care in BC.

However, the overwhelming majority of economic evaluations of primary prevention have focused on bio-medical and behavioral risk factors, and clinical and behavioral interventions. There have been few studies that have looked at broader socio-environmental conditions or the strengthening of community action (and none that have looked at healthy public policy), at the school setting, or at health problems such as mental health, alcohol and drug abuse, nutrition or physical activity. Thus there is a dearth of evidence with respect to the economics of some of the more important public health issues and health promotion strategies of our day; this makes it important to recall that absence of proof of economic impact is not proof of absence of economic impact. Having said that, it is worth summarizing some of the economic evidence we do have.

- A recent US report on the cost-effectiveness of different key public health prevention interventions found that the following interventions had cost-effectiveness ratios of less than $166,000 U.S. per life year or quality-adjusted life year gained, a ratio deemed acceptable:
  - breast cancer - mammography screening
  - cervical cancer - screening average-risk asymptomatic women aged 20 through 75 either every years or annually
  - colorectal cancer - annual fecal occult blood testing in a 65 year-old population
  - smoking - brief advice and counseling on smoking cessation by a physician
  - coronary heart disease - a regular exercise regimen
- Another study reviewed the evidence on the cost-effectiveness of a number of clinical and public health measures, based on U.S. studies and found the following cost per life-year saved for selected cancer prevention interventions (all amounts are in 1995 U.S. dollars):

- restriction of cigarette sales to minors - $840
- Pap smear every four years among women aged 20 to 75 - $14,000
- annual fecal occult blood screen for colorectal cancer among adults aged 50 to 75 - $14,000
- mitigation of radon in homes - $47,000
- annual Pap smear for women over age 65 - $51,000
- annual mammography for women aged 55 to 65 - $120,000
- annual mammography for women aged 40 to 50 - $200,000
- annual Pap smear for women aged 20 to 75 - more than $1,300,000

Their findings with respect to the cost of selected coronary heart disease prevention interventions per life-year saved were:

- education to promote cholesterol reduction among the general population ages 35 to 84 - $3,400
- for treatment of hypertension among patients aged 35 to 64 with
  - beta-adrenergic blocker- $15,000
  - diuretic - $22,000
  - calcium channel blocker - $43,000
  - alpha-adrenergic blocker - $83,000
  - ACE-inhibitor - $96,500
- Lovastatin for treatment of men aged 45 to 74 with
  - prior coronary heart disease and cholesterol less than 250 mg/dl - $20,000 to $31,000
  - blood cholesterol > 300 mg/dl - $71,000 to $135,000
  - blood cholesterol > 250-299 mg/dl - $105,000 to $270,000

- A recent Australian study examined the costs and benefits of several public health programs in Australia. Two of the programs that were reviewed focused on chronic diseases and are summarised here:

- Tobacco - the $176 million invested in those programs since 1971 yields, conservatively:
    - total societal benefits from 1971 - 2010 of $8.6 billion and a net societal benefit of $8.43 billion, a benefit - cost ratio of nearly 50:1.
    - total direct government savings for health care expenditures are estimated to be $344 million, a benefit – cost ratio of 2:1.
    - the net societal benefit in 1998 alone from public health tobacco control expenditures was $1.182 billion.
- Coronary heart disease - the $810 million invested in these programs since 1971 yields, conservatively
    - total societal benefits from 1971 – 2010 of $9.29 billion and a net societal benefit of $8.48 billion, a benefit - cost ratio of more than 11:1.
    - total direct government savings for health care expenditures are estimated to be $577 million, which is less than the expenditures for the public health programs.
    - the net societal benefit in 1998 alone from public health coronary heart disease risk reduction expenditures was $934 million.

Changing social, economic and cultural conditions

But despite the gaps in our knowledge, there is evidence of the effectiveness - or ineffectiveness - of a wide range of strategies for the prevention of chronic diseases.

- A recent US Institute of Medicine report (2001) discussed health-related interventions at the individual, family, organization, community and societal levels. Among the key findings of the report are the following:
    - "Interventions must recognize that people live in social, political and economic systems that shape behaviours and access to the resources they need to maintain good health."

    and

    - "While biological interventions and exhortations to individuals to change their behaviours are easier to administer, changes in social factors, policies, and norms are necessary for improvement and maintenance of population health."
- In another recent IOM Committee report, Smedley and Syme (2000) conclude that such factors as "stress, insufficient financial and social supports, poor diet, environmental exposures, community factors and characteristics, and many other

health risks", which contribute significantly to the risk of disease and death, are probably more effectively addressed at the level of community and environmental interventions than through individual-level interventions.

The Committee identified a number of interventions for which there was compelling evidence, including

- paying more attention to the conditions that affect the health of women over their life course can help them deliver healthier children
- comprehensive, high-quality services that address basic needs of children and families can improve the health of infants and assist children to enter school ready to learn
- greater attention paid to the environmental and social contexts in which young people operate can improve their health and prevent future health problems
- coordinated efforts addressing adolescents and adults in the various settings in which they live their lives can improve their health
- institutions and public policies that address not just the physical but also the social, cognitive and psychological needs of older adults can help them to age more successfully
- paying special attention to the contexts which influence the health of population groups, including those of different socio-economic, racial and ethnic backgrounds
- paying attention to the "broader social, economic, cultural, and political processes that determine and maintain . . . disparities" in health
- fully engaging members of the community in the planning, design and implementation of efforts that seek to enhance the social and environmental conditions of the community
- coordinated, multi-faceted, multi-level interventions that are funded over the long term.

- The UK's Independent Inquiry into Inequalities in Health (1998) both summarized the evidence on the determinants of inequalities in health and identified priority areas of future policy development to reduce such inequalities. The report notes that the scientific evidence indicates that "health inequalities are the outcome of causal chains which run back into and derive from the basic structure of society". Thus policies need to be broad-based and to be both "upstream" and "downstream". They address a number of key policy areas where they feel interventions are most justified, based on a

combination of "the scale of their potential impact on health inequalities, and the weight of evidence". These policy areas include:

- poverty, income, tax and benefits
- education
- employment
- housing and environment
- mobility, transport and pollution
- nutrition.

Reducing poverty and inequalities

Noting that a 1998 WHO Europe review of health in Europe had observed that "Health is best where active steps are taken to address the social determinants of health (such as poverty, homelessness, unemployment)" Black and Mittelmark (2000) cite evidence that improving equity in health (which means "a focus on the ideal of providing a fair opportunity for all people to enjoy health to their fullest potential") has a positive impact on peoples' health status, the strengthening of community and families, and a more productive - and thus economically "healthy" society.

Enhancing child development

". . . recent research in child health shows that early life health is, for each child, the basis of health in adult life. Therefore investment in health in early life has beneficial effects, specifically on the future health of a nation as well as on the future functioning of its citizens." (Wadsworth, 1999)

- The Community Guide to Preventive Services found strong evidence to support comprehensive pre-school programs for low-income children aged 3 - 5 years. Follow-up for periods as long as 15 - 20 years showed higher rates of high school graduation, decreased teen pregnancy, decreased rates of delinquency and higher rates of employment in these disadvantaged children.
- Both the Independent Inquiry . . . (1998) and a May 2000 Cochrane review examined the issue of pre-school education and came to similar conclusions, the former concluding that:
  - "overall the evidence suggests that pre-school education or day care may be especially effective in improving the achievement and health of the most disadvantaged children"

  while the latter found that

- "Daycare has beneficial effect on children's development, school success and adult life patterns", although noting that

  "to date all randomized trials have been conducted among disadvantaged populations in the USA. The extent to which the results are generalizable to other cultures and socio-economic groups has yet to be evaluated."

Changing environmental and psycho-social living conditions

Settings such as homes, schools, workplaces and communities are both physical spaces and social spaces. Making these settings healthier means focusing on both the physical and psycho-social aspects of their environments.

Healthy Schools

- The Independent Inquiry (1998) focused a lot of attention on the need to develop health-promoting schools, in line with the World Health Organization's definition of such schools. They concluded, based on recent evaluations, that such schools can "lead to gains in people's knowledge, attitudes, self-esteem and health behaviours, particularly in primary schools". They paid particular attention to the promotion of life management skills, substance misuse and sex education, all of which had been evaluated and shown to be generally effective, particularly when they focused on early education, a broad approach to wider influences on health-related behaviour, a supportive school setting, quality programs and a comprehensive approach linked to broad life management skills. They conclude that

  "successful health promotion at school should increase "life skills" with resultant improvements in many aspects of physical, mental and social health".

- In the IUHPE review carried out for the European Union, St. Leger and Nutbeam (2000) caution that since "student's health status is influenced far more substantially by factors external to the school . . .", we should have somewhat modest expectations of how powerful school health interventions can be. They also state that school-based interventions would be more effective if

  - the focus is on cognitive and social outcomes as a joint priority with behaviour change
  - programs are comprehensive and 'holistic', linking the school with agencies and sectors dealing with health
  - the intervention is substantial, over several school years, and relevant to changes in young people's social and cognitive development
  - adequate attention is given to capacity building through teacher training, and provision of resources.

They put particular emphasis on the concept of the health-promoting school as an holistic approach, since the evidence suggests that effective school health programs address a combination of the curriculum, the environment, health services, community partnerships and school policies.

They found the evidence shows that:

- nutritional practices can be improved, particularly through multifaceted (skill development, policy supported) programs
- positive changes in physical activity can be achieved if the intervention is comprehensive and integrated, uses properly trained personnel, ensures adequate time (60-80 minutes per week), provides quality facilities and resources and occurs regularly during the week
- even well designed and implemented health promotion programs aimed at tobacco, alcohol and drug use have "only a modest effect on behavioural goals", and then only if they meet the same criteria as for nutrition and physical activity programs.

- The Centers for Disease Control and Prevention (2003) note that "rigorous studies in the 1990's showed that health education in schools can reduce the prevalence of health-risk behaviors among young people", including smoking, obesity, alcohol and marijuana use. A set of promising practices for school health incorporate four key concepts:
  - the coordination of multiple components and the use of multiple strategies
  - the coordination of health and education agencies and other organizations
  - the implementation of CDC's school health guidelines, and
  - the use of a program planning process to achieve health promotion goals.
- A review of 12 primary studies regarding the health promoting schools approach and 32 reviews of reviews of effectiveness of school health promotion (EPHPP, 2003) found that

  "Although the evidence supporting the health promoting schools approach is limited, this approach is demonstrated to have an impact on the social and physical school environment in areas of staff development, school lunch program, exercise, and social context. In some studies, this approach had a positive impact on nutrition, physical activity, and mental and social well-being."

  and the reviewers concluded that:

- "Health promotion interventions are most effective when they entail a multifaceted approach.
- Classroom education should be implemented in combination with changes to the school environment and/or family/community participation.
- When initiating the health promoting schools approach, it is important to implement all components inherent to this approach."

Healthy workplaces

There are three broad areas of focus for a comprehensive workplace health promotion program:

- workplace behaviour change
- health-promoting job and organizational design
- internal communication and marketing/policy development.

- Breucker and Schroer (2000) state that essential factors for effective workplace health promotion programs include:
    - interdisciplinary effort involving many different players in the company
    - participation and cooperation of all players
    - a comprehensive approach, combining activities that focus on the individual with those that address the design of the working and organizational conditions.

  They indicate that there is strong evidence for the health effectiveness of both behavioural and structural approaches and for the importance of combining them in a comprehensive program of workplace health promotion. Benefits move beyond positive health effects to improve productivity and the quality of both product and process in the work site, making workplace health promotion a positive competitive factor.

- However, in a review of 15 studies of health promotion interventions in the workplace (EPHPP, 2003), the reviewers found that "data supporting workplace programs are still not definitive. Most evaluations were considered methodologically flawed due to the absence of a control or comparison group" and that "no clear trends in effectiveness could be identified in relation to certain types of interventions, health topics or category of service provider." In a separate review, EPHPP reviewers also conclude that there is little evidence that workplace-based health risk appraisal alone can produce sustainable changes in individual health behavior or risk status. However, they

provided a number of examples where specific interventions were found to be effective and concluded that

- "A sustained program based on principles of empowerment and/or a community-oriented model using multiple methods, visibly supported by top management and engaging the involvement of all levels of workers in an organization, is likely to produce the best results.
- A focus on a definable and modifiable risk factor, which constitutes a priority for the specific worker group, can make an intervention more acceptable and increase their participation.
- Interventions should be participatory and tailor-made to the characteristics and needs of the employees."

- The authors of the Independent Inquiry (1998) note the substantial evidence relating psycho-social factors in the workplace (particularly the imbalance between psychological demands and control, and lack of control at work) to a variety of physical and mental health problems, and there is evidence of successful interventions to improve working conditions in ways that both improve health and, in some cases, improve productivity at the same time. In essence, such interventions "follow principles of good management practice" and include the following features:
  - appropriate commitment and effort from management
  - support by management and the workforce
  - workforce participation in planning and implementation
  - the creation of trust.

Healthy communities – the built environment

Many of the health impacts of the urban built environment are related to the relationship between the built environment and land use and transportation decisions, which has been the topic of growing concern in health policy circles, because of the growing evidence of the relationship between air pollution, car dependency and physical inactivity and a wide variety of health impacts.

- A recent report (Jackson and Kochtitsky, 2002) co-authored by the Director of the USA's National Center for Environment Health has reviewed the issue of the relationship between the built environment and health and proposed some policy directions. They conclude that

"It seems imperative that new transportation options be developed and implemented in order to help alleviate the public health problems related to worsening air quality in the United States."

- The authors of the Independent Inquiry make four broad policy recommendations:
    - the further development of a high quality public transport system which is integrated with other forms of transport and is affordable to the user
    - further measures to encourage walking and cycling as forms of transport and to ensure the safe separation of pedestrians and cyclists from motor vehicles
    - further steps to reduce the usage of motor vehicles to cut the mortality and morbidity associated with motor vehicle emissions
    - further measures to reduce traffic speed, by environmental design and modification of roads, lower speed limits in built-up areas, and stricter enforcement of speed limits.

Strengthening community action

There is general agreement that comprehensive, community-based approaches are needed that combine several different risk factors in a single 'healthy living' package in the settings in which people lead their lives. Studies that have taken a broad , integrated approach have shown some success, most notably in the North Karelia project in Finland. Thus in recent years there has been considerable interest in developing community-based coalitions to address a variety of chronic disease-related issues, as well as injuries and other important public health concerns.

- In a review of 15 studies using a strong or moderate methodology (EPHPP, 2003) statistically significant changes were found in health status (nine studies), in health risk behaviours (five studies) and knowledge changes (one study). However, the reviewers note that many of these coalitions were supported by research or special project funding, and this might limit the generalizability of the findings to routine public health work. Nonetheless, they conclude that
    - "Community-based public health coalitions can be effective, and may be a prerequisite for working with certain populations
    - Initiating and maintaining coalitions requires substantial skill and human and financial resources."

Building social-emotional competence and resilience

The development of social-emotional competence , resilience and other positive attributes depends to a significant extent on what happens to people during their infancy and childhood,

and the psycho-social and physical environments in which they develop. Wallander (2000) concludes that it is reasonable to suggest that the enhancement of social-emotional competence

- in childhood can improve the health of the population over the life span
- in childhood can prevent the development of biological pathology before it leads to disease and thereby prevent some physical health problems over the life span
- in adults can improve biological functioning, thereby preventing or reducing some physical health problems over the life span.

The development of competence - "the behaviourial effectiveness of one's transactions with the environment, as well as one's sense of personal wellbeing in diverse aspects of life" (Weisberg, Caplan and Harwood, 1991) will be most effective when family-, school-, and community-based prevention programs

> "attempt both (a) to enhance children's capacities to coordinate skills, prosocial values, and information in order to cope adaptively with society's social tasks, challenges, and stresses and (b) to create environmental settings and resources that support the development of young people's positive personal, social and health behaviour."

However, short-term, poorly implemented prevention programs that focus solely on the individual and do not pay attention to the social context do not produce lasting behaviour change, while comprehensive programs that focus on family support, early childhood education and a comprehensive, school-based approach to the promotion of social competence do have long term effects.

With respect to resilience, there are significant variations in individual susceptibility, and environmental interactions may be most important for those people who are also genetically at risk. Three key experiences that are protective are

- secure intimate relationships
- the experience of pleasurable success
- previous experience of success in dealing with a challenge

Thus in both the school and home, the evidence indicates that it is important to offer children

- the opportunity to exercise responsibility and autonomy
- the opportunity to experience success in some area of their lives
- good teacher/pupil (and parent/child) relationships
- encouragement and reward

- a focus on positive features
- appropriately high expectations.

In addition, the evidence indicates that warm and supportive relationships in the home and parenting programs for high risk groups are important, while school programs on effective social problem-solving are important. The research also indicates that it is not simply general family discord and conflict that reduces resilience, but hostility, criticism, negative feelings towards others in the family, and "scapegoating". The policy implications are that therapeutic interventions are needed with troubled families that focus on avoiding scapegoating and negativity, and avoid bringing children into family conflicts.

Supporting healthy living and behavioural change

There is a wide range of promotive, protective and preventive behaviours that contribute to healthy living. Common to all of them is the widespread and well-accepted evidence that behaviour is significantly influenced by a wide variety of psychological, social, environmental, cultural and other factors, and that this requires a comprehensive approach to changing behaviour.

- The results of integrated behavioural strategies have often been disappointing, as in the case of the MRFIT program in the USA., which deployed significant resources in an attempt to change the risk behaviours of a group of 6,000 men who were at high risk because of their high rates of cigarette smoking, hypertension and hyperlipidaemia. In commenting on this, Smedley and Syme (2000) note that:

  > "It is clear that behaviour change is a difficult and complex challenge. It is unreasonable to expect that people will change their behaviour easily when so many forces in the social, cultural, and physical environment conspire against such change."

  This may explain why a Cochrane review of multiple risk factor interventions for primary prevention of coronary heart disease, which examined 10 trials which reported clinical data for intervention studies using counselling or education to modify more than one cardiovascular risk factor over a period of at least six months, found that for this form of intervention "The pooled effects suggest multiple risk factor intervention has no effect on mortality." Changes in risk factors were relatively modest, and those using personal or family counselling and education appeared to be more effective at achieving risk factor reduction.

The focus here is on a set of three particular behaviours that are significantly associated with the four categories of disease (cardiovascular disease, cancer, chronic respiratory disease, diabetes) that are the focus of current national and provincial chronic disease prevention initiatives. These three behaviours are not smoking, eating healthily, and being physically active; the latter two are strongly related to maintaining an ideal body weight.

- The UK's Health Development Agency (2001) recently proposed an overall strategy to reduce smoking, promote healthy eating, increase physical activity and reduce overweight and obesity. The report summarizes the features of effective interventions in these four areas. The following were deemed to be effective activities to support local action:
    - reducing smoking prevalence
        - develop smoking cessation services
        - reduce smoking in public places including workplaces
        - support national media campaigns
        - use media advocacy
        - reduce sales of cigarettes to children under 16 years old
        - encourage the introduction of smoking policies in schools
    - improving diet and nutrition
        - school programs
        - local/community projects
        - workplace programs
        - health care programs
    - increasing physical activity
        - health care interventions
        - exercise referrals schemes
        - workplace programs
        - mass media
        - school programs
        - older people
        - physically active transport
- The EPHPP (2003) examined 13 heart-health community-based initiatives and concluded that

- "Compared to usual care, community-based heart health interventions are effective in reducing smoking prevalence in men, adolescents and certain high-risk groups, and in reducing the proportion of the population with an elevated body mass index.

- Compared to routine cardiovascular disease preventive care, heart health interventions are effective in reducing the proportion of the population with elevated blood cholesterol, increasing awareness of blood cholesterol levels, and increasing individual's awareness of their risk for cardiovascular disease.

- When measured at the community level, heart health interventions are <u>not</u> effective at changing outcomes such as smoking prevalence, physical activity level, mean systolic and diastolic blood pressure, blood cholesterol, CVD risk factor score and CVD mortality. However, there is evidence suggesting these interventions do have an effect on high-risk groups that is masked when community level data is used for analysis."

And they conclude that

- "Community-based heart health interventions directed at smoking, physical activity, blood pressure, blood cholesterol, CVD risk factor score and CVD mortality should be targeted at specific high-risk populations."

<u>Non-smoking</u>

Based on the evidence in the published literature and the experience of the two best state programs in the US - Massachusetts and California – there are nine best practice components of comprehensive tobacco control programs, according to the Centers for Disease Control:

- Community programs to reduce tobacco use
- Chronic disease programs to reduce the burden of tobacco-related diseases
- School programs
- Enforcement
- Statewide programs
- Counter-marketing
- Cessation programs
- Surveillance and evaluation
- Administration and management

Approximate annual costs to implement all of the recommended program components have been estimated to range from $7 to $20 per capita in smaller States (population under 3 million), $6 to $17 per capita in medium-sized States (population 3 to 7 million), and $5 to $16 per capita in larger States (population over 7 million). For BC, with a population of some 4 million, implementing this set of evidence-based, effective tobacco control policies would require an annual expenditure of a minimum of $24 million and as much as $68 million.

- The Community Guide to Preventive Services came to similar conclusions, finding strong evidence for the effectiveness of
    - increasing the unit price of tobacco, and mass media education campaigns (when combined with other interventions) as strategies to reduce the initiation of tobacco use by children, adolescents and young adults;
    - smoking bans and restrictions to reduce exposure to environmental tobacco smoke;
    - increasing the unit price of tobacco, mass media education campaigns (when combined with other interventions), provider reminder and education (with or without patient education), and patient telephone support (quit lines) when combined with other interventions as strategies to increase tobacco cessation.
- The Community Guide to Preventive Services also found sufficient evidence to recommend as strategies to increase tobacco cessation:
    - reducing patient out-of-pocket costs for effective treatments for tobacco use and dependence
    - provider reminder systems.
- Anderson (2000) also reviews the evidence with respect to prevention and control of tobacco, alcohol and illicit drugs. His summary of the proven effective health promotion and disease prevention strategies with respect to tobacco use, which also summarises well all the other reports reviewed, is as follows:
    - market regulation
    - increased taxes on tobacco and alcohol
    - restricting access to tobacco products for young people
    - advertising controls, in particular banning all forms of direct and indirect tobacco-related advertising and sponsorship
    - litigation and product liability
    - legislation to control smoking in public places to reduce involuntary exposure to tobacco smoke

- interventions by primary health care providers
- counselling during primary care encounters, coupled with the use of nicotine replacement therapy and other treatment products are effective in encouraging smokers to quit
- education and public information interventions - "The general conclusion is that although information can increase knowledge, such activity alone rarely influences behaviour".
- school-based interventions, although
    - the influence of school-based education on attitudes and behaviour is uncertain, although peer-led sessions and skill-based learning have been shown to be effective
    - such education needs to be integrated into the concept of the health-promoting school
    - education level itself is "a very strong predictor of making healthy choices in relation to the use of tobacco and alcohol products"
- workplace interventions
- legislation to control smoking in the workplace
- the community approach

  "It has been increasingly recognized in public health that the preventative approaches that hold the greatest promise are community-based and community-wide, and focus on both individual behaviour and environmental influences".

- The UK's Health Development Agency (2001) reviewed the effectiveness of interventions to reduce smoking prevalence and concluded that the best approach is a comprehensive, community-wide one that includes direct smoking cessation, help lines, training and resources for health professionals, development of policies to reduce smoking in public places, media campaigns and advocacy, reducing sales to minors, and work in schools. The overall purpose is to influence both individual behaviour and the environmental, social and cultural conditions that affect tobacco use.

Healthy eating

- The UK Health Development Agency report cites a review that found the following characteristics for effective interventions to promote healthy eating:
    - a focus on diet alone, or diet plus physical activity, rather than addressing a range of risk factors

- clear goals for dietary change, linking improvements in knowledge with development of skills and the provision of opportunities to put the knowledge into practice

- personal contact with individuals or small groups sustained over time

- personalized feedback to participants on changes in their behaviour and risk factors

- changes in the local environment, including shops and catering outlets, that help people choose a healthy diet.

- Schuit (2000) reviewed the evidence with respect to proven effective health promotion and disease prevention strategies related to nutrition and found that:

  - Community intervention programs have had limited success, particularly in the general population, who are more likely to change their diets on the basis of short-term benefits (such as better taste) rather than intermediate or long-term benefits.

  - While school-based programs that use an integrated approach (education, healthy food in the school, education of staff, involvement of parents and community) have been effective, and while schools provide an ideal setting for such programs, dietary choices in the home and community and cultural beliefs and values play an important role in establishing food choices. A similar situation pertains to work site-based programs as well.

  - Because of the many opposing forces in people's daily lives (time pressures, economic constraints, food advertising, limited access - economically or socially - to healthy foods, etc.) an integrated approach is needed that combines education with structural measures, environmental and social changes that reinforce behavioural change, and involvement of the food industry. A community coalition may be a useful strategy to apply.

- A review of interventions to enhance fruit and vegetable consumption in people four years of age and older (EPHPP, 2003) examined 18 strong or moderate quality studies of community intervention programs that were intended to increase fruit and vegetable consumption by school children, adolescents and adults with no diagnosis of disease. They found that the most effective interventions:

  - gave clear messages about increasing fruit and vegetable consumption;

  - incorporated behavioural theories and goals, providing a consistent framework for implementation and evaluation;

  - provided longer, more intensive interventions rather than one or two contacts;

- actively involved influential people such as family members; and,
- had a greater impact on those whose knowledge or intake were lower at the beginning.

Physical activity

- The Community Guide to Preventive Services has reviewed the evidence for the effectiveness of interventions to promote physical activity. The following were recommended on the basis of strong evidence
  - Social support in community contexts, including the creating, strengthening and maintaining of social networks, the use of 'buddy' systems, contracting, and walking groups
  - Individually adapted health behaviour change, including goal setting and self-monitoring, building social support, behavioural reinforcement, structured problem-solving, and relapse prevention.
  - Community-wide campaigns, involving large scale, high intensity, high visibility programs; the use of TV, radio, newspaper and information sites; and multi-component, multi-site, "combined package" interventions.
  - Modified physical education in school, including modified curricula and policies, modified amounts of physical activity during physical education and modified, more active activities and games
  - Creating or enhancing access to places for physical activity, including trails and/or facilities access, reduced safety and affordability barriers, training and incentives, and site-specific programs.
- The UK's Health Development Agency (2001) has recently reviewed the evidence with respect to physical activity and concluded that effective interventions are those that
  - encourage walking and do not require attendance at a facility; brisk regular walking can achieve most of the health benefits associated with physical activity
  - involve environmental modifications such as signs posted to increase stair climbing
- Finally, the school is a setting where physical activity is of concern. A review of 19 evaluation studies of the effectiveness of school-based interventions in promoting physical activity and fitness among children and youth aged 6 to 18 (EPHPP, 2003) found that such programs "are moderately effective in promoting physical activity and duration of physical activity in children and adolescent girls", and that adults who participated in such programs in childhood were more active as adults.

Maintaining an ideal body weight

The UK's Health Development Agency (2001) has recently reviewed the evidence with respect to obesity and concluded that effective strategies to reduce obesity include:

- reduce sedentary behaviour (or promote active living) in obese children
- use diet, physical activity and behavioural strategies for adults, in combination where possible
- use maintenance strategies such as continued therapist contact
- use a gradual, incremental stepwise approach
- integrate lifestyle changes over a long period of time
- family therapy is essential in treatment with younger children
- habitual physical activity is important both for losing weight and for keeping weight off.

A Cochrane review examined seven long-term and four short-term studies and concluded that "currently there is limited high quality data on the effectiveness of obesity prevention programs and as such no generalizable conclusions can be drawn", although “concentration on strategies that encourage reduction in sedentary behaviours and increase physical activity may be fruitful”

Prevention of infections linked to chronic diseases

With respect to the current and immediate future state-of-the-art of vaccines against oncogenic organisms, Khleif and Frederickson (2001) report as follows:

- HPV vaccines are in the early phase of development, with ongoing trials, and early results appear promising (see below for more detail).
- Several clinical trials of EBV vaccine are underway, but "it is still unclear whether any form of these vaccinations will generate neutralizing antibody or prevent or eliminate infection . . . (or) prevent or eliminate resultant tumours".
- Hepatitis B virus vaccine is already in wide-spread use. It is effective in reducing the carrier rate, and has been associated with reductions in the incidence of hepatocellular carcinoma.
- Development of a hepatitis C vaccine has been hampered by genetic and antigenic variability, but active research is underway.

- Work is underway to develop a vaccine against H pylori, with initial tests in humans showing that the vaccine can generate an antibody response and can reduce - but not eradicate – the bacterium in the stomach.

Chemoprevention

Chemoprevention refers to the use of pharmacologic or natural agents as a medication or supplement to prevent a disease. There have been two broad areas of interest in the use of chemoprevention for chronic diseases; cancer and cardiovascular disease. Indeed, the U.S. Preventive Services Task Force in 2002 strongly recommended that

> "clinicians discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD). Discussions with patients should address both the potential benefits and harms of aspirin therapy"

while the American Heart Association, in a 1999 Science Advisory noted that there is evidence to suggest that anti-oxidants in the diet may play a protective role , and in particular that vitamin E at levels only attainable through supplementation may play a role in preventing some disease end-points in people with pre-existing heart disease. However, at that time, the AHA felt it premature to make recommendations for vitamin E supplementation, pending further research (Trimble, 1999).

With respect to cancer, however, while interest is high, at present (2003) the U.S. Preventive Services Task Force concludes that

> "the evidence is insufficient to recommend for or against the use of supplements of vitamins A, C, or E; multivitamins with folic acid; or antioxidant combinations for the prevention of cancer or cardiovascular disease" and specifically "recommends against the use of beta-carotene supplements, either alone or in combination" for these purposes.

In addition, of 19 large-scale phase III (definitive efficacy) primary prevention trials of chemoprevention, only 3 have been positive (2 involving tamoxifen in breast cancer prevention and 1 involving retinol in the prevention of skin cancer), 2 have been negative (ß-carotene actually increases the risk of lung cancer in smokers and in people exposed to asbestos) and the remaining 8 were neutral.

Nonetheless, our understanding of the process of carcinogenesis does suggest that there is a potential for chemoprevention both for the prevention of cardiovascular disease and for cancer prevention.

Clinical prevention

For a number of years, the Canadian Taskforce on Preventive Health Care (formerly the Task Force on the Periodic Health Examination) has been developing and publishing systematic reviews and recommendations of preventive actions that should be included (or not included) in the periodic health examination. Their recommendations for the primary and early secondary preventive services pertaining to chronic diseases include six “A” recommendations for which there is good evidence and nineteen "B" recommendations for which there is fair evidence to include the service in the periodic health exam. These positive recommendations are outweighed by thirty-four ”C” recommendations (where evidence is conflicting) and sixteen “D” recommendations, where there is fair evidence to exclude the service from the periodic health exam.

In the USA, the US Preventive Services Task Force currently lists thirty reviews - several of which include multiple recommendations – that are relevant to chronic disease prevention; they include 12 related to screening for cancer, 11 related to screening for other conditions (mainly cardiovascular disease), 4 related to counselling and 2 related to chemoprevention. Of these, 3 reviews related to screening for cancer, 6 related to other screening, 1 related to counselling and 2 related to chemoprevention are in the “A” (strongly recommended) or “B” (recommended) category.

Coffield et al (2001) undertook a systematic assessment of the value of clinical preventive services recommended for average-risk patients by the U.S. Preventive Services Task Force. Based on a combination of the burden of disease prevented by each service and the cost-effectiveness of the intervention, they identified the following priority interventions relevant to chronic disease prevention- those ranked highest in priority (seven or more out of 10) and yet having the lowest delivery rates (less than 50 percent in the U.S.) are:

- tobacco cessation counselling for adults
- screening older adults for undetected vision impairment
- offering adolescents an anti-tobacco message or advice to quit
- counselling adolescents on alcohol and drug abstinence
- screening adults for colorectal cancer
- screening adults for problem drinking

Challenges in implementing clinical prevention

Five key elements of a formal system for delivering preventive services which increases their delivery in the clinical setting are identified by the US “Put Prevention Into Practice” program. They are:

- Establish preventive care protocols

- Define staff roles for delivering and monitoring preventive care
- Determine patient and material flow
- Audit the delivery of preventive care continually
- Readjust and refine your delivery system and standards

Researchers evaluating this approach have found that technical support was needed, that a 'one size fits all' approach would not meet the needs of diverse providers, which suggests the need for a more tailored approach, that simple availability of the kit is inadequate, and that additional strategies might be needed such as the provision of external consultation services to practices, the incorporation of preventive services into HMO organizations, and residency training. Other researchers concluded that while the use of these materials could have a modest impact, "sustained improvement will require substantial system changes and ongoing support". Another set of researchers found that factors that seemed to predict the successful initiation of PPIP included "a medium patient load, the ability to serve low-resource populations, prior attempts to implement categorical programs, existence of the philosophy of prevention, and pre-implementation planning". From these and other studies, one must conclude that programs such as PPIP can have some impact on the delivery of preventive services, but this requires providing external resources such as a nurse facilitator, tailoring the interventions to the needs and capacities of individual practitioners and practice environments, finding a champion, and finding ways to institutionalize the process.

Genetic screening and family history

Yoon et al (2002) point out that "DNA-based testing is limited for the most part to analysis of highly penetrant single gene disorders that account for approximately 5 percent of the total disease burden in the population" and that therefore we should not look to such tests contributing much for some years to our ability to predict the onset of common diseases and treat them appropriately. Instead, they suggest that family history can be used with some degree of reliability to detect people at high risk, making them a natural focus for disease prevention, screening and early intervention.

Preventive treatment early in the disease process

While all treatment is a form of secondary prevention, some forms of treatment are really primary prevention for other conditions. In chronic disease prevention, two forms of treatment are of particular importance:

- the treatment of tobacco dependence, which prevents a wide range of chronic diseases, and
- the prevention of hypertension, which prevents cardiovascular and renal disease.

A recent US Guideline on tobacco cessation, based on a review of 3,000 articles in the peer-reviewed literature between 1975 and 1994 and a further 3,000 article published between 1995 and 1999, made the following key points:

- Brief tobacco dependence treatment is effective, and every patient who uses tobacco should be offered at least brief treatment.
- There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness.
- Treatments involving person-to-person contact (via individual, group, or proactive telephone counseling) are consistently effective, and their effectiveness increases with treatment intensity (e.g., minutes of contact).
- Three types of counseling and behavioral therapies were found to be especially effective and should be used with all patients attempting tobacco cessation:
    - Provision of practical counseling (problemsolving/skills training).
    - Provision of social support as part of treatment (intra-treatment social support).
    - Help in securing social support outside of treatment (extra-treatment social support).
- Numerous effective pharmacotherapies for smoking cessation now exist. Except in the presence of contraindications, these should be used with all patients attempting to quit smoking. Five first-line pharmacotherapies were identified that reliably increase long-term smoking abstinence rates:
    - Over-the-counter nicotine patches are effective relative to placebo, and their use should be encouraged.
- Perhaps the most important finding is that
    - "tobacco dependence treatments are both clinically effective and cost-effective relative to other medical and disease prevention interventions"

and this leads to the key recommendation that health insurance programs, whether public or private, should cover effective tobacco cessation therapies and that clinicians be "reimbursed for providing tobacco dependence treatment just as they are reimbursed for treating other chronic conditions".

Hypertension is the most common reason in Canada for visits by adults to doctors; the successful treatment of hypertension has been shown to reduce mortality, cardiovascular events, stroke and stroke recurrence, myocardial infarction, Alzheimer's dementia, renal

complications and renal failure, and incidence of diabetes . Yet only 50% of Canadians with hypertension are aware of their diagnosis, and only 16% of Canadians with hypertension have adequate blood pressure control. Clearly, this is an area where effective detection and treatment can have a significant impact on health.

The potential for prevention

The potential for prevention can be understood by examining the health and economic costs of chronic diseases to BC, the evidence that prevention has already worked in BC, and the remaining gap between our rates of chronic disease mortality and of risk behaviours and the best rates that have been attained by comparable countries such as those in the OECD. Closing this prevention gap is the principal challenge we face.

Recent estimates of the contribution of tobacco use, physical inactivity and obesity to both deaths and to economic costs reveals the burden these factors place on the people of BC and its economy:

- Tobacco use contributes to 5,600 premature deaths annually in BC, $381 m in direct health costs and $1,720 m in indirect costs, a total of $2.1 billion.
- Physical inactivity contributed to 1,727 premature deaths annually in BC in 1998, $185.7m in direct health costs and $236m in indirect costs, a total of $421 million.
- Obesity contributed to approximately 2,000 premature deaths annually in BC in 1998, $380m in direct health costs and $350 - 450m in indirect costs, a total of $730 – 830 million.

It is not possible to completely avoid all these costs, both because not all these diseases can be completely prevented and because, even if they were, we would develop other diseases and die of other causes in their place that would have their own costs. Nonetheless, a proportion of these diseases are preventable and a (probably somewhat smaller) proportion of the costs should be avoidable, or at least postponable.

It is worth considering the considerable evidence we already have in BC that prevention can and indeed does work, and that the potential of further benefits from prevention is considerable. The effectiveness of prevention can be seen in evidence from B.C. with respect to smoking, lung cancer and cardiovascular disease.

- smoking rates among men in B.C. have declined from more than 50 percent in the 1960's to less than 30% in the late 1990's, while the rates for women have declined from more than 30% to less than 20% in that same period.
- The impact of this decline in smoking rates on lung cancer cases and deaths is clear; new cases of lung cancer in B.C. continued to increase among men until the late 1980's, since when both deaths and new cases have declined. Among women, both in new cases

and deaths continue to increase, reflecting the fact that the decline in smoking among women did not really begin until the late 1970's.

- There has been a dramatic and continuing decline in cardiovascular disease death rates in B.C, which have fallen by more than 50 percent for both men and women between 1950 and 1997.

When compared with citizens of leading OECD countries, British Columbians have the second highest life expectancy in the world, according to a recent report prepared for the Ministry of Health Planning (Bearing Point and Conference Board of Canada, 2003), with Icelandic males and Japanese females being the only ones to surpass life expectancy for BC males and females respectively. However, for the 12 OECD countries for which data on disability-free life expectancy (DFLE) was available, BC's DFLE was exceeded by Japan, Austria, Germany and Switzerland for both males and females. And when age-standardised mortality rates for major chronic diseases in BC and some of the main countries in the OECD are compared,[4] while BC compares favourably in many cases, there are nonetheless significant gaps between the mortality rates in BC and the best rates attained in some of these other countries.[5] These gaps suggest the potential for prevention that remains.

- On the positive side, the study found that, compared to those OECD countries for whom data was available, B.C. has:
    - the lowest rate of cerebrovascular disease mortality
    - the second lowest rate of deaths from
        - all causes
        - all cardiovascular disease
        - colon cancer
    - the third lowest rate of deaths from
        - all forms of cancer
        - breast cancer
    - In addition, the age-standardized mortality ratio for BC is lower - sometimes dramatically lower - than in the USA for all causes except prostate cancer.

However, on the negative side, B.C. lags behind

[4] Surveillance and Epidemiology Unit, Population Health and Wellness, Ministry of Health Planning (unpublished report, 2003)

[5] The study unfortunately excludes the U.K., France, Italy, and Canada as a whole, for whom comparable ICD-10 data was not yet available.

- Japan, for all causes, especially cardiovascular diseases, as well as breast and prostate cancer
- Finland, for deaths from all causes of cancer, especially colon cancer and also breast cancer
- Iceland, for deaths from diabetes
- Spain, for deaths from ischaemic heart disease
- Sweden, for deaths from lung cancer.

When it comes to some key lifestyle determinants of chronic disease the evidence is also mixed:

- Japan, Norway, Switzerland, Sweden, the Netherlands, Denmark, France, Ireland, Belgium, Finland, and Germany all have lower rates of obesity;
- on the other hand, with a rate of 16%, BC has the lowest rate of smokers age 15 and older among all OECD countries, including Canada; in the USA, only Utah, at 13.9%, has a lower smoking rate then BC (Bearing Point and Conference Board of Canada, 2003)

Unfortunately, OECD data were not available for physical activity.

Reducing the burden of chronic diseases and promoting the health of the people of BC is one of the most important tasks that we face as a society today, not only because of the economic and social benefits, but because it is the right thing to do. Thus we should act in the face of uncertainty, applying what evidence we have, with due regard for both the strength of the association and the weight of the evidence. Indeed, we should undertake prevention even if it were to cost money - as indeed it might, under some forms of economic analysis - for the same reasons that we treat disease; not for economic gain, but because it is the hallmark of a civilised, humane, caring and compassionate society.

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1. Introduction

This paper is a companion piece and sequel to the first paper in the series – "A Framework for a Provincial Chronic Disease Prevention Initiative". Like the first piece, and consistent with the approach taken by the World Health Organisation (2002), the US Centers for Disease Control and Prevention (2003), the National Public Health Partnership in Australia (NPHP, 2001), the Chronic Disease Prevention Alliance of Canada (CDPAC), the BC Chronic Disease Prevention Alliance and the emerging Pan-Canadian Healthy Living Strategy, it focuses primarily on a selected set of physical diseases (cardiovascular disease, some of the principal cancers, chronic respiratory disease and diabetes [6]) that share a common set of risk behaviours (smoking, unhealthy eating patterns, physical inactivity). The evidence summarized herein suggests that in addition to specific strategies aimed at the common risk factors and the set of physical diseases that are the focus here, there are also common strategies that can contribute in general to the prevention of a wide range of chronic disease, as well as effective interventions for a variety of specific chronic diseases. As Professor Robert Evans has noted:

> "The evidence continues to strengthen, that patterns of health in a particular society are deeply rooted in the social and economic structure of that society. That same evidence suggests that that there is no limited set of well-defined policies to change these deep-rooted patterns. Furthermore, to the extent that the behavioral and biological responses to stress are biologically embedded in early life, the time horizon for significant impact may be measured not in years but in decades, or even generations." (Evans, 2002)

1.1 The burden of chronic disease

Three priority non-communicable conditions between them account for almost three-quarters of the burden of disease in British Columbia and in Canada (Table 1). These conditions are:

- selected chronic diseases (heart disease, cancer, chronic respiratory disease, and diabetes) that share three principal common risk factors (smoking, unhealthy eating patterns, physical inactivity)
- injuries, both unintentional and intentional
- mental health problems and addictions disorders.

The four categories of disease that are the focus of the provincial chronic disease prevention initiative together accounted for almost half (48.6%) of the burden of disease in BC in 1998, expressed as DALYs [7] (Table 1). The economic cost of these chronic diseases in British

[6] The NPHP includes mental health in its definition of chronic disease, but has developed a separate mental health strategy, while both CDCP and CDPAC exclude mental health from their definition of chronic disease

[7] Disability-adjusted life years, which combines years of life lost due to 'premature' death with years of life lived with a disability, weighted according to an assessment of the severity of the disability.

Columbia is very high, as shown in Table 2, which shows the direct and indirect costs for the diseases that are the major focus of concern in this report, namely cardiovascular disease, cancer, chronic obstructive pulmonary disease [8] and diabetes. [9] Together they account for roughly one-sixth of the direct and one third of the indirect costs of illness in BC.

[8] In the case of respiratory diseases, this total is for all respiratory diseases: chronic obstructive pulmonary disease (COPD), bronchitis, emphysema and asthma contributed 43.9% of all respiratory system deaths in BC in 2002, while asthma and chronic respiratory disease contributed 20.1% of all respiratory system hospital and medical costs in BC in 2001/2 (Surveillance and Epidemiology, Population Health and Wellness, MOHP). For Canada (comparable figures are not available for BC), COPD and asthma accounted for 51% of the mortality-related costs and 85.3% of the morbidity costs due to long-term disability, but only 2.8% of the short-term disability costs; pneumonia, influenza and acute respiratory infections accounted for20.5% of these latter costs (Health Canada, 2002).

[9] In the case of endocrine diseases, this total is for all endocrine diseases: diabetes contributed 78.7% of all endocrine system deaths in BC in 2002, and 55% of all endocrine system hospital and medical costs in BC in 2001/2 (Surveillance and Epidemiology, Population Health and Wellness, MOHP)

Table 1: The Burden of Disease in British Columbia, 1998

(Source: BC Ministry of Health, 2001)

Cancer	20.7% of DALYs	
Cardiovascular disease	18.3%	
Injuries	12.2%	(9% unintentional, 3.2% intentional)
Mental disorders	11.0%	
Neurological & sensory disorders	8.7%	
Chronic respiratory disease	6.5%	
Musculo-skeletal diseases	3.4%	
Digestive disorders	3.2%	
Diabetes mellitus	3.1%	
TOTAL =	**87.1%**	

****

Table 2: The costs and proportion of costs of selected chronic diseases in BC, 1998
(Source: "Economic Burden of Illness in Canada" website, Health Canada)

Chronic disease	Direct costs	Indirect costs
Cardiovascular disease	$873m (7.4%)	$1,632m (14.7%)
Cancer	$383m (3.2%)	$ 843m (7.6%)
Respiratory disease (acute and chronic – see footnote above)	$453m (3.8%)	$ 767m (6.9%)
Endocrine disease (mainly diabetes – see footnote above)	$196m (1.7%)	$ 271m (2.4%)
TOTAL	**$1,905m (16.1%)**	**$3,513m (31.6%)**

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NB: A significant proportion of the costs (57.8 % of direct costs and 9.8% of indirect costs) are in the categories of “unspecified”, “ill-defined conditions”, “wellness”, and “other”. Thus cardiovascular disease actually accounts for 17.4% of direct costs that can be attributed to a specific disease category or condition.

2. The chronic disease prevention framework

Based on a review of the evidence concerning the wide range of factors and conditions that play an important role in the development - or avoidance - of chronic disease, a model has been developed [10] showing the relationship of these factors and conditions to each other and to the outcomes, namely biological changes and disease itself (Figure 1). This model has been developed in the context of an understanding of 'chronic disease' as encompassing not only a selected set of physical diseases (cardiovascular disease, some of the principal cancers, chronic respiratory disease and diabetes) that share a common set of risk behaviours (smoking, unhealthy eating patterns, physical inactivity), but as well other chronic conditions (such as musculo-skeletal disorders and neurological and sensory disorders, mental health disorders and addictions) that all share with these diseases a common set of social, economic, environmental and cultural circumstances, and living and working conditions, that influence their onset. Genetic, psychological and other biological factors that can contribute to or protect against risk are also included in the model. Where possible, the proportionate contribution of these different factors to the burden of disease is indicated.

In addition to the determinants, which are the 'boxes' in the model (Figure 1), the model also integrates the various strategies that need to be used to change these determinants. Thus on the left part of the model is a set of 'primordial' prevention [11] strategies that is drawn from the Ottawa Charter for Health Promotion (WHO, 1986), while on the right side are the more clinical primary prevention strategies that can be drawn from the Canadian Task Force on Preventive Health Care. Once the disease is present, the clinical components of the chronic disease care model come in to play, so at the right hand edge, the model links up to chronic disease management.

A key factor linking the broad environmental determinants to the biological changes in chronic disease is the psycho-neuro-immune system. Evidence suggests the pathway from environment to mind to body is a crucial one and that it is important throughout life. The reference to life course (which should not be understood literally as running in a linear fashion across the model, but as interacting with all elements of the model) indicates that many of the determinants of chronic disease exert their influence from before birth – indeed from before conception – throughout life and into old age. Thus interventions, although often appropriately focused early in life, may need to be made throughout life, and indeed over several generations, in order to be effective. Such interventions need to be not only preventive or protective (essentially defensive, or anti-disease), but also health-enhancing, or 'salutogenic'

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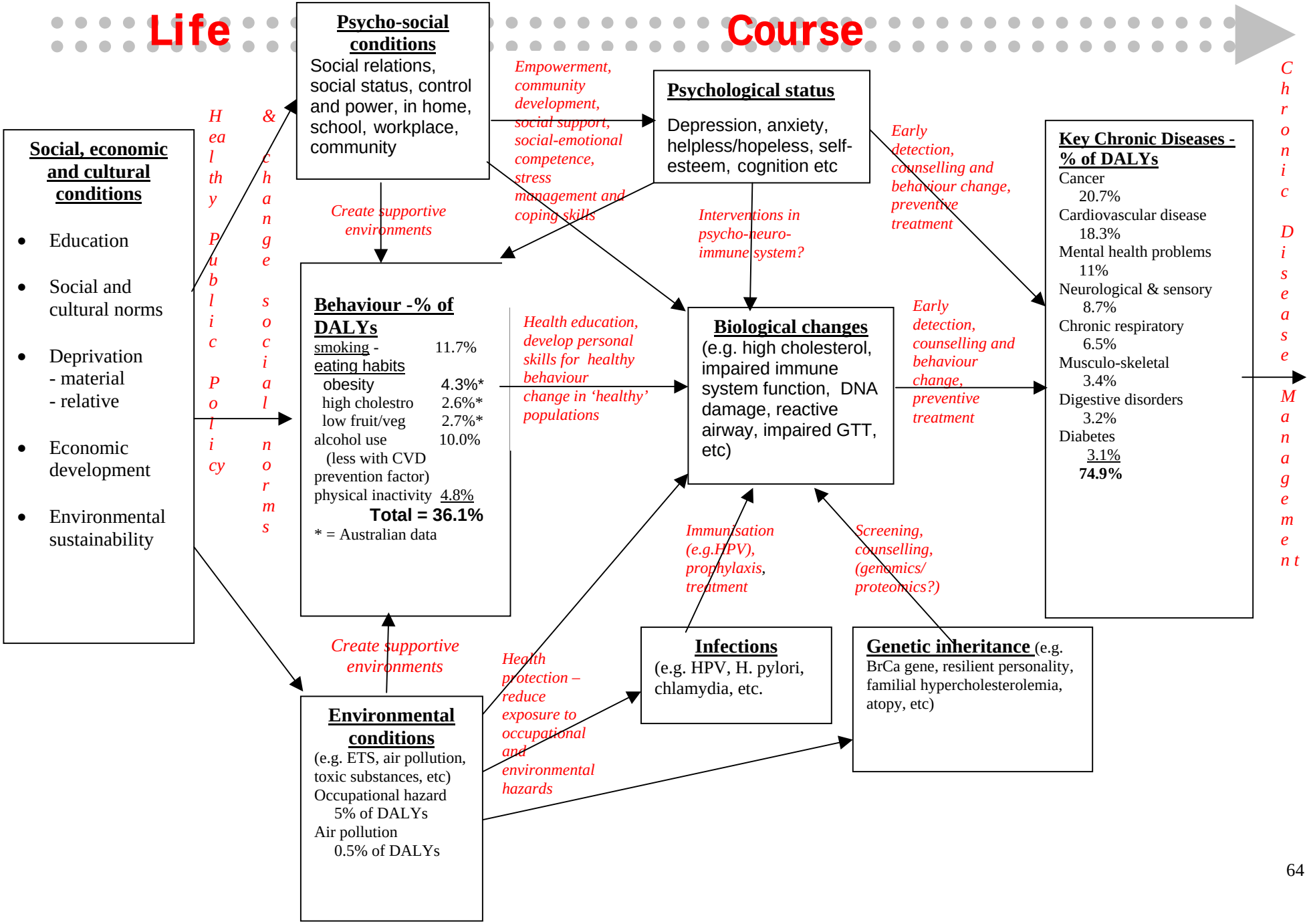
10 It is worth recalling the sage advice of the distinguished statistician George Box that "All models are wrong - but some models are useful". This model is no exception; for the sake of clarity in what is already a complex model, not every relationship is shown, although some additional aspects of those relationships are discussed in the text.

11 Primordial prevention involves "actions and measures that inhibit the emergence and establishment of environmental, economic, social and behavioural conditions, cultural patterns of living, etc., known to increase the risk of disease" (Last 2001)

FIGURE 1 - CHRONIC DISEASE PREVENTION MODEL



(Antonovsky, 1979), building – and building on – the capacites and the resilience of both individuals and communities.

The components of the model are briefly reviewed below, involving a discussion of the determinants, the interventions, psycho-neuro-immunology, the life course, and salutogenesis.

2.1 Determinants

- Social, economic and cultural conditions influence behavior, psychosocial conditions and physical environments. Interventions involve the development of healthy public policy and the changing of social norms and societal values, which requires health impact assessment and health advocacy for health in a wide range of "non-health" sectors.

- Psychosocial conditions (social relations, social status, and power and control) in homes, schools, workplaces and communities influence psychological status and behavior, and also influence biological factors through the psycho-neuro-immune system (see section 2.3). Interventions include the creation of supportive psycho-social environments, community development and empowerment in the settings in which people lead their lives, the development of social-emotional competence, and stress management and other potential interventions in the psycho-neuro-immune system.

- Environmental conditions in the built environment (homes, schools, workplaces, communities) and in the natural environment influence psychological status and behavior, and produce biological change both directly and via infections and genetic change. Interventions include the creation of supportive physical environments (especially built environments) and protecting people from exposure to environmental hazards such as toxics or micro-organisms in air, water and food that are associated with chronic disease.

- Psychological status is shaped from infancy and throughout life by broad social, economic and cultural conditions, by more immediate psycho-social and environmental conditions, and by biological and genetic factors. Psychological status in turn shapes behaviour and may directly cause biological change through the psycho-neuro-immune stystem. Interventions include efforts to create positive psychological characteristics through modifying the social relationships and the psycho-social environment in homes, schools and workplaces, helping young people to improve their social-emotional competence, and helping people to learn effective stress management and coping skills.

- Behaviour is shaped by social, economic, cultural, psychosocial and physical environment conditions, and by psychological status. Interventions (other than those already discussed aimed at the determinants of behaviour) include health education to change knowledge and attitudes and to assist people in developing self-health-care skills that enable them to look after their own and their families' health and wellbeing; these interventions are intended mainly for currently healthy populations.

- Infections are of growing interest as potential contributors to the development of chronic disease. This suggests potential preventive interventions including behavioural change, immunization, prophylaxis and treatment of those infected both to prevent development of chronic disease in themselves and to prevent transmission to others.

- Genetic inheritance interacts with the other determinants, which help to determine the extent to which genetic predisposition is expressed. There are few direct interventions at present that will modify genetic inheritance, although over time it may be possible to intervene with genomics. In the meantime, screening and counselling for those at high risk of transmitting genetic predisposition for chronic diseases, and screening during pregnancy to identify fetuses with congenital anomalies and genetic disorders, are the principal interventions.

- Biological change is the final stage in the process prior to the onset of symptomatic and clinically apparent disease. For example, in the case of cancer, DNA damage and other early steps in the process of carcinogenesis may precede the clinical onset of cancer by many years; indeed, if the damage is repaired or its effects suppressed, clinically apparent disease may not occur. Interventions here are essentially secondary prevention, since the disease process has already been initiated. Interventions include early detection, behavioral modification (but now targeted to those at high risk and with early changes) and treatment of precursor conditions to reverse the change prior to the onset of frank morbidity.

2.2 Interventions

Interventions to prevent chronic disease fall into two broad categories. One set of interventions is based on the Ottawa Charter for Health Promotion, and as such primarily addresses the broader determinants of health through interventions that are political, environmental, economic and social in nature; these tend to be clustered on the left side of the model. The second set of interventions is more focused on individuals, and ranges from psycho-social interventions to clinical interventions; they are more to the right side of the model. There is a degree of overlap between these two categories of intervention.

- Developing healthy public policy: Healthy public policy refers to the development of public policy that supports, faciltates and promotes good health - and for that matter, private sector policy where it has an effect on the health of the population - in non-health sectors. Given the importance of these non-health sectors as determinants of population health, the development of healthy public (and private) policies may be more important for the prevention of chronic disease than anything that occurs within the health policy field. For example, urban design and transportation policies have an influence on physical activity, while the policies and practices of the fast-food industry have important implications for obesity and fat consumption. Policies that affect social inequality, which is known to be related to differential rates of chronic disease, are also important.

- Changing social norms and societal values: One of the most effective strategies to prevent chronic disease in recent years has been the emergence of the non-smokers' rights movement, which has changed the norm regarding the social acceptability of smoking. This in turn has led to measures such as legislation to protect non-smokers and even the prosecution of the tobacco industry. Further progress in preventing chronic diseases will require changes in the social norms with respect to issues such as portion size in restaurants and at home, the social acceptability of active living, social expectations around physical appearance, what constitutes a pleasing diet and so on. These norms and values cannot be imposed, but they can be modified through a broad societal effort, as the example of tobacco shows.

- Creating supportive environments: Individual behaviours, community life styles, social norms and societal values are influenced by our social and physical environments. If we create environments that support or reinforce unhealthy ways of life, we should not be surprised if people and communities make unhealthy choices. We have to make the healthy choice the easy choice by creating social and physical environments that support those choices in our homes, schools, workplaces, care facilities and communities.

- Protecting people from hazards: People may be unwittingly and unwillingly exposed in their homes, schools, workplaces and communities to chemical or biological factors that contribute to chronic diseases . Examples include urban air pollution, persistent organic pollutants in food, carcinogens in the workplace or infectious agents in the blood supply. Protecting people from these hazards is an important role for governments and industry.

- Empowerment, community development and social support: Enabling individuals and communities to exert greater control over the factors that determine chronic disease has both direct and indirect impact on their health. The direct impact stems from the well-established role of social support in determining health status and longevity, mediated no doubt through the psycho-neuro-immune system. The indirect impact results from the ability of empowered individuals and communities to create supportive environments, push for healthier public policies and in other ways alter the determinants of chronic disease.

- Enhance social-emotional competence: At the individual level, enhancing the competence and effective functioning of the individual - in the context of supportive social environments - strengthens their ability to make positive choices that will result in lower levels of risk and of chronic disease for themselves and their families.

- Stress management and coping skills: In light of the evidence of the important role of stress in altering physiological functioning in ways that may contribute to a wide variety of chronic diseases, it is important to help individuals to better cope with adverse conditions and to manage stress more effectively. However, this needs to

occur within the context of the creation of social and physical environments that reduce the stress to which people are subjected.

- Prevention of infections linked to chronic diseases: Given the growing evidence of the role of some infectious organisms in the development of some chronic diseases, interventions to prevent and/or treat such infections before the onset of the chronic disease is likely to assume increasing importance. This may be accomplished through behavioural change, immunization, prophylactic treatment, or reducing or eliminating the organism in the environment.

- Genetic screening and counseling: As research continues to identify genes that increase the probability of developing specific chronic diseases, the importance of genetic screening will increase. However, as with all screening, it is essential that an effective intervention and/or counselling be available for those in whom a genetic marker or abnormality is detected.

- Early detection/screening: The detection of pre-symptomatic, sub-clinical or early clinical changes that mark the early development of chronic diseases, while not primary preventive in nature, remains an important means of preventing the full clinical condition from emerging. In some cases, early detection can lead to fully effective treatment (surgical excision of cervical carcinoma-in-situ, for example).

- Counselling, behavioral change and preventive treatment: These forms of intervention in those who already exhibit biological change or clinical disease are secondary prevention, in that they do not prevent the onset of the disease, but they do prevent, delay or slow down progression. Counselling and behavioural change services help people acquire the self-health-care skills that enable them to change their risk behaviours and slow or even reverse the risk factors they exhibit, while self-medical-care skills may include self-management of chronic diseases. Moreover, in some cases the treatment of one condition (e.g. hypertension) can prevent the onset of a second condition (e.g. stroke). As such, these interventions may straddle the boundary between chronic disease prevention and chronic disease management.

2.3 The pathway from environment to mind to body

Psycho-neuro-immunology provides a scientific model to explain something that has been common knowledge in many cultures for centuries: stress, being out of balance with one's self and one's community, can result in physical and mental disease. Psycho-neuro-immunology (Ader, 1980) provides a plausible biological mechanism - and one that has been verified in a wide variety of experiments - that shows how environmental stressors can result in abnormal physiological changes that are the precursors of disease. The mechanism by which these psychological and behavioural factors influence health and disease is presumed to be through the psycho-neuro-immune system, in which the central nervous system "'talks to' the immune, hormone and clotting systems" (Kelly, Hertzman and Daniels, 1997). Moreover, it is presumably through this mechanism that the social environment may affect the body, through

a process of "'biological embedding' wherein life experiences condition individual biological responses", a process that is presumed to account for much of the "systematic differences in resilience and vulnerability to disease across the range of social class experience" (Kelly, Hertzman and Daniels, 1997). [12]

The first stage in this process is the perception of an environmental stressor as a stress (if it is not perceived as a stress, consciously or subconsciously, it presumably has no effect). A negative emotional response to perceived stress influences the hypothalamic-pituitary-adrenocortical axis (Figure 2):

- the hypothalamus is a part of the brain that influences the pituitary gland, which secretes a number of hormones that regulate the function of endocrine glands, including the adrenal cortex, the thyroid gland and the ovaries, among others;
- the pituitary gland also secretes growth hormone, while a variety of neuropetides that are also responsive to stress play a variety of roles in the neuro-endocrine system;
- the adrenal medulla secretes more adrenaline in response to stress, while the adrenal cortex secretes more cortisol and other steroids.

While the response to stress involves increased secretion of adreno-cortical and other hormones and neuro-peptides, chronic stress can in effect deplete the adrenal cortex, resulting in lower levels of cortisol secretion. Since cortisol is involved in the inflammatory process, lower levels of cortisol can result in changes in the inflammatory process, as well as in other immune functions (Wright, Rodriguez and Cohen, 1998).

The psycho-neuro-immune system is thus the pathway for transmission of psycho-social environmental challenge to the body, a process that occurs throughout the life course; it mediates to an extent the role of the social environment in the development and prevention of chronic (and other) diseases.

12 The issue of the social environment and the way it may affect health through this psycho-neuro-immune system is addressed in section 3.3.

Figure 2 Hypothalamic – pituitary – adreno-cortical axis

Source: Marmot and Wilkinson, 1999, Chapter 2

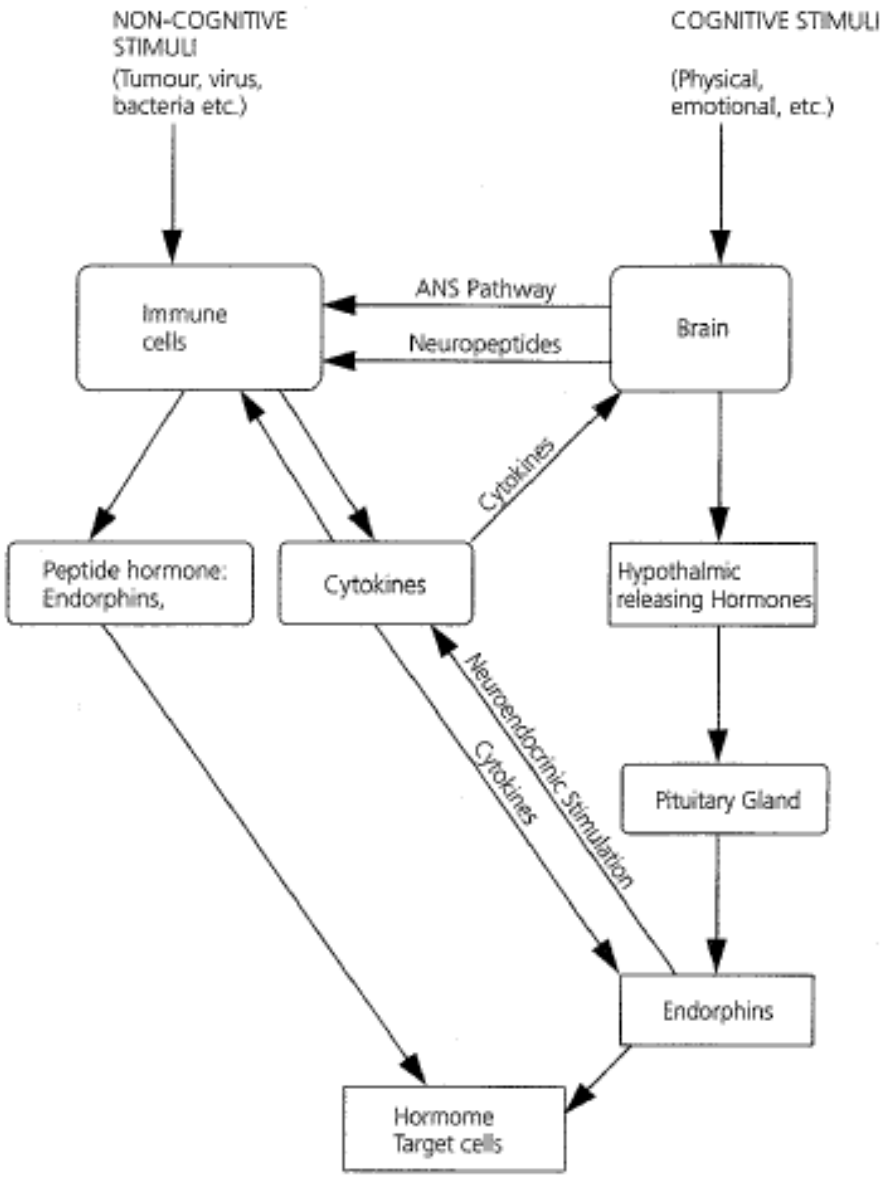


Fig. 2.6 Communications between brain, hypothalamic–pituitary–adrenal axis, and immune system. The brain perceives cognitive stimuli which can influence immune function via neuropeptides, the autonomic nervous system (ANS), and the HPA axis. The immune system responds to non-cognitive stimuli (infection and tumour growth) by secreting cytokines (immune messengers) and peptide hormones which act on the brain and neuroendocrine system. The immune system thus has a sensory function. (Redrawn from Brown 1994.)

2.4 The life course and health development

There is growing evidence linking chronic disease prevention to the preconception and prenatal health of the mother, and to healthy infant and child development - it seems that early life experience can 'imprint' both physiologically and psychologically in a way that affects the expression of disease throughout the life course.

> "The life course may be regarded as combining biological and social elements which interact with each other. Individual biological development takes place within a social context which structures life chances so that advantages and disadvantages tend to cluster cross-sectionally and accumulate longitudinally. Exposure to one environmental hazard is likely to be combined with exposure to other hazards and these exposures are likely to accumulate over the course of life." (Blane, 1999)

The various societal conditions that affect the development of chronic disease appear to exert their effect on health through two main pathways: either their effects contribute to or result from differential access to the determinants of health - a process that has been referred to as social programming - or their effect on the psyche and on the body directly alters biochemistry, physiology and cellular and organ functioning – biological programming.

Social programming also affects the development of the social-emotional competence of the individual, which not only affects their internalised sense of self, and thus their resilience in the face of challenge, but also affects their ability to develop skills that enable them to avoid or successfully manage the challenges - physical or psycho-social - that are inherent in life.

According to Brunner and Marmot (1999) the process of biological programming begins with biological stressors occurring before birth such as maternal malnutrition, maternal smoking or infection, and continues through infancy, in particular in response to stressors such as malnutrition and infection; to this list might be added exposure to toxins in utero. These early changes have life-long impact because "The in-utero environment programs organ systems of the developing fetus that change the person's likelihood of developing chronic disease later in life" (Marmot, 1999).

In both cases, these changes interact with the genetic and acquired biological programming of the individual and their impact - whether positive or negative - accumulates over the course of an individual's life, affecting their psychological and physiological resilience to challenges to their health, a process that Cl;yde Hertzman has referred to as the 'biological embedding' of life experience.

Wadsworth (1999) cites Sylva to the effect that there are sensitive (a better word than critical) developmental periods such as "the child's particular sensitivity to caretaking at ages 6-8 months" and a "sensitive period of intellectual and linguistic development" at age 12-13 months, while Blane (1999) points to work by Bartley et al who have identified a set of critical social transitions which include:

- the move from primary to secondary school

- labour market entry
- establishing own residence
- occupational change
- onset of chronic illness
- retirement from paid employment.

These social transitions were the basis for a report by the Premier's Council on Health in Ontario that proposed a strategy for population health improvement based upon them (Premier's Council, 1994).

In a major review of the research on the life course and health development, Halfon and Hochstein (2002) suggest that there are several key concepts that underpin the current scientific understanding of health and human development:

- embedding - "the process by which experiences are programmed into the structure and functioning of biological and behavioral systems"
- risk and protective factors that interact
- a life course perspective - "experiences at the beginning of life relate to functional outcomes during the middle and end of life"
- multiple determinants of health - "environmental, social, psychological and biological systems interact to influence health and developmental outcomes"
- trajectories of development - "changes in functional status over time" – i.e. ageing.

Health development is defined by Halfon and Hochstein (2002) as "a lifelong adaptive process that builds and maintains optimal functional capacity and disease resistance". They suggest that "multiple nested environments" (historical, cultural, social, environmental and economic), usually correlated with other influential factors, influence the life path from childhood onward. Early life experiences are particularly influential "because of the persistence of bio-behavioral attributes that are acquired early in life", although they are not deterministic - people do remain malleable throughout life.

These larger environmental and life experiences are 'translated' into "biological information that alters the functioning of biological processes" through the psycho neuro-immune system, as described above. This system, although present at birth, is not fully functional then but is "adaptively programmed in response to different experiences". Throughout life, "stress-induced wear and tear" (allostatic load) such as family stress and conflict alters the functioning of the neuro-endocrine system; these changes can be detected using biological markers. Halfon and Hochstein suggest that "health development can be understood as the interaction between cumulative and programming mechanisms, which are controlled by genes,

experiences, and past adaptive responses". Cumulative mechanisms, which are dependent on dose or exposure, may involve a pattern or clustering of risk as well as "chains of risk" that build upon each other, while programming mechanisms involve exposures which are dependent on critical or sensitive developmental periods, often early in life. During these sensitive periods of development, environmental, hormonal or other influences "can serve as programming agents that deactivate, activate, or alter functional pathways ", with lifelong effects. For example, they cite the work of researchers in the U.K. who have found that factors such as birth weight, placenta size, and weight gain and growth in the first year of life are associated with chronic illnesses such as cardiovascular disease, diabetes or hypertension decades later. The mechanisms for such fetal programming involve adverse maternal environments affecting placental hormonal function, which in turn affects hormonal response patterns in the fetus, and thus physiological responses affecting the cardiovascular system, the insulin-glucose system, the renal system, and the hypothalamic-pituitary axis.

> " . . . these potential long -term effects raise important policy questions about the potential value of concentrating resources on improving and optimizing the initial developmental status versus concentrating on reducing risks and promoting positive outcomes for persons already exposed to less optimal initial conditions."

Clearly, the 'initial developmental status' needs to be understood in terms of the health of women long before they are pregnant, and not just during their pregnancy.

Halfon and Hochstein (2002) suggest that if we want to improve health over the long term, we need to pay attention to:

- critical/sensitive periods during the life span - "during these past two decades, epidemiological studies have found an independent predictive effect for adult disease and disability of prenatal and early childhood factors . . . ; maternal socio-economic circumstances and attachment to the child; the child's educational attainment; and divorce by the parents and their smoking behavior"

- important transitions and turning points, which are times of rapid change that lead to increased vulnerability. These transitions include "starting nursery school, entering middle school, or entering or leaving the work force" [13]

- multiple time scales - our natural or biological clock is also influenced by social and cultural change. For example, puberty is occurring earlier, while adolescence is extending into the twenties; on the other hand, many older people have lost their social status as elders and have become isolated and uncared for.

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13 This corresponds to the concept of a "life-events score" (Holmes and Rahe, 1967), in which the cumulative total of stressful life events - not all of them negative - can be used to predict the likelihood not only of chronic disease but of injuries and acute illnesses as well.

2.5 Salutogenesis and capacity-building

Underlying much of our understanding of the determinants of chronic disease and our approach to prevention is the concept of 'salutogenesis'. This term – based on the Latin word salus, meaning health - was created by Aaron Antonovsky (1979) as the antonym of pathogenesis, which is concerned with the development (genesis) of pathology. Antonovsky pointed out that we had focused most of our attention on why and how people become sick, and had paid little attention to the equally - indeed, perhaps more – interesting question of why and how they became or remained healthy. Based on his research on concentration camp survivors, and later on cancer survivors, Antonovsky suggested a set of positive attributes – sense of meaning or purpose, sense of comprehensibility (understanding the circumstances in which one finds oneself), and a sense of manageability (the situation can be handled) – which he called a sense of coherence. Others have found a wide range of factors - self esteem, resilience, social-emotional competence, social networks and many others - that are related to better health. In most cases, these factors have a generalized benefit on health, reducing a wide range of health problems.

When it comes to interventions to improve health and prevent chronic disease, efforts to increase these positive factors have become an important strategy, as will be discussed later. What they share in common is an approach that focuses on building – or more accurately, building on – the capacity of individuals and communities. If the strengths, skills and abilities that people already possess to a greater or lesser extent can be further enhanced, then it is more likely that they can make wise and healthy choices, resist the blandishments of those – their peers, the marketers of unhealthy products, etc - who would persuade them to make unhealthy choice, and respond more effectively to, and cope more effectively with, challenges to their health.

3. Evidence regarding the determinants of chronic diseases (especially heart disease, cancer, chronic respiratory disease, and diabetes)

The evidence in this section of the report is presented beginning with the most immediate determinants of chronic disease, and working back up the chain – or, more accurately, the web – of causation or protection. The concept of a causal web is important to an understanding both of the evidence with respect to the determinants of chronic disease and – even more important - the range of strategies and specific interventions that must be deployed if the massive toll exacted by chronic disease is to be reduced.

3.1 Complex causation and decision-making

Blane (1999, p 66) comments with respect to factors leading to disease that

> "What appears to be important is not any one factor which has a major long-term influence on health, but a number of comparatively small differences which become linked into a chain of disadvantage"

The concept of causal chains or webs is used to explain the complexity of the interactions of multiple risk factors - genetic, biological, behavioural, psychological, environmental, social, economic, cultural - that ultimately determine health status. There is seldom if ever a simple 'single cause, single effect' relationship in chronic disease. Moreover, in a statement made in the context of mental health, but also true for chronic physical disorders,

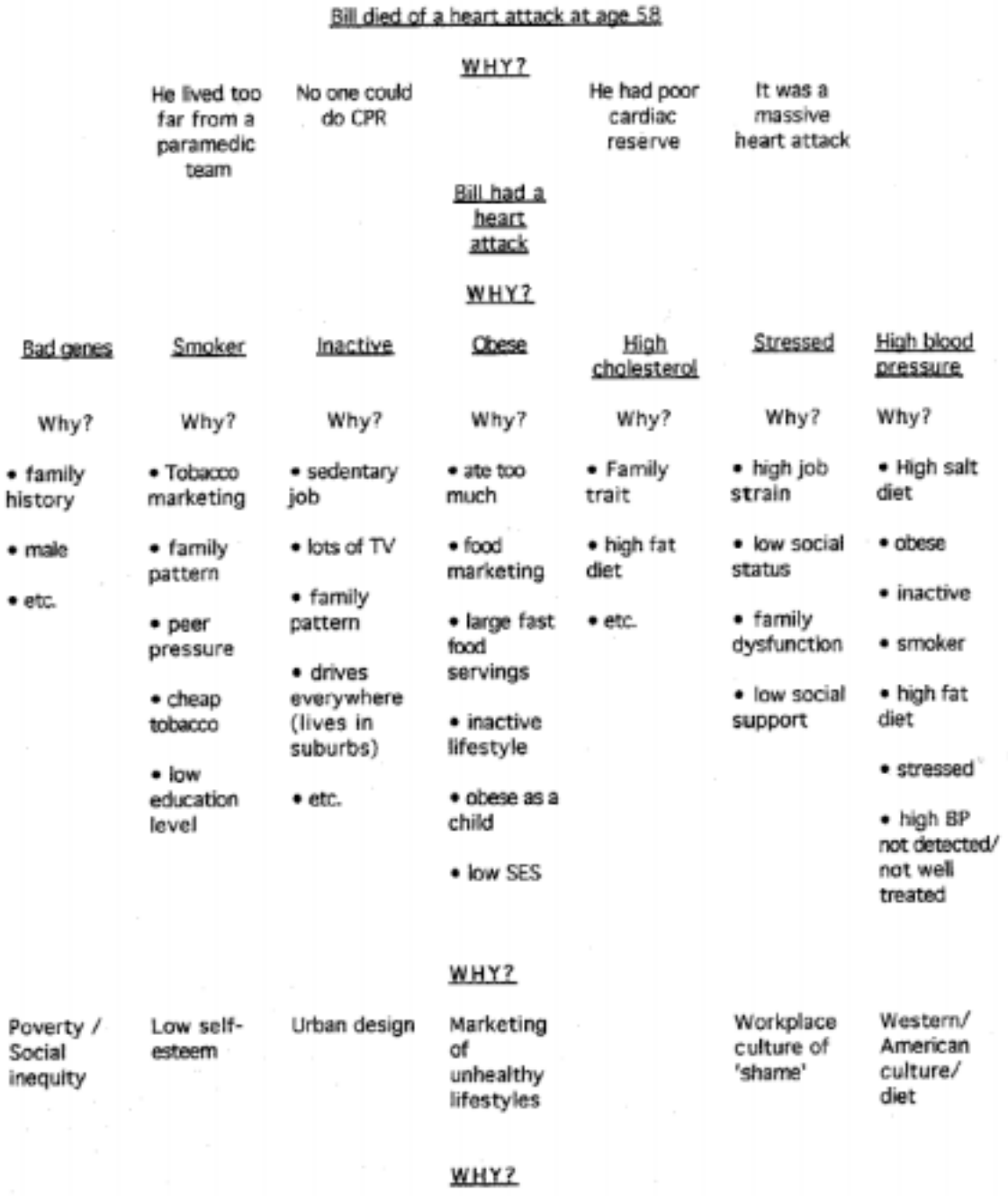
> ". . .we are unlikely to prove all the steps in the 'causal chains' for mental problems and mental disorders. Many of the important influences on mental health and mental ill health occur early in life, and a wide range of intervening factors affect the outcomes for individuals. The further away in time, or the greater the number of intervening variables between an influence and its outcome, the less likely it is that randomised controlled trial evidence - the 'gold standard' of scientific evidence - will be available or feasible. Yet it is possible to achieve favourable mental health outcomes even without a clear understanding of causation . . ." (Commonwealth of Australia, 2000)

In the Second Report on the Health of Canadians (Federal, Provincial and Territorial Advisory Committee . . ., 1999a) a simple story at the beginning explains why Jason is in the hospital with an infected leg wound. The chain of events includes the fact that he played in a dangerous area, because he lived in a rundown neighbourhood, because his father didn't have much education and was unemployed, and so on. Would that it were so simple!

Figure 3 shows a partial analysis of why Bill might die of a heart attack at age 58.[14] The proximate causes include access to and quality of health care (while making it clear that

14 If we were instead asking why Marie got breast cancer, the list of factors would be much less complex and extensive - not because the causes are less complex but because we know much less about them.

Figure 3 – Partial web of causation for Bill's heart attack



sometimes even that is not enough), but the more interesting set of questions are concerned with why Bill had the heart attack in the first place. A number of factors that contribute to heart disease are listed, and for each of them a number of factors that contribute to that condition - and the list is by no means exhaustive.

But Figure 3 does not even begin to go into the inter-relationships among all these factors or, for the most part, the complexity of the broader psycho-social, socio-economic and cultural factors that underpin these various components of risk. So where exactly do we intervene in this complex web of causation? And how far back up the web of causation should we go? Clearly there is no one single intervention that will prevent Bill's heart attack, although research tells us that some things, such as smoking or psycho-social factors in the workplace tend to be more important than others.

An indication of the complexity we face can be found in an example used by Spencer (2000), who discusses the need for "complex models and pathways which reflect the complexity of the relation between multiple factors acting at different times". He provides an example of a model that examines the relationship between stress and low birth weight (Figure 4). The correlation coefficients in this model show the relationship among the different factors, while the arrows from the outside (e.g 0.78 for "no social support") indicate the amount of variance that is unexplained by the variables in the model. What this demonstrates, at least in this model - and we need to recall that all models are wrong - is that economic stress explains 22% of the variance with respect to social support, 11% of the variance with respect to family stress and, through those mechanisms, 25% of the variance with respect to addictive behaviour and yet, ultimately, only 10% of the variance with respect to low birth weight.

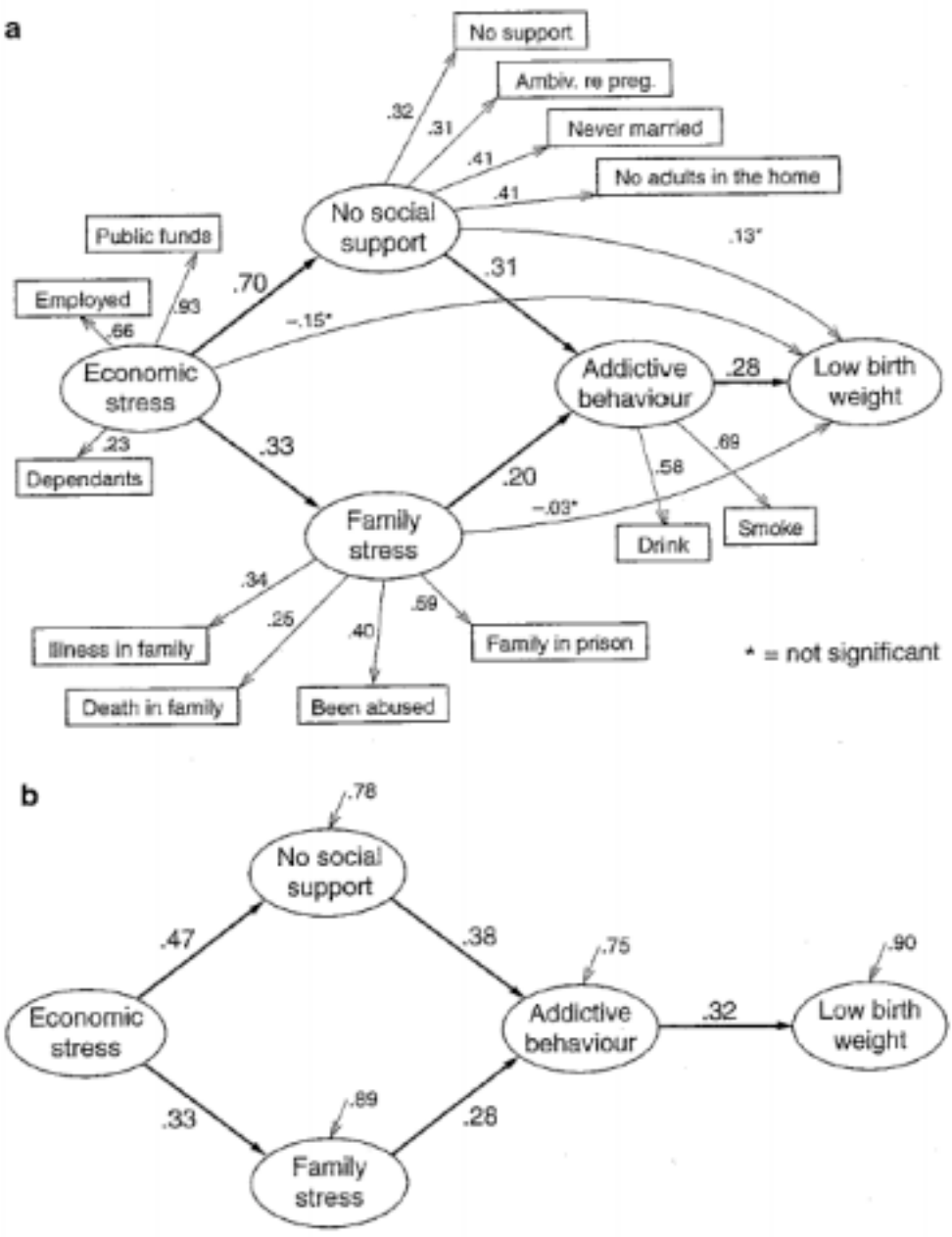
A full understanding of the precise contribution to the burden of disease of the various risk factors, behaviours, environments and conditions that are the subject of this report is quite likely not possible, and is certainly not available today. But we cannot postpone action until we have perfect information. Instead, we need to recognise that in the face of uncertainty , we have to use the best information we have and apply the precautionary principle of environmental science to public health.[15]

15 The Wingspread Statement on the Precautionary Principle – January 1998 states “When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically”, while the “Rio Declaration” signed by hundreds of world leaders in 1992 contains as its Principle 15 “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

Figure 4

The Relationship between stress and low birth weight

(Source: Spencer, 2000)



3.2 Proximate protective and risk factors

Proximate factors are those that operate primarily at the individual level. They may be either protective factors, reducing the risk of chronic disease, or risk factors that increase the risk. Some key proximate risk factors - biological and behavioural - are reviewed first, followed by a review of some key protective factors. However, particularly with respect to behavioural factors, it is important to keep in mind that behaviour is shaped by the community settings in which people lead their lives and by broader societal and cultural conditions.

3.2.1 Biological and psychological factors

Disease is expressed in terms of abnormalities in biological or psychological functioning. Such disease may be ultimately fatal (including psychological disease that may result in suicide) or can result in impaired function that ranges in severity from asymptomatic to gross pathology, from minor to major impairment, and from acute to chronic and life-long disability. Biological and psychological risk factors may be either inherited (a breast cancer gene, a familial tendency for depression or hyperlipidaemia) or acquired over the life-course (immunity arising from infection or immunization, high blood cholesterol levels due to diet, DNA damage that leads to carcinogenesis) or a combination of both (e.g., high blood pressure, a 'hardy' personality), with the expression of the inherited tendency influenced by life events and conditions. Individual susceptibility to disease varies as a result of each individual's inherent or acquired biological and psychological condition; some will be particularly susceptible, others particularly resilient, while the bulk of the population is distributed normally between these two extremes.

- Inherent biological and psychological risk factors, those we are born with, are often (but not always) non-modifiable. Among the key biological and psychological risk factors that affect both individual susceptibility to disease and population-wide disease patterns are the following: sex, age, genetic inheritance (as discussed in more detail below), and the biological variation of these factors across a population.

- Acquired biological and psychological risk factors result from exposure to a variety of physical and social environmental influences throughout life that, while not necessarily causing disease in their own right, can increase our risk of subsequent disease. The extent to which they increase our risk of both initial and subsequent disease depends in part upon the level and duration of exposure and in part upon our inherent or acquired ability to cope effectively with the agent or condition to which we are exposed. Thus acquired biological and psychological risk is also distributed across the population, with the pattern of distribution subject to socio-economic, cultural, gender-related and other community and societal influences. For example, our immune competence is inherent but it is also influenced by our exposure in infancy and childhood to infectious diseases, to immunisation, to chemicals or psycho-social stress that can impair immune competence and so on. Our immune competence in turn may affect the way in which we cope with and respond to infection not only with the conventional infectious diseases, but with 'new' infectious agents that we are now

recognising are related to chronic diseases, such as the human papilloma virus (HPV) that is a causative factor in cancer of the cervix, or the H.pylori bacterium, which is known to be strongly associated with gastric ulcers; some have suggested that infectious agents may also play an important role in other chronic diseases such as heart disease, several forms of cancer and schizophrenia. (Ewald, 2000)

In short, biological and psychological risk factors are complex and interact with the psychosocial and physical environment and societal conditions. Three aspects of biological risk factor are discussed here: genetically inherited factors; factors related to the individuals sex and gender (the former being biological, the latter sociological); and the process of carcinogenesis, which has a genetic component, may be initiated either by endogenous or exogenous factors and may or may not lead to cancer, depending in part on the integrity of the individual's DNA repair mechanisms.

3.2.1.1 Genetic factors

While there is considerable interest in the genetic contribution to cancer, heart disease and other chronic conditions, the actual contribution of our knowledge of the human genome to the prevention of chronic diseases may be less - and certainly less dramatic - than some might hope. This is because, while a single gene may be sufficient to cause a chronic disease like cancer or cardiovascular disease on its own, they are rare; much more common are genes that, in the presence of specific environmental exposures, increase our risk of the disease.

- Tonstad (1998) makes this point with respect to ischaemic heart disease. While mutations have been identified in a number of genes that affect lipid metabolism, "none of the recently described or established genetic markers of increased cardiovascular risk appear to contribute substantially to differences in cardiovascular disease between populations". Tonstad also notes that the differences in hypertension between black populations in different continents are not explained by genetic differences, and that there is "persuasive evidence" that ischaemic heart disease is "strongly influenced by the environment" - which of course, in genetics terms, is everything that is not a gene, including diet.

- With respect to chronic obstructive pulmonary disease, Anto et al (2001) note that it is likely that genetic variants increase susceptibility, but not much is known, and the one genetic factor for which there is clear evidence (the gene that codes for alpha-1-antitrypsin, low levels of which contribute to emphysema), accounts for only 1% of COPD.

- Similarly, Lebovitz (1999) notes that approximately 85% of Type 2 diabetes is attributable to polygenic defects (or alternatively, perhaps, to fetal malnutrition), and that "clinical expression of the disorder requires both genetic and environmental factors".

These 'susceptibility' genes may alter the way that individuals metabolize carcinogens or other substances or repair DNA damage, and in turn may be influenced by hormones, infections,

vitamins or immune factors (Caporaso and Goldstein, 1997). For example, Ozturk and Killeen (1999) note that "in most patients with hyperlipidemia, the disorder results from the aggregate effect of small influences at multiple loci", while O'Shaughnessy (2001) comments that essential hypertension "is currently seen as a 'complex' genetic trait caused by multiple susceptibility genes, the effects of which are modulated by gene-environment and gene-gene interactions" and that while " some familial forms of hypertension are inherited as single-gene disorders . . . they are a small proportion of the total cases".

In population terms, it is the accumulative interaction of multiple susceptibility genes that is important, but such genes are so common (they may have a frequency > 20%) that they do not result in distinct family aggregations (Caporaso and Goldstein, 1995). So while there are examples of single genes causing some forms of cancer, familial hyperlipidemia and other chronic conditions or precursors, their population health impact is likely to be small, even though their familial risk is high.

As Caporaso and Goldstein (1995) note:

> "Rare single genes causing cancer generally result in very high absolute risks and enormous relative risks but low population attributable risks . . . . in contrast, the much more modest relative and absolute risks of the susceptibility genes may be more significant at the population level because the gene is common."

(See Table 3 for a summary of the relative risks of cancer among the siblings of an affected individual compared to the risk to individuals in the general population, for some cancers where a genetic component has been identified, as well as the extent of the heritability of the cancers in question (i.e. the proportion of the variance between cancer rates in affected families and the general population that is attributable to genetic factors, based on twin studies. However, it is worth noting that families share environments as well as genes).

Goldgar (2002) reviewed the literature on population aspects of cancer genetics, contrasting familial risk with population attributable risk and finding "no particular correspondence". For example, an allele occurring in the population with a frequency of one in a thousand people that confers a 25-fold increase in cancer risk for those who carry at least one such allele would convey a familial risk of 1.52, but only 4.6% of all cases in the population would be attributable to this allele. On the other hand, an allele occurring with a frequency of 0.20 (which would mean that 36 percent of all individuals would carry it) but only conferring a doubling of cancer risk to those carrying at least one copy would have a large population attributable risk (24% of cases occurring in the population) but only a low familial risk (1.05). Goldgar concludes that "there is increasing evidence that a high proportion of cancers arise in a susceptible minority who carry low-penetrance genes or gene combinations".

These findings have important implications for interventions, as discussed later, since it appears that no simple, population-wide genetic tests for cancer susceptibility (and by analogy, susceptibility to other chronic diseases) will become available, although identification of high-risk families (primarily on the basis of a family history) can enable members of those families to be counselled and screened.

Table 2: Familial relative risk and heritability for some common causes of cancer (Source: Goldgar, 2002)

(NS = not significant)

Cancer	Familial relative risk	Heritability
Prostate	2.2	0.42
Early (< 60)	4.1	
Breast	1.8	0.27
Early (< 50)	3.7	
Colon	2.7	0.35
Early (< 60)	4.0	
Lung	2.6	0.26
Early (< 60)	2.5 (NS)	
Uterus	1.3 (NS)	0
Melanoma	2.1	-
Early (< 50)	6.5	
Brain/CNS	2.0	-
Cervix	1.7 (NS)	0
Ovary	2.1	0.22
Stomach	2.1	0.28
Thyroid	8.6	-
Testes	8.6	-

3.2.1.2 Sex and gender-based factors [16]

Acheson (1999) points out that "at all stages of life from the fetus to old age, the mortality of males is higher than that of females" and that, even more dramatically, in the UK "women living in the least favourable circumstances have a substantially better mortality experience than men living in the most favourable conditions". The authors of the report of the Independent Inquiry into Inequalities in Health (1998) also note that "mortality is greater in males at all ages" and that these differences are greater in more deprived areas than in relatively affluent areas. They also note that while it is generally true that females have higher rates of morbidity than males, "in more detailed analysis, this generalization often does not hold true," varying by age group, the type of morbidity under consideration and how it is measured.

In Canada, life expectancy for males has been less than that of females throughout the 20th century. Thus females born in 1901 had a life expectancy of 50.1 years, which was three years longer than that of males (Bourbeau and Légaré, 1982). The gap widened until, in 1971, life expectancy among females, at 76.4 years, was 7 years greater than for males . By 1997 the gap had narrowed to 5.6 years, with female expectancy at 81.4 years and male life expectancy at 75.8 years (Statistics Canada, 2001a). This gap in life expectancy between males and females is even larger than the gap in life expectancy between high and low income Canadians, which was 4.6 years in 1971 and 3.2 years in 1996 (Wilkins, Ng and Berthelot, 2001).

According to the Second Report on the Health of Canadians (Federal, Provincial and Territorial Advisory Committee . . ., 1999a) "Men are far more likely than women to die before age 70", with rates of potential years of life lost before age 70 that are almost twice as high for men as for women, and almost three times higher for men aged 20-34. Most of these differences are attributable to differences in mortality rates due to heart disease, cancer, suicide and unintentional injuries. In terms of the burden of disease in BC, males accounted for 53.8% of the DALYs, while women accounted for the remaining 46.2%. The most notable difference was that for women cancer, mental disorders, neurological and sensory disorders, and musculo-skeletal disorders contributed a larger proportion and injuries and cardiovascular disease a smaller proportion of total burden of disease than was the case for men.

However, these gender-related differences in health are not attributable solely to biological differences, but encompass broad socio-cultural differences as well. The authors of the Independent Inquiry report suggest there are three routes to gender inequalities in health. The first is related to the different biology of males and females, including diseases of the reproductive organs and those associated with child bearing. A second set of gender differences is related to "social and cultural influences which have a differential impact on

[16] The term "sex" in this report is used to connote biological sex: the term "gender" will be used to describe differences between males and females that are inherently socio-cultural. Thus the terms male and female are generally used in this report to refer to sex-related diseases, while the terms men and women are generally used to refer to gender-related conditions. Obviously, the two concepts are closely inter-linked and may well overlap.

men and women", such as the higher rates of accidental death in young male adults. The third basis for gender inequalities in health relate to different male and female cultural roles, with impacts on mental and social health. Examples include food poverty among single mothers, who tend to go without food in order to feed their children; a possibly greater impact on the mental health of men who become unemployed and so on.

So while men live shorter lives and have a lower disability-free life expectancy, women suffer from a variety of health problems that are unique to their sex (disease of the breast, ovaries, uterus and cervix) and as well a wide range of diseases that are in part or in whole the result of - or worsened by - gender bias in society. This includes higher levels of stress resulting from the double or triple burden of work they may carry; mental health problems such as depression that may be a result of lower feelings of self-worth arising from discrimination and a lower status in work and in society; a greater likelihood to be victims of family violence; different treatment in the health care system, and other factors. As a result, women have a higher rate of morbidity than men, and while they have longer lives, they experience more disability.

Clearly, a chronic disease prevention strategy needs to address differences in the burden of disease between men and women. The strategy needed to address the differences in health status between men and women depends in part on whether the differences are rooted in biological differences or social inequity.

3.2.1.3 Carcinogenesis

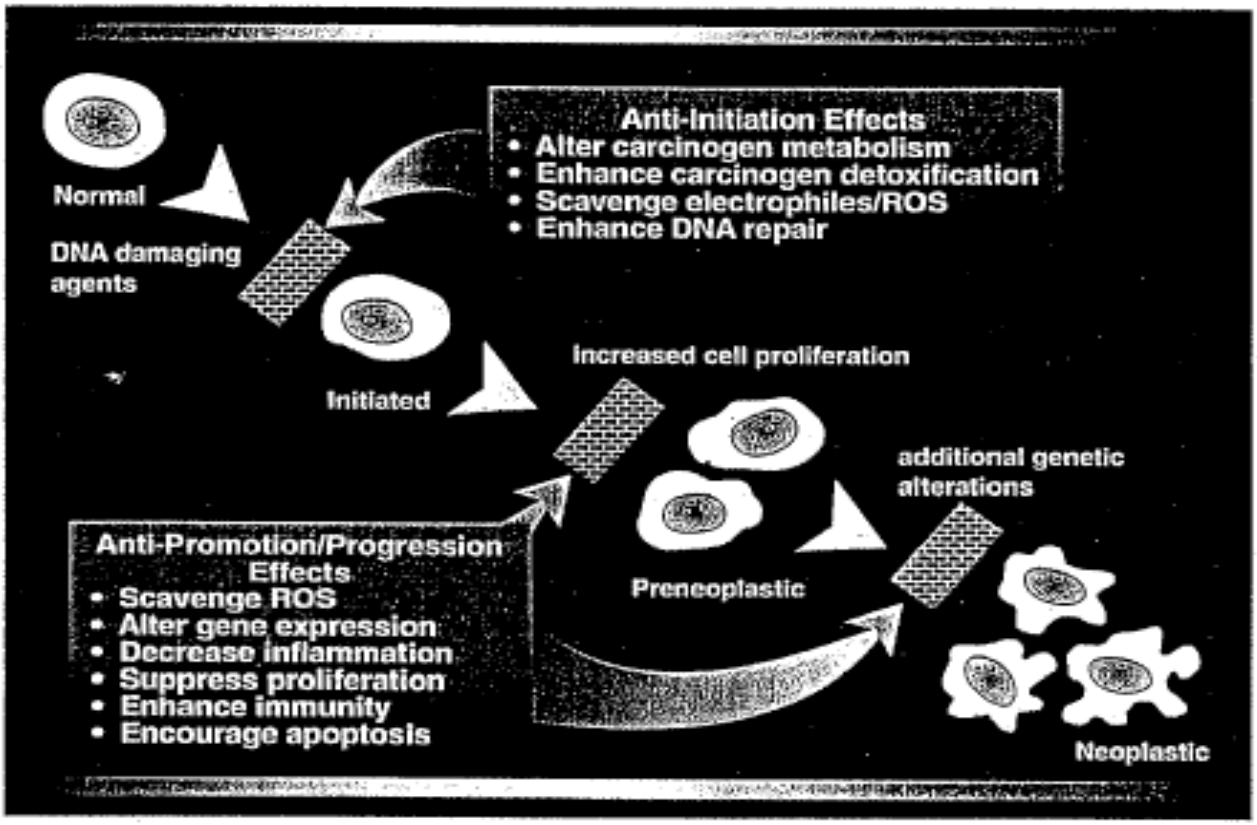
Although a full understanding of the mechanism of disease causation is not necessary (an old public health principle that goes back at least as far as John Snow and the Broad Street pump), it is nonetheless important to understand the mechanism of carcinogenesis in order to understand opportunities for prevention and the relevance and importance of research and development in this area.

Carcinogenesis has three or four main stages (depending on who is classifying them):

- initiation, with DNA damage (mutagenesis) resulting from exogenous or endogenous carcinogens
- promotion, with resultant proliferation of these initiated cells
- progression, in which additional genetic changes or damage and progressive genomic instability result in pre-neoplastic cells developing into invasive tumours (Hursting and Kari, 1999 - see Figure 5).

Figure 5: The process of carcinogenesis

Source: Hursting and Kari, 1999



Cancer cells are generated from normal cells by the accumulation of multiple genetic alterations which are produced by carcinogenic agents (Sugimura, 1998). These agents fall into two broad classes, genotoxic and non-genotoxic carcinogens:

- genotoxic carcinogens or mixtures (chemical, viral or radiation) that attach to or damage DNA or other cellular macromolecules and induce mutations in oncogenes, tumour suppressor genes or DNA repair and replication genes (Weisburger, 2001). If DNA-repair or replication genes are mutated, genomic instability may result, with other mutations "successively produced with or without the necessity of agents" (Sugimura, 1998). This is an issue of growing importance in the literature (Editorial, 2001) because "one genetic alteration leading to genomic instability may thus correspond to hundreds or thousands of mutations in other sites . . . in fact malignancy is generally accompanied by genomic instability . . ." (Sugimura, 1998).

  Genotoxic carcinogens or mutagens are of two broad sorts: exogenous (xenobiotics) and endogenous (autobiotics) (Sugimura, 1998).

  - Xenobiotic agents include naturally occurring substances such as aflatoxin, contaminants such as dioxins or PAHs, heterocyclic amines resulting from the browning of meat and fish in cooking, contaminants in tobacco smoke, or iatrogenic agents such as x-irradiation or cancer chemotherapeutics.

  - Autobiotic agents are reactive oxygen species (ROS) produced by cells in the process of generating energy, and particularly in the inflammatory process (Sugimura, 1998).

  Mutagenesis can also occur through "the acquisition of exogenous genes from oncogenic pathogens" such as HBV, EBV, HPV, HCV, or HIV (Khleif and Frederickson, 2001).

- non-genotoxic promoting or enhancing stimuli (chemical or viral) that do not react with DNA but promote the growth of transformed cells and of tumours in various ways. They are involved in tumour promotion, tumour progression, angiogenesis, invasion, and metastasis, to use a schema proposed by de Flora et al (cited in Editorial, 2001).

Each of the stages in the process of carcinogenesis is in turn a multi-stage process. Thus, for example, proliferation involves signalling, growth factor activity, hormones, activation of oncogenes, loss of tumour suppression function, loss of apoptosis, stimulation of angiogenesis, and suppression of anti-metastasis genes (Krishnan, Ruffin and Brenner, 1998). Each of these stages provides potential sites for preventive intervention, preferably as early as possible.

3.2.2 Infections

In recent years, infections have been linked to a number of chronic diseases that have not normally been thought of as being infectious in origin. While the evidence is clearest with respect to some forms of cancer, other chronic conditions in which infection may play an

important role include atherosclerosis, gastric ulcers and perhaps even Alzheimer's disease (Ewald, 2000).

With respect to cancer, a growing number of infectious organisms such as the human papilloma virus (HPV), HIV, Epstein-Barr virus (EBV), hepatitis B and hepatitis C virus (HBV, HCV), and other pathogens such as H pylori and schistosomiasis are known to be oncogenic (Khleif and Frederickson, 2001):

- Of the more than 70 HPV types, HPV 16 accounted for about half of the cervical carcinomas in a study involving 22 countries throughout the world, with HPV 18, 31 and 45 accounting for another 25 percent (Sherman et al, 1998).
- 80 percent of hepatocellular carcinoma is attributed to HBV.
- Epstein-Barr virus (EBV) is associated with anaplastic nasopharyngeal carcinoma (100 percent) and Burkitt's lymphoma (90 percent) as well as several other malignancies.
- Hepatitis C virus is also associated with hepatocellular carcinoma, with an estimated 3 percent of the world's population infected.
- Helicobacter pylori, a bacterium which is found in the gastric mucosa of more than half of the world's population, has been linked to gastric adenocarcinoma and gastric lymphoma.

In recent years, there has been growing evidence that atherosclerosis, which is the "primary pathologic process in coronary artery disease, carotid artery disease, abdominal aortic aneurysm and peripheral vascular disease" is at least in part the result of a low-grade inflammatory process (Ismail, Khosravi and Olson, 1999) "in which infections are incriminated as possible contributors" (Mayr et al, 2000).

- Prasad et al (2002) have shown that "the immunglobulin-G [IgG] antibody response to multiple pathogens (pathogen burden) is an independent risk factor for endothelial dysfunction" ; pathogen burden was "an independent determinant of endothelial function in the subgroup with angiographically normal arteries" .
- Graham-Clarke et al (2003) have shown that individuals who have evidence of prior infection with cytomegalovirus virus (CMV) have endothelial dysfunction, with impaired vascular response to nitrogen oxide, independent of conventional risk factors.
- In a prospective population-based study, Mayr et al (2000) found a significant association between seropositivity for Chlamydia pneumoniae and the prevalence and severity of atherosclerosis in the carotid and femoral arteries of their subjects after adjusting for the established risk factors. The odds ratio for carotid atherosclerosis reached 10.3 for seropositive subjects with both elevated levels of C-reactive protein and evidence of chronic respiratory infection, providing "strong evidence for a potential pathogenic role of persistent bacterial infection, especially C pneumoniae".

- Zhu et al (2000) evaluated 233 patients, 68% of whom had coronary artery disease (CAD) based on angiography, for IgG antibodies to five different pathogens. They found a significant association between CAD and seropositivity to hepatitis A virus, and that "pathogen burden was significantly associated with increasing CAD risk, even after adjustment for traditional CAD risk factors". Individuals with evidence of exposure to 2 or fewer of the 5 pathogens had a 48% prevalence of CAD, rising to 69% for those with antibodies to 3 - 4 pathogens and 85% for those with antibodies to all five. They conclude that this suggests "that infection does play a role in the genesis of atherosclerosis".

- Espinola-Klein et al (2002a) similarly investigated 572 patients for evidence of infection (IgG or IgA antibodies) to eight different organisms. They found that advanced atherosclerosis was associated with elevated IgA antibodies against C pneumoniae and elevated IgG antibodies against H. pylori, cytomegalovirus, and herpes simplex virus 2. They also found a significant association between advanced atherosclerosis and infectious burden, with an odds ratio (compared to those with seropositivity to 0 - 3 pathogens) of 1.8 for 4 - 5 seropositivities and 2.5 for 6 - 8 seropositivities, as well as a cardiovascular mortality rate over 3.2 years of 7% for those seropositive for 4 - 5 pathogens and 20% for those seropositive for 6 - 8 pathogens.

- In a related study, Espinola-Klein et al (2002b) examined carotid artery stenosis in connection with infectious burden. They found that progression of atherosclerosis over a 2.5 year period was associated with elevated IgA antibodies against C pneumoniae and elevated IgG antibodies against Epstein-Barr virus and herpes simplex virus type 2, after adjustment for the common cardiovascular risk factors. They also found a significant association between progression of atherosclerosis and infectious burden, with an odds ratio of 1.8 for 4 - 5 seropositivities and 3.8 for 6 - 8 and seropositivities, compared to those with 0 - 3 seropositivities.

- Finally, Rupprecht et al (2001), in a prospective study of patients with angiographically documented CAD followed for up to 4.3 years, found that seropositivity to Epstein-Barr virus, H pylori and herpes simplex virus type 2 "were independently associated with the future risk of cardiovascular death". They also found that the pathogen burden was "significantly predictive of the long-term prognosis", with mortality rates of 3.7% for those with 0 - 3 seropositivities, 7.2% for 4 - 5 seropositivities, and 12.6% for 6 - 8 seropositivities. Those who were seropositive to more than 5 pathogens had a 5.1 times higher risk of future cardiac death than those seropositive to fewer than 4 pathogens.

3.2.3 Risk behaviours

Our behaviours are the result of the interaction of our inherent psychological makeup with the knowledge, attitudes, values and behaviour that we acquire, and the ways in which our psychology is influenced by family habits and dynamics, peer pressure, and community, societal

and cultural influences. The result is a lifestyle [17] which is not freely chosen but rather is a reflection of the family, community, societal and cultural lifestyle, values and norms in which we are immersed and by which we are influenced. Not surprisingly, influencing and changing behaviour is a complex and difficult process and is rarely as successful as we might wish it to be.

Risk behaviours include all those behaviours that place us at higher risk of physical or psychological disease or disorder. While some risk behaviours are comparatively well studied (smoking, alcohol use, diet, exercise, illicit drug use, unsafe sex - the "usual suspects" – as well as failure to adopt protective behaviours such as wearing seat belts, brushing teeth or having appropriate cancer screening) others are more subtle, more pervasive but may be equally important. These latter behaviours include our ability – or inability, to be more accurate - to cope with and manage stressful situations, to form social relations and establish social networks, and to participate effectively in family and community life.

Unfortunately, there is as yet no comprehensive assessment of the contribution of the various risk factors to the burden of disease in Canada, never mind in BC. However, in recent years, estimates of the population attributable fraction of some key proximate risk factors that are common to a number of different diseases that constitute the major burden of chronic disease in Canada and in BC have been carried out, principally in terms of the economic burden of disease, and using somewhat different methods; that evidence is summarized here.

- A recent study by Single et al (2000) examined the relative risks and etiologic fractions of different causes of death and disease that were attributable to alcohol, tobacco and illicit drug use in Canada.
    - They found that tobacco accounted for 16.5 percent of all deaths (21 percent of male deaths and 11.5 percent of female deaths) and 6.5 percent of hospital admissions (9.3 percent of male admissions and 3.7 percent of female admissions). A relatively small amount of this impact is due to deaths and injuries resulting from fires caused by careless smoking.
    - Alcohol was found to account for only 3.1 percent of all deaths in Canada, a total of 6,701 deaths. However, it was also estimated that alcohol prevented 7,401 deaths because of the beneficial effects of moderate alcohol use in preventing heart disease. Similarly, while alcohol contributed to 2.7 percent of hospital admissions, almost half as many admissions were prevented as were caused, for

17 The term "lifestyle" is used in the sense that the pioneering sociologist Max Weber used the term - "to designate the stylised modes of living (and consuming) that social groups adopted to express and sustain their identity in the social world" (Powles, 1992). In this sense, then, a healthy or unhealthy lifestyle is not something that is freely and independently chosen by individuals but is a collective lifestyle that becomes a social norm. Powles makes the point that campaigns to change social norms (such as improved cleanliness in the 19th century) are initially seen as coercive but over time become incorporated into the way of life of a community or society. A similar effect is seen today with respect to the normalization of non-smoking behaviour, or the use of seat belts, or not driving while impaired.

the same reasons. They also found that "the relative contribution of accidents to over-all alcohol-related mortality and morbidity is much greater than previously thought", accounting for 47 percent of all alcohol-attributed deaths. On the other hand, while previous estimates suggested that 62 percent of alcohol-attributed deaths could be categorised in three broad chronic disease categories - respiratory system disease, circulatory system disease and cancer - they found that only 18.5 percent of alcohol-related deaths in 1995 were due to these chronic conditions.

- Illicit drug use accounted for 0.4 percent of deaths and 0.2 percent of hospital admissions.

- The economic burden of physical inactivity in Canada has been estimated recently by Katzmarzyk, Gledhill and Shephard (2000). They estimated the direct health care costs (hospital care, physician care, drugs and research) for seven conditions known to be associated with physical inactivity (coronary artery disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes mellitus and osteoporosis). They did not estimate the indirect costs of physical inactivity such as lost productivity due to premature death and long or short-term disability. Nonetheless, they estimated that 2.5 percent of direct health care costs and 10.3 percent of deaths could be attributed to physical inactivity.

    - A similar study has just been completed for BC (Colman and Walker, 2003). It is estimated that physical inactivity cost BC $185.7 million in direct health care costs alone in 2001, or 1.6% of the health budget. In addition, physical inactivity cost the BC economy a further $236 million in indirect costs (productivity loss) due to disability and premature mortality. The total cost of physical inactivity in BC was thus approximately $422 million in 2001.

- The cost of obesity (which results from a combination of unhealthy diet and physical inactivity as well as biological and genetic factors) in Canada was estimated by Birmingham et al (1999). As with the study on physical inactivity, the direct costs that were included were expenditures on hospital care, physician services, services by other health professionals, drugs, other health care, and health research; indirect costs were not included. The study also calculated the population attributable fraction for each of 10 co-morbidities associated with obesity (post-menopausal breast cancer, colorectal cancer, coronary artery disease, endometrial cancer, gall bladder disease, hyperlipidaemia, hypertension, pulmonary embolism, stroke and type 2 diabetes). They estimated that the proportion of total direct health care costs attributable to obesity is 2.4 percent. They also included an estimate for osteo-arthritis based on American data.

- Based on this same methodology, the cost of obesity in BC was recently estimated (Colman, 2001), using economic costs from 1993 (adjusted to 1997 costs), as per the report on the Economic Burden of Illness in Canada (Health Canada, 2002). [18]

    - The total direct costs of obesity in BC in 1997 were estimated to be $217.3 million, or 2.6% of the province's $8.5 billion (1999 – 2000) health budget. To this might be added an additional $58.7 million (based on an estimate that the obesity-related PAF for osteo-arthrits and musculo-skeletal disorders is 15%), and other adjustments (for BMI between 25 and 27 – this study used 27 as the cutoff, for under-reporting of self reported weight – estimated to be at least 10%, for capital and other costs not included in the estimates – about an additional 20%, etc), yielding a total direct cost estimated at $380 million.

    - The indirect costs (productivity loss from premature mortality and from disability) attributable to obesity were estimated to be $350 – 450 million annually.

    - The total economic cost of obesity for BC in 1997 was thus estimated to be between $730 million and $830 million, or between 0.8% and 0.9% of BC's GDP.

[18] This estimate was based on a pro-rating of Canadian costs to BC, adjusted for the age distribution of the BC population. The estimate has not yet been updated using the BC-specific costs available from the most recent report on the economic burden of illness in 1998 (Health Canada, 2002).

In addition to diet as it relates to obesity, other aspects of diet are also pertinent to the development of a wide array of chronic diseases. However, the economic burden of these other aspects of diet has not yet been estimated either for Canada or for BC, although a recently released a report from a joint FAO/WHO expert consultation on diet, nutrition and the prevention of chronic diseases (WHO, 2003) summarized the strength of the evidence for various risk factors for obesity, type 2 diabetes, cardiovascular disease, cancer, dental disease, and osteoporosis. Convincing evidence was found for the following relationships:

- obesity - increased risk from a high intake of energy-dense foods and physical inactivity; decreased risk from high intake of dietary fiber and fruits and vegetables, and from regular physical activity.

- type 2 diabetes - increased risk from abdominal obesity, overweight and obesity, physical inactivity, and maternal diabetes; decreased risk from weight loss in overweight and obese people, and from regular physical activity.

- cardiovascular disease - increased risk from intake of saturated and trans-fatty acids, myristic and palmitic acids, high sodium intake, high alcohol intake, overweight and obesity; decreased risk from intake of linoleic acid, fish and fish oils, potassium, fruits and vegetables, low to moderate alcohol intake, and regular physical activity.

- cancer - increased risk of nasopharyngeal cancer from intake of Chinese-style salted fish, cancer of the oral cavity, esophagus, stomach and colorectum from high alcohol intake, liver cancer from aflatoxins, cancer of the esophagus, colorectum, breast (in post-menopausal women), endometrium and kidney from being overweight and obese; decreased risk of colorectal cancer from regular physical activity.

- dental disease - increased risk of dental caries from frequent intake of free sugars, of periodontal disease from vitamin C deficiency, and of enamel development defects from excess fluoride ; decreased risk of enamel development defects and from intake of vitamin D, and of dental caries from local or systemic fluoride.

- osteoporosis - increased risk from high alcohol intake and low body weight ; decreased risk from vitamin D intake, calcium intake, and regular physical activity.

In addition, a study of the burden of disease for the state of Australia (National Public Health Partnership, 2001) estimated the population attributable fraction (PAF) not only for obesity (4.3%) but for a high cholesterol diet (2.6%) and a diet low in fruit and vegetable (2.7%), while two European studies estimated the contribution of fruit and vegetable intake: a Dutch study found that 19% of cancer deaths and 16% of cardiovascular disease deaths could be avoided if there were an increase in fruit and vegetables intake from 250gm/day to 400 g/day (van't Veer, Jansen, Klerk & Kok, 2000), while an Italian study found that 15-40% of hospital admissions for digestive tract cancers could be avoided with a high fruit and vegetable intake (LaVecchia and Tavani, 1998.)

Thus diet is not only of concern with respect to cardiovascular disease, but also cancer. In addition to the links between cancer and low levels of fruit and vegetable intake, or high levels of fat in the diet, our diet is the source of a number of carcinogens. Dietary carcinogens include

- naturally ocurring carcinogens in the foods we eat
- contamination with naturally occurring substances (e.g. aflatoxin, a product of a mold commonly associated with peanuts)
- contamination with human-created carcinogens, many of them chlorinated hydrocarbons that are persistent organic pollutants (POPs). Examples include dioxins (a by-product of combustion, including the incineration of chlorine -rich materials), PAHs (present in diesel exhaust), chlorinated by-products of water disinfection and other sources
- heterocyclic amines (carcinogens that result from the browning or charring of meat and fish during cooking).

Of particular interest is the fact that many of these POPs are lipophilic, so they accumulate in fatty tissues. They are absorbed into food chains where they bioconcentrate, reaching concentrations that may be many million times greater in the tissues of the top-predators (which includes humans) than in the ambient environment. For example, POPs such as PCBs, may reach concentrations in bald eagle eggs that are 25 million to 100 million times greater than the levels in the water (Gilbertson, 1998). High fat diets are therefore richer in POPs, a fact that seems relevant to the discussion of the relationship between high fat diets and cancer. Indeed, for selected organochlorines and PCBs, Ontario adults eating Ontario grown food receive 88 percent (range = 68 - 100%) of their exposure from food, (Davies, 1990) and thus food chain contamination is of concern. [19]

The removal - or failing that, the reduction – of these dietary carcinogens is an important strategy for prevention of cancer.

Finally, a BC study of the burden of disease (measured as DALYs), using the WHO/World Bank methodology, BC mortality data and morbidity data from the Australian state of Victoria (suitable BC data were not available) tried to put the whole picture together (BC Ministry of Health, 2001). The study found that the largest risk factor contributions to the burden of disease for which estimates were available were tobacco and alcohol (Figure 5) although data for nutrition and obesity were not applicable using this methodology. (It should be noted that the contribution of alcohol to the burden of disease in this BC study does not include the beneficial effects of alcohol in preventing cardiovascular disease. In the Australian study, taking this factor into account reduced the PAF from 4.9% to 2.1%.)

[19] It has been reported that 196 different organochlorines have been identified in the tissues of North Americans, with several hundred others detected but not chemically characterized (Thornton, 2001).

The evidence summarised above and in Figure 5 shows that some 25-30 percent of the burden of disease in Canada can be attributed to the following four proximate risk factors: [20]

- smoking
- physical inactivity
- unhealthy eating patterns
- immoderate use of alcohol.

It is important to note from both the BC study and the Australian study that while these factors are not unimportant, together they explain at most less than half of the 87% of the total burden of disease attributed to the top 10 categories of diseases and conditions in the BC study. The "big four" (tobacco, alcohol, diet, physical inactivity) account for only 25.4 percent of the burden in the Australian study (which includes obesity), while tobacco, alcohol and inactivity (diet and obesity were not included) account for 26.8 percent of the burden in the BC study. This is because these top ten causes include a number of conditions that are not explained very much, if at all, by these risk factors, as indicated below: [21]

- neurological and sensory disorders - no obvious links except to alcohol and perhaps vascular disease (neuropathy)
- mental disorders - linked to a degree to alcohol and drugs and to vascular disease (dementia), as well as to injuries
- unintentional injuries (some are linked to alcohol, especially in the case of MVAs)
- musculo-skeletal disorders (some conditions are linked to obesity, inactivity and poor nutrition)
- digestive disorders (linked in some cases to low fibre/low fruit and vegetable/high fat diets)
- intentional injuries (linked in part to alcohol and illicit drug use and to mental disorders).

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20 Obesity is not included here as a separate risk factor since it is really an intermediate outcome that results primarily from a combination of genetic factors, unhealthy eating patterns and physical inactivity, and contributes in turn to a number of major chronic diseases including heart disease, cancer, diabetes, arthritis and other musculo-skeletal disorders.

21 It is also noteworthy that dental disease, which at $6.4 billion is the third highest direct health cost in Canada after cardiovascular disease and mental health (Health Canada 2002 - Economic Burden of Illness in Canada, 1998, Table 2, footnote #4) is not even included in these analyses.

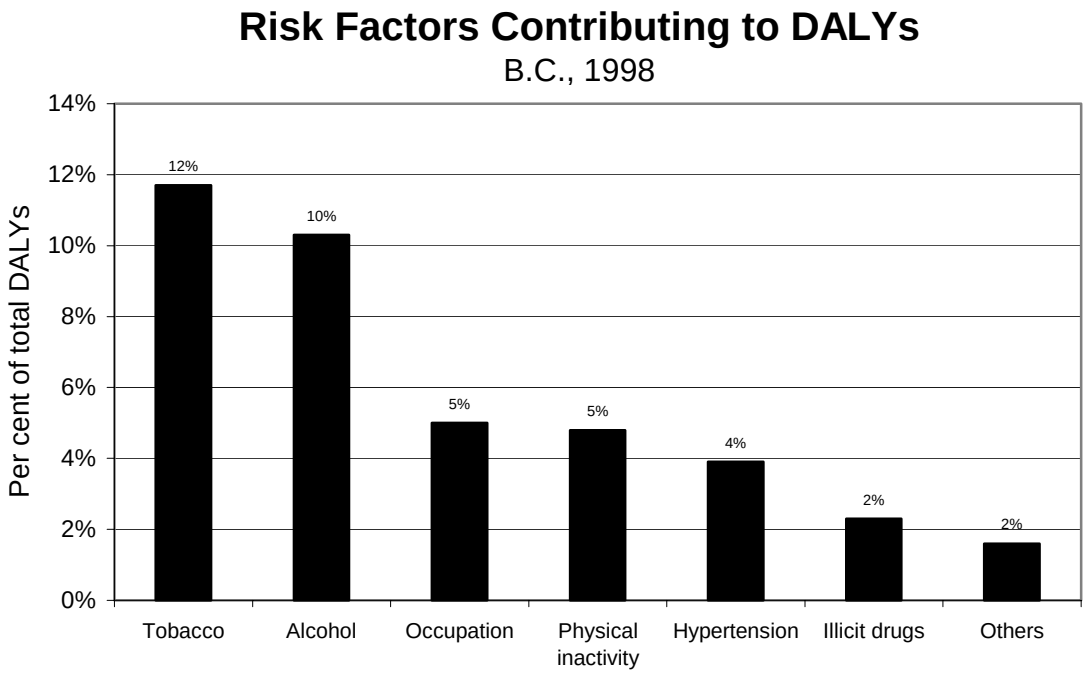
Clearly, however, for that portion of the burden of disease that is explained, the most important biological and behavioural risk factors are tobacco, physical inactivity, obesity, alcohol and diet; between them they account for something between 1/4 and 1/3 of the burden of disease.[22]

As noted earlier, and as is apparent in the model (Figure 1), it is vitally important to understand that these "lifestyle" behaviours are not freely chosen, but result from the influence of a wide array of environmental, social, economic, political and cultural influences. Any attempt to modify these proximate risk factors through simplistic behavioural change strategies is likely to fail, or at best may achieve only modest success, and only in some population groups. A comprehensive, integrated, long-term approach is required, as discussed later. Moreover, a more positive approach to these risk factors is to cast them in a positive light of building capacity through empowerment and positive messaging (i.e. a health promotion approach) rather than a negative, prohibitive approach. Thus we need to talk about healthy living rather than unhealthy lifestyles, and to consider protective factors as well as risk factors.

22 This is consistent with Marmot (1999), who notes that in the Whitehall study that examined the gradient in health status across different grades in the UK Civil Service

"The standard coronary risk factors, serum cholesterol, blood pressure, smoking, body mass index, and physical activity accounted for between one-quarter and one-third of the social gradient". He went on to state that "More than half the gradient appeared to be accounted for by low control in the workplace".

Figure 5



Source: Evaluation of the Burden of Disease in British Columbia. Strategic Policy and Research Branch, B.C. Ministry of Health, January 2001.

3.2.4 Protective behaviours, social-emotional competence and resilience

While our behaviours may put us at risk, there are a range of behaviours and skills that can be acquired and that serve to protect us from developing chronic diseases. At their simplest, these behaviours are just the opposite of the risk behaviours noted above; not smoking, being physically active, eating healthily and drinking moderately. Another set of protective behaviours involves seeking out regular and effective preventive and screening services such as blood pressure screening, immunization, preventive medications and supplements, cancer screening etc. There are in addition a set of coping skills and the sense of self-esteem, self-worth and self-efficacy that develop to a greater or lesser extent in young people. The development of these skills has as much to do with family dynamics, the modelling of behaviour and skills, the social context, and with teaching methods as with the content of what is taught. These skills can collectively be referred to as 'social-emotional competence', defined as

> "the ability to effectively manage and coordinate ones affective, cognitive and social behaviour to achieve positive developmental outcomes" (Wallander, 2000)

Social-emotional competence includes a number of specific abilities in four broad domains:

- awareness of self and others
- positive attitudes and values
- responsible decision-making
- social interaction skills (See Table 4 for details)

A related concept is that of resilience, which has been defined as “the ability to experience adverse circumstances and to overcome them” (Mangham et al, 1995). While the concept of resilience has emerged from the mental health field and has particular relevance to mental health – particularly for children and youth, it has a broader application, given our modern understanding of the relationship between the psyche and physical health, as has been discussed elsewhere in this report. Some of the key aspects of the concept of resilience, according to Rutter (2000), are that it is concerned with positive outcomes such as social competence and self-efficacy, it is affected by a positive experiences such as social support, it is a process of coping with stress and adversity and includes a range of coping strategies, and it is a mechanism or process of resistance to stress and adversity.

Risk and protective factors that contribute to or undermine resilience include poor parenting, genetic factors, the extent of adversity experienced, and protective factors that include personality factors such as autonomy, self-esteem, and a socially positive orientation; family cohesion, warmth and an absence of discord; and external positive or reinforcing social support (Rutter, 2000).

Table 4: Key Components of Social-Emotional Competence

(Source: Payton et al, cited in Wallander, 2000)

Awareness of Self and Others

Awareness of feelings: The capacity to accurately perceive and label one's feelings

Management of feelings: The capacity to regulate one's feelings

Constructive sense of self: The capacities to accurately perceive one's strengths and weaknesses and handle everyday challenges with confidence and optimism

Perspective taking: The capacity to accurately perceive the perspectives of others

Positive Attitudes and Values

Personal responsibility: The intention to engage in safe, healthy, and ethical behaviors

Respect for others: The intention to accept and appreciate individual and group differences and to value the rights of all people

Social responsibility: The intention to be honest and fair in social interactions, contribute to the community,and protect the environment

Responsible Decision Making

Problem identification: The capacity to identify situations that require a decision or solution and assess the associated risks, barriers, and resources

Adaptive goal setting: The capacity to set positive and realistic goals

Social norm analysis: The capacity to critically evaluate social, cultural, and media messages pertaining to social norms and personal behavior

Problem solving: The capacity to develop, implement, and evaluate positive and informed solutions to problems

Social Interaction Skills

Active listening: The capacity to attend to others both verbally and non-verbally to demonstrate to them that they have been understood

Expressive communication: The capacity to initiate and maintain conversations and to clearly express one's thoughts and feelings both verbally and non-verbally

Cooperation: The capacity to take turns and share within both dyadic and group situations

Negotiation: The capacity to consider all perspectives involved in a conflict in order to resolve the conflict peacefully and to the satisfaction of all involved

Refusal: The capacity to make and follow through with clear "NO" statements, to avoid situations in which one might be pressured, and to delay acting in pressure situations until adequately prepared

Help seeking: The capacity to identify the need for support and assistance and to access available and appropriate resources

3.3 Community and societal protective and risk conditions

Humans are both biological and social animals and we live both in physical places and in social spaces - what in health promotion are called settings. The characteristic of these settings is that they are physical, or place-based, and exist at the community level, although they obviously overlap and interact with broader and more diffuse, less locality-based societal and global risk conditions. These settings include the homes, neighbourhoods, communities and cities in which we are born, live and die, and the schools, workplaces, institutional, recreational and other settings in which we live, learn, work and play.

In their book on health promotion settings, Poland, Green and Rootman (2000) note that settings don't just present "captive audiences" as targets within a "fixed arena" for health promotion. Settings vary from one to another and over time, and the social relationships within the setting matter. They are not necessarily more amenable to shaping by health professionals, and they require environmental change, not just education within a fixed arena. They also fraught with power issues and change, even for better health, cannot just be mandated and imposed, nor can consent be manufactured. Moreover, not everyone is necessarily in a setting. Nonetheless, these settings present important venues for improving health and 0preventing chronic disease.

Obvious examples of unhealthy settings include damp and over-crowded housing conditions that may contribute to respiratory disease, or homes where there is domestic violence; neighbourhoods that have high levels of violence or poor protection from road traffic, or are situated adjacent to hazardous industries or contaminated or unsafe lands; dangerous working conditions such as are found in a variety of hazardous or low-paying occupations, and so on. Other risk environments are found at a larger scale, such as the higher risk of respiratory and cardiac disease resulting from air pollution levels in Southern Ontario (Ontario Medical Association, 2000), or levels of radon in some parts of Northern Ontario or arsenic levels in some parts of Nova Scotia and other problems resulting from variations in geology.

Much of the variation in protective and risk factors is related to income, with low income populations more likely to have unhealthy living and working conditions that may contribute in a wide variety of ways to higher rates of disease and death. These can be thought of as 'risk conditions'. The term "risk conditions" (Labonté, 1987, 1993) is used here to describe the broad psycho-social, socio-economic, cultural and environmental conditions of society that predispose people to varying levels of risk; in our globalized world, it now includes global economic conditions, our increasingly global culture, and global environmental conditions.

3.3.1 Psycho-social conditions in our homes, schools, workplaces and communities

Psychosocial factors are important as determinants of health because "most behaviours are not randomly distributed in the population, but are socially patterned and often occur together" (Institute of Medicine, 2001). According to this recent Institute of Medicine report on social and behavioural influences on health, the social environment influences behaviour in a number of ways including

- shaping norms

- enforcing patterns of social control
- providing (or failing to provide) environmental conditions that encourage particular behaviours
- reducing or producing stress
- placing constraints on individual choice (Institute of Medicine, 2001).

Among the psycho-social factors that the report discusses are socio-economic status, social inequalities, social networks and support, work conditions, depression, anger, and hostility. Noting that "A fundamental finding of the report is the importance of the interaction of psychosocial and biological processes in health and disease", the report summarizes the evidence on social factors as determinants of health as follows:

- At the individual level, important factors include
    - social integration (there are adverse effects from divorce, bereavement, loneliness, lack of sense of belonging, social conflict)
    - quality of social ties ("deep, meaningful, loving and human connections"; "positive ties with parents during childhood, intimate ties with spouse during adulthood")
    - extent of social support.
- At the population level, health outcomes are related to
    - patterns of social cohesion
    - social capital.

These psycho-social factors constitute the community, societal and cultural 'ocean' within which we swim, and they affect physical health via the psycho-neuro-immune system, as described earlier. Just like fish, we may be unaware of the presence of some of these conditions, so embedded are they in our personal and collective ways of life; and just like the apocryphal frog that slowly boils to death as the pot heats up, we may be unaware of the growing risk conditions in which we sometimes finds ourselves, either individually or collectively.

3.3.1.1 Homes

Kalnin (2000) defines a home as “a physical dwelling space that houses a social environment, typically a family”. The home and the family constitute a key setting; after all, Canadians spend almost 2/3 of their time at home (Leech et al, 1996). Of greatest importance, the home provides a physical shelter from the elements, but at the same time, if improperly constructed or maintained, may actually contribute to ill health, including chronic disease (see

discussion in next section). The home also provides a social setting that can contribute greatly to a healthier or less healthy way of life, and a haven from the wider society.

In a chapter on homes and families as health promotion settings, Soubhi and Potvin (2000) note that families are "the most immediate and private system of influence on the individual", although Fisher (2000) notes that families are "by definition well-circumscribed, well-defended, and self-protective social units with a penchant for maintaining the status quo". It is here that primary relationships are formed; here that parenting exerts its magic - or takes its toll; here that habits and behaviours are formed that may prove to be life-long; here that people spend most of their time - eating and drinking, sleeping, playing, relaxing, working, in short, living life. In particular, young people's healthy or risk behaviours are influenced by factors such as the sense of connection they have with their parents, the level of expectations their parents have of them with respect to school attainment, or the ease with which tobacco, alcohol or drugs are available in the family (Perry, 2000).

Not surprisingly, the evidence is clear that the risk of developing chronic disease is 'inherited' not only genetically but socially, particularly from families as well as from other social settings. For example, dietary behaviour, including snacking habits, is established very early in life, while the children of parents who smoke are much more likely to smoke then the children of parents who don't smoke. Similarly, exercise patterns, attitudes towards preventive health care services, towards work and so on are strongly influenced by the family.

3.3.1.2 Television

A key issue that is mainly home-based concerns the use of television and, more recently, computers (including the internet) by both children and adults. Canadians aged 18 and over on average watched television 21.2 hours per week (or 3 hours per day) in 2001, (20.8 hours in BC) (Statistics Canada 2002) compared to just one hour per day (for those aged 15 and over in 1998) engaged in active leisure (Statistics Canada, 1998). Canadian children age 2 – 17 spent, on average, 15.5 hours per week watching television in 1999 (Statistics Canada, 2001b). However, TV viewing seems to be decreasing as children switch to using the internet more or playing video games. Thus "while the national average remained stable during (the past three years), viewing time decreased by more than two hours among teens and by more than one hour among children."(Statistics Canada, 2002). Moreover, as with many other determinants, there is an equity issue here: Moscovitch (1998) points out that

> "The people most likely to watch TV for significant periods of time are those at lower literacy levels. Over 10 per cent of those in the lowest stratum watch more than five hours a day; over 20 per cent of those at the highest level watch less than an hour a day."

It has taken 40 years of the wide-spread use of television for its ill effects on children to become an accepted health problem (American Academy of Pediatrics, 1995). These effects result from both the actual time spent watching television - which has been described as a form of play deprivation by one author - and the content, from which children learn. The concerns raised by pediatricians and others with respect to the impact of television on health

- both in terms of the medium in and of itself and in terms of its content - may well apply equally to information technology.

Johnson (2000) observes that a quarter of all US children watch 4 or more hours of television each day, and reports that this is positively associated with both increased BMI and increased skin fold thickness. Gortmaker et al (1996) looked at the prevalence of overweight in 1990 and the incidence and remission of overweight from 1986-1990 in relationship to the hours of television viewed by a cohort of 746 10-15 year old youths. They found that among those watching more than 5 hours of television per day, in comparison with those watching 1-2 hours, the odds of being overweight were 4.6 times greater, and the odds of increased incidence in overweight during the 4 year period were 8.3 times greater. Estimating the attributable risk, they conclude that more than 60 percent of the incidence of overweight in this population could be linked to excessive television viewing time.

3.3.1.3 Schools

The school is the childhood equivalent of the workplace, in that it is a key setting where much socialisation occurs; it is also "one of the key sites where individual and social development occurs" (St. Leger and Nutbeam, 2000). As such, the school has for many years been an important focus of public health work, both for the overall improvement of health and the prevention of communicable diseases and, more recently, for the prevention of chronic diseases. A national study in the US, however, found that it is more than just the public health interventions that are important; student's "connectedness to school was a primary protective factor for adolescents for a variety of risk-related behaviours", as well as for school performance and achievement (Perry, 2000). Thus the whole school environment and culture is relevant to the prevention of chronic diseases.

However, at the same time, St Leger and Nutbeam caution that since "student's health status is influenced far more substantially by factors external to the school . . .", we should have somewhat modest expectations of how powerful school health interventions can be.

3.3.1.4 Workplaces

Work is one of our most important social roles, and the indoor workplace is a site where adults on average spend 10 percent of their time [23] (Leech et al, 1996). The workplace can be a source of both adverse and promotive health conditions. Work-related disease is a significant contributor to the overall burden of disease. A study based on data from Denmark and Norway estimated that work-related conditions account for approximately one-third of all musculo-skeletal disorders, one-fifth of cardiovascular diseases and almost half of all skin diseases. Another study estimated that accidents at work and other work-related ill health cost between 1.4 percent (UK) and 8.3 percent (Sweden) of the GNP. (Cited in Bruecker and Schroer, 2000)

Marmot et al (1999) suggest that psychosocial work characteristics (such as low control, low use of skills, low support at work and a slow pace of work) is responsible for about 25 percent

[23] This is for all adults; for those in the labour force, a 40 hour work week for 47 weeks of the year is 21% of their time.

of the gradient of sickness absence between high and low grade employment among men and about 35 percent of the gradient among women, while elsewhere Marmot (1999) notes that in the Whitehall II study "more than half the gradient [in the occurrence of coronary heart disease] appeared to be accounted for by low control in the workplace".

Marmot et al (1999) discuss two different models that are used to examine psychosocial characteristics of the work environment. One is the demand-control model of Karasek and Theorell (1989) which focuses specifically on the characteristics of the workplace environment, and on control in the workplace; the other is the effort-reward imbalance model of Siegrist et al, which distinguishes between the characteristics of the situation and those of the individual, links workplace conditions such as salary or job security to wider labour market characteristics, and focuses on "threats to, or violation of, legitimate rewards". In this latter model, it is the lack of congruence between high cost efforts and low gain which is seen to underlie distress and its associated health problems.

Both models have been used in the Whitehall Study to examine the relationship between working conditions and CHD. What was found was that "both men and women with low control, either self-reported or independently assessed, had a higher risk of reported CHD during a mean follow-up period of 5 years". In predicting future onset of coronary heart disease, both effort-reward imbalance and low job control are associated with approximately a two-fold increase in the risk of developing new CHD (Marmot et al, 1999).

3.3.1.5 Communities

The Task Force on Community Preventive Services, an independent national body created under the auspices of the U.S. Department of Health and Human Services, was established in the mid-1990's to "summarize what is known about the effectiveness of community-based interventions to improve population health outcomes" (Anderson et al, 2003). As part of its work, the Task Force "identified aspects of the social environment known to influence health" and incorporated these in a model. The model acknowledges the importance of societal resources and conditions such as the standard of living, culture and history, social institutions, built environments, political structures, economic systems, technology, equity and social justice. The conditions in the social environment operating mainly at the community level for which the Task Force found evidence of an association with health outcome are:

- neighborhood living conditions such as the affordability and quality of housing; neighborhood safety; the building, improving and retaining of neighborhood assets; and the enhancing of neighborhood cohesion and social support systems.

- opportunities for learning and developing capacity which depends upon the quality of early learning and child development, the educational system, job-training programs, and leisure opportunities, and life-long learning .

- community development and employment opportunities, which involve enhancing community economic viability, providing job training opportunities, developing employment opportunities, and improving working conditions.

- social cohesion, civic engagement, and collective efficacy , which involves increasing both civic and social engagement , and a building a community infrastructure that will increase local decision making.

- prevailing community customs, norms and processes which can be influenced through the promotion of social solidarity and understanding across diverse groups, providing a focal point for community growth and social support activities through religious institutions, recognizing multicultural beliefs and customs, supporting community centers for socialization, and strengthening democratic norms for equal voice and influence for all community members.

- health promotion, disease and injury prevention, and health care opportunities which involves defining community goals, supporting safe and satisfying living conditions, providing health education in communities, promoting culturally appropriate health services, making health care accessible, promoting health and disease prevention through school settings and the workplace, and monitoring community health through sentinel health indicators.

There is growing understanding that the set of conditions variously referred to as social cohesion, social capital or community capacity have important implications for the health of people in a community. The concept of social cohesion is well captured by Kawachi (1998), who refers to it as the "web of social ties . . .(that) acts as the social glue that binds society together". The Social Cohesion Network [24] (Strategic Research and Analysis . . . 2001) also describes social cohesion as

> "the glue that holds society together and makes it possible for it to function . . . (providing) the background condition for the healthy functioning of all major social processes; economy, health, security, politics and community life, etc.".

In discussing the relationship between social cohesion and health Wilkinson (1996) describes the research carried out by Bruhn and Wolf in the small town of Roseto, Pennsylvania. This community had a much lower mortality rate - especially from heart attacks, which were up to 40% lower - than neighbouring communities for many years, dating back at least to the 1930s. Roseto was a community settled mainly by Italian immigrants who all came from the town of Roseto in southern Italy. The high level of social cohesion and "an egalitarian ethos" that were characteristic of Roseto, the degree of family and community support and a sense of common purpose were believed by Bruhn and Wolf to be at the core of their lower risk of myocardial infarction.

Social capital increasingly is conceptualized as having at least three “domains”:

- density of associational membership

[24] The Social Cohesion Network was established in 1997; it involves 23 departments and agencies and is coordinated by the Canadian Policy Research Networks

- levels of interpersonal trust
- norms of reciprocity (Kawachi 1998)

Kawachi found that variations in the level of trust explained 58% of the variance in total mortality across 39 US states studied. Mistrust was also highly inversely correlated with the maximum level of welfare grant, i.e., the more generous the state's welfare "safety net," the higher the trust and the higher the health of communities. Density of association membership is also a predictor of deaths from coronary heart disease, malignant neoplasms and infant mortality (Kawachi 1998).

A related concept is that of community capacity - "the set of assets or strengths that residents individually and collectively bring to the cause of improving local quality of life" (Easterling et al, 1998) - and its relationship to health status. A recent report for the Colorado Trust, which has initiated and supported one of the largest healthy community programs in the United States, reviews the evidence and concludes that "a growing body of research indicates that an increase in community capacity produces tangible payoffs in health status" (Easterling et al 1998).

3.3.1 Environmental conditions in our homes, schools, workplaces and communities

The built environment is now the 'natural' – or at least usual – human environment; not only do we spend 90 percent of our time indoors - and a further 5 percent in our cars (Leech et al, 1996), we are also 80 percent urbanised. Physical conditions in our homes, schools, workplaces and communities may contribute to – or help to protect us from – chronic diseases in a variety of ways.

3.3.2.1 The indoor environment

The Independent Inquiry . . . (1998) identified three ways in which housing conditions affect health: homelessness, poor housing quality, and unsafe living environments. In many respects (with the exception of homelessness) the issues they identify also apply to other indoor environments such as schools and workplaces, although these latter settings may also have characteristic problems of their own. .

- The health effects of homelessness are well documented, and are significant. People without homes are at risk for a wide variety of health problems including hypothermia or heat stroke, infectious diseases, respiratory and cardiovascular diseases, infestations and other skin diseases due to improper hygiene and many other problems. In addition, many of them are suffering from hunger or malnutrition and from a wide variety of mental disorders (Daly, 1989). Policies to reduce homelessness and increase the availability of housing will have significant benefits, particularly for families with young children and for mentally ill young people.
- The relationship between poor quality housing and poor health is also well documented. Badly built, damp and poorly heated housing contributes to respiratory diseases,

including asthma that is associated with the molds and fungi that are found in such housing.[25] Miller (cited in Pollution Probe, 1998) noted that as many as 36% of North Americans live in damp homes, that this is worse among those living in poverty and probably worse in Aboriginal communities. Problems of mould in portables in schools are an example of how similar problems can be found in these settings, even in seemingly prosperous middle-class suburban communities.

- Poorly designed and maintained housing contributes to accidents; the Independent Inquiry notes that "40 percent of all fatal accidents happen in the home" in the UK. Older and poorly maintained housing, particularly in the absence of smoke alarms, also contributes to deaths and injuries resulting from fires.

A fourth important aspect of the indoor environment that affects chronic disease is the quality of indoor air since, as already noted, Canadians spend 90 percent of their time indoors. In addition to dampness and mould, mentioned above, environmental or second-hand tobacco smoke contributes to lung cancer, asthma and other serious health problems in the spouses and children of smokers, while pet dander, dust mites, cockroaches and moulds (which can all be part of 'house dust') both cause asthma in the first place and can trigger asthma attacks (Centre for Disease Prevention and Control, 2002).

Many of the same conditions as are found in homes and schools are also found in workplaces, but there are additional issues at work. One obvious one is the presence in some workplaces of toxic chemicals, some of which contribute to asthma (Centre for Disease Prevention and Control, 2002) or to cancer; it is estimated that up to 4 percent of cancers can be attributed to occupational exposure to carcinogens (Cancer Care Ontario, 2003).

3.3.2.2 The outdoor environment of our communities

The physical environment of the community affects health and contributes to chronic disease in a number of ways. Chief among them is the contribution of air pollution (arising mainly from fossil fuel use) to cardiovascular disease, chronic respiratory disease, asthma and cancer. Urban design, especially urban sprawl, also contributes through its emphasis on energy-intensive transportation systems, which not only contribute to air pollution, but to an inactive way of life, to obesity, to injuries and unsafe environments, and to stress and other mental and social health problems. Finally, the physical environment of the community includes a wide range of toxins and physical hazards that may contribute to cancer and other chronic diseases, as well as to a range of other health problems, including developmental disabilities. All of these need to be considered in a comprehensive approach to the prevention of chronic disease.

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25 In 2001, 14.4% of Canadian dwellings were constructed prior to 1945, of which 16.4% required major repairs, a rate "almost two and one-half times the rate reported in the stock built since 1945. Other components of the stock exhibiting higher than average need for major repairs include band housing on Indian reserves or settlements (39.2 per cent) and housing in the northern territories of Nunavut (19 per cent), Northwest Territories (16 per cent) and Yukon (13.9 per cent)." (CMHC, 2003). Those earning less than $35,000 are over-represented in such housing.

Romm and Ervin (1996) point out that

> "The connection between energy policy and increased levels of respiratory and cardiopulmonary disease has become clearer in the past few years. People living in cities with high levels of pollution have a higher risk of mortality than those living in less polluted cities. The pollutants most directly linked to increased morbidity and mortality include ozone, particulates, carbon monoxide, sulphur dioxide, volatile organic compounds, and oxides of nitrogen. Energy-related emissions generate the vast majority of these polluting chemicals."

The Ontario Medical Association, in a report on the illness costs of air pollution in Ontario (DSS Management Consultants, 2000), forecast that in 2000 air pollution in Ontario would result in approximately 1,900 premature deaths, with the number of premature deaths rising to 2,600 by 2015 if nothing is done to reduce air pollution. Of these deaths, 70% are due to cardiovascular disease, with another 30% due to respiratory disease; 40 percent occur below the age of 65.

The report also estimated that 9,800 hospital admissions (57% due to respiratory disease, the rest due to cardiovascular disease), 13,000 emergency room visits (55% respiratory) and 47 million minor illness days were attributable to air pollution, rising under a 'business as usual' scenario to 13,000 hospital admissions, 18,000 ER visits and 53 million minor illness days by 2015, and that the current costs of the health impacts of air pollution in Ontario are in excess of $10 billion annually. These costs include about $600 million in direct medical costs and another $560 million in direct costs to employers and employees for lost time. The value of the pain and suffering that is incurred is about $5 billion, with another $4 billion for the value of the premature deaths attributable to air pollution. If nothing is done, these costs will rise to around $12 billion by 2015.

In BC, a report commissioned by the Medical Health Officers of the Lower Mainland concluded that, while not as bad as in Ontario, air pollution in that area contributes to between 15 and 150 premature deaths annually (Environment Canada, undated), while a report from the Greater Vancouver Regional District "recently estimated that between 1985 and 2020, AirCare and other [air pollution prevention] programs will save 2,800 lives, prevent 33,000 emergency hospital visits and will result in a $1.6 billion benefit to the provincial economy" (AirCare, undated)

In addition to causing cardiovascular disease and chronic respiratory disease, air pollution also contributes to cancer. The chief culprit here is diesel exhaust, which has been recognised by the International Agency for Research on Cancer as a probable human carcinogen (Frumkin and Thun, 2001), while "the California EPA estimates that 450 out of every million Californians are at risk of developing cancer due to diesel exhaust exposure" (Union of Concerned Scientists, undated). Prolonged exposure to diesel exhaust, such as is experienced by transportation workers and others, "probably increases the risk of lung and perhaps of other cancers" (Frumkin and Thun, 2001)

An issue that links this issue to the health of children and to schools is a report by the National Resources Defense Council (Solomon et al, 2001) that found that children who ride

diesel school buses may be exposed to as much as four times more toxic diesel exhaust than people riding in vehicles traveling directly behind, or in front of, such buses. That exposure level on the buses is more than eight times the average ambient air pollution level in California, and as much as 46 times the diesel fumes cancer risk exposure threshold established by the U.S. Environmental Protection Agency (EPA), the report concludes.

The health impact of transportation systems is not limited to the effects of air pollution. McCarthy (1999, in Marmot and Wilkinson) reviews the evidence relating transportation to health in industrialized countries. Among the other health effects of transportation he identifies the following:

- a reduced risk of heart disease in those who undertake moderate to vigorous exercise, specifically walking and cycling
- improved social networks and better mental health among those living on streets with less traffic
- injuries and deaths resulting from motor vehicle accidents.

To this, the Independent Inquiry . . . (1999) adds such mental health concerns as noise pollution and feelings of insecurity among older people and families with children. They also note the important role of transportation in enabling people to gain access to goods and services that they need for health, and to maintain social networks.

As noted earlier, we now spend as much of our time in our cars as we do outdoors; the average Canadian spent 0.3 hours a day travelling, but for the 18 percent who reported travelling, the time spent travelling per day was 1.9 hours (Statistics Canada, 1998). In fact "according to Statistics Canada, only 8% of employed Canadians did not commute to work in 1992", while

> "for the majority that commute, the total time to work and back averaged 48 minutes each day during the week . . . residents in Toronto and Vancouver had the longest daily commute, averaging 60 minutes, while 10% of the national average spent more than 90 minutes commuting each day." (CMHC, 1995).

Thus the average Vancouver commuter who spends one hour a day commuting (one half hour each way) for 230 working days a year (46 weeks) will spend 230 hours commuting, the equivalent of almost six 40-hour weeks. And most of that time is inactive, because most commuting is done by car.

As already noted, this physically inactive lifestyle has a significant health impact, contributing to a wide range of chronic diseases. A recent study in the US, for example, examined rates of overweight and obesity, high blood pressure and walking in 448 counties and 83 metropolitan areas ranked on a 'sprawl index'. The researchers found that the BMI was significantly higher in the high-sprawl counties compared to the low-sprawl counties, a difference amounting to more than 6 pounds weight difference between the extremes of the counties on the sprawl index. Moreover, they had a slightly higher blood pressure, and spent less time walking (Ewing et al, 2003)

Clearly, not all of this human and economic toll can be laid at the door of our current inactive transport system, but it does play a part. Consider for a moment the difference in travel patterns between Canadians, Americans and Europeans, in terms of 'modal split' in 1995 (Table 5). Compared to the Americans, who use autos for 89% of trips, we don't look too bad at 76%, and not very different from the English and Welsh (65%). But in the rest of Europe 20 percent or more of trips are on foot, compared to our 10 percent, and most Europeans also bicycle a lot more. The result? Roughly half their trips for all purposes are by car, compared to three-quarters of trips in Canada (Pucher, 1998). Moreover, even though 72% of children prefer to travel to school by walking and cycling, less than half of all children in Canada now walk to school, while some 20-25 percent of all peak hour trips in a typical Canadian community are related to travel to and from school (O'Brien, 2001).

Table 5: Modal split for urban passenger travel in Europe and North America, 1995 as percent of trips, all trip purposes (Pucher, 1998)

Country	*Percent of trips by travel mode*				
	Auto	*Public Transport*	*Bicycle*	*Walking*	*Other (a)*
USA	*89*	*2*	*1*	*6*	*3*
Canada	*76*	*10*	*2*	*10*	*2*
England and Wales	*65*	*14*	*4*	*12*	*5*
France	*54*	*12*	*4*	*24*	*6*
Italy	*52*	*16*	*4*	*24*	*4*
Germany	*49*	*16*	*12*	*22*	*1*
Switzerland	*46*	*20*	*10*	*24*	*0*
Sweden	*46*	*11*	*10*	*29*	*4*
Netherlands	*45*	*7*	*28*	*18*	*2*
Austria	*45*	*13*	*9*	*28*	*5*
Denmark	*42*	*14*	*20*	*21*	*3*

Source: Ministries of transport and departments of transportation in various countries.

Another aspect of the physical environment of the community as it relates to health is noted by Jackson and Kochtitsky (2001), who observe that in research on physical activity, lack of structures or facilities (eg., sidewalks and parks) and fears about safety are two of the main reasons people give for not exercising in the US. They comment that "It is dishonest to tell citizens to walk, jog, or bicycle when there is no safe or welcoming place to pursue these "lifesaving" activities."

It is evidence such as this that led Dr. Richard Jackson (Director of CDC's National Center for Environmental Health) to observe that diseases such as heart disease, diabetes, obesity, asthma, and depression "are diseases that can be modulated by how we design and build our human environment" and to suggest that public health needs to pay a great deal more attention to land use decisions in particular, by supporting research into the health impacts of the built environment, participating in local planning processes and land use decisions and working with planners and other land use professionals to ensure that health is taken into account (Jackson and Kochtitzky, 2001).

Environmental carcinogens

Estimates of the proportion of cancer that can be attributed to environmental exposure vary widely; a recent report from Cancer Care Ontario (2003) on the future of cancer prevention accepts a figure of Expert Panel convened in April 2001 by Cancer Care Ontario addressed the issue of environmental exposures and cancer prevention (Krieger, et al, 2001). They defined environmental exposure as

> "natural and anthropogenic chemical and physical hazards in air, water, soil, foods (ie., food contaminants, not natural food toxins), consumer products and our climate to which people may be exposed, usually involuntarily because of the need to eat, drink and breathe in order to live."

It is important to note that this definition might also be considered to include occupational carcinogens. However, the panel explicitly excluded diet itself (as opposed to food contaminants, such as those discussed above, which are included in the definition) as well as lifestyle factors such as smoking and physical activity, exposures to medical and dental radiation or other iatrogenic carcinogens, and infectious agents.

The Panel then identified a framework to prioritize these exposures, which utilized four key questions:

- How strong is the evidence of an association between the environmental exposure and the occurrence of cancer?
- How large is the problem relating to the exposure? (eg., prevalence of exposure, incidence of outcome, and magnitude of effect)
- Is there a public concern or pressure for a response regarding control of exposure levels?

- How does this apply to Ontario?

The panel identified and prioritized the following list of environmental exposures of concern for cancer prevention:

- ultraviolet radiation
- environmental tobacco smoke
- polycyclic aromatic hydrocarbons, other outdoor air pollutants, and other combustion by-products
- asbestos
- water disinfection by-products
- electromagnetic fields
- endocrine disrupters
- radon
- pesticides
- radio frequency waves
- dump site contaminants
- heavy metals.

Preventing exposure in the home, school, workplace, community and general environment, clearly, should focus first on reducing exposure to these priority chemical and physical agents. The Cancer Care Ontario (2003) report on cancer prevention in the future identified three of these issues – chlorination by-products, associated with bladder cancer, fine particulate air pollution, associated with lung cancer, and UV exposure, associated with skin cancer – as those where there is reasonable documentation of risk that warrant targets to reduce exposure. Their overall target is that "No Ontarian will be exposed to ambient levels of environmental carcinogens from all sources above the minimum risk level of one in a million excess cancer risk for candidate substances."

3.3.3 Social, economic and cultural conditions

Social, economic and cultural conditions contribute in a general way to the overall burden of disease. They do so in part by shaping the behaviour of societies, communities, families and individuals and in part through influencing the individual's physiological and biochemical functioning, acting through the psycho-neuro-immune system. Unlike the proximate risk factors, these societal conditions appear to affect all aspects of the burden of disease, in particular mental health problems as well as other important chronic disease conditions,

resulting in marked inequalities in health. Such inequalities are found everywhere, from the global to the local level, and BC is no exception. As shown in Figure 7, there is a clear relationship between regional ranking of health status and regional ranking of determinants of health in BC. As the Provincial Health Officer (2000a) noted:

> ". . . regions that score well on living and working conditions, early childhood experiences, personal health practices, the physical environment, and health services have a higher level of health."

Among the key societal conditions that have been shown to affect health are:

- early child development
- educational attainment and social-emotional competence
- unemployment
- social status, social hierarchy and relative deprivation
- poverty and absolute deprivation.

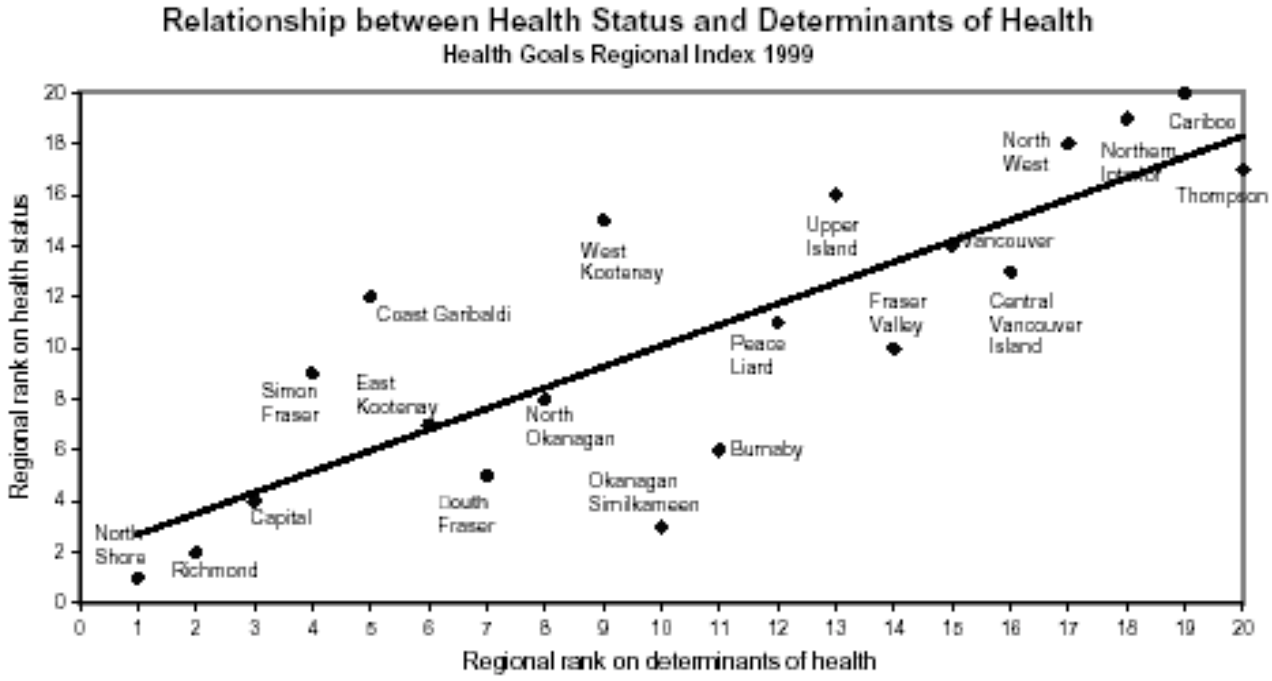
But while there is a good deal of research, there is as yet little data on the population attributable risk of these societal conditions for specific diseases and conditions, although Wilkinson (1999) maintains that "something between 1/3 and 2/3 of the differences in measures of the social environment, in mortality and in violence may be attributable to the extent of income inequality alone."

However, as a recent Australian report reviewing the determinants of mental health (but more generally applicable to all chronic diseases) points out:

> "For many disorders, however, the risk factors are generic and it is not possible to determine which risk factors will lead to a particular mental disorder. Effective prevention programs (that) tend to target a range of risk factors . . . are likely to have a preventive effect for all mental health problems and mental disorders." (Commonwealth of Australia, 2000)

Figure 7

Source: **Provincial Health Officer (2000a)**



3.3.3.1 Early child development [26]

An important Canadian review of early child development (Guy, 1997) examined recent research that showed that "the first few years of life can have a lifelong impact on health, mental ability and coping skills". Among the most important factors are early stimulation as a result of good parenting, good early childhood education and child care, all of which stimulate brain development, with important implications for intellectual, emotional and social development; caring and supportive relationships with parents and other close family members; a supportive community that protects children from harm and neglect and provides them with opportunity and hope. The converse of these conditions constitute risk factors and risk conditions that may adversely affect both child development and health and subsequent adult health.

3.3.3.2 Education

Educational attainment is strongly and consistently associated with higher health status:

> "Educational attainment is widely acknowledged as one of the key components of socio-economic status and is positively associated with health status and health behaviours." (Federal, Provincial and Territorial Advisory Committee . . ., 1999a)

Education is one of the most important determinants of health, affecting such factors as income level and job security, as well as providing people with a sense of control over their life circumstances (Health Canada, 1999). Higher levels of education not only confer a more sophisticated level of knowledge but increase the likelihood of attaining a well-paying job and higher levels of social status, all important predictors of health.

The authors of the UK's Independent Inquiry . . . (1998) point out that education influences health and inequalities in health in at least four different ways:

- education largely determines an individual's labour market position, and thus socio-economic position, which influences their access to basic material resources for health such as food, housing and so on.
- education prepares children for life, providing "the practical, social and emotional knowledge and skills to achieve a full and healthy life". These life skills include knowledge about health and its determinants, "skills in developing relationships and dealing with conflict, and practical skills such as budgeting and cooking".
- education plays a social role in developing in children what might be termed citizenship skills; the ability to fully participate in society, cooperate and work together, understand other groups and be tolerant, and so on.
- the education system itself, which should "protect and promote the current health of children, by providing an environment and culture which is safe, healthy and conducive to learning".

[26] See section 2.4 for a fuller discussion of early child development and the life course.

Unemployment

While work can be a source of ill health, as noted earlier, so too can the loss of work, whether through unemployment or retirement. Marmot et al (1999) note that "loss of job was shown to be associated with elevated risk of mortality in independent prospective studies both in Britain and in Finland", while Bartley et al (1999) note that "longer term unemployment causes deterioration in mental health in those who were previously healthy". It was recent unemployment, rather than the total amount of unemployment a person experienced, they noted, which put him or her at risk for deterioration in mental health.

The Independent Inquiry . . . (1998) notes that for most people, unemployment has "a significant adverse affect on both physical and mental health", including premature mortality, higher rates of suicide, higher risks of morbidity (including depression and anxiety) and lower levels of psychological wellbeing". While there is a degree of selection of unhealthy people into unemployment, the authors note that this is "not the dominant factor", but rather that unemployment results in poorer health because of

- increased poverty and hardship
- social exclusion
- changes in health-related behaviour
- disruption of future work careers.

Moreover, not only are unemployed people affected, so too are their spouses and children.

3.3.3.4 Social status, social hierarchy and relative deprivation

Marmot (1999) argues that the causes of inequalities in health are due to both material deprivation (discussed next) and psychosocial factors related to social gradient or relative deprivation. Noting that "The mechanisms linking social position to health, across the whole social gradient, are likely to involve psychosocial factors", Marmot proposes that among the key psychosocial factors that are related to inequalities in health are the following:

- lower levels of social support or integration
- low level of control in the work place
- low overall perceived level of control or mastery in society
- hostility levels at both the personal and community level.

Relative deprivation results from the inferior position of some people within a socio-economic structure of hierarchy behaviour in society and in specific settings such as communities and workplaces. Evidence suggests that subordinate status in itself has adverse health effects,

mediated once again through psychosocial factors and the psycho-neuro-immune system.[27] Low social status is associated with lack of control over life and health, high levels of anxiety, depression, shame and insecurity, lower levels of trust and group membership, and higher levels of hostility which manifest as racism, classism, sexism and violence. Physiological effects include a state of chronic arousal with increased basal cortisol levels, increased fibrinogen levels, unfavourable HDL/LDL ratios, insulin resistance and other effects (e.g., on the immune system) which increase the individual's risk of disease (Marmot and Wilkinson, 2001).

In summing up the evidence presented in Social Determinants of Health (Marmot and Wilkinson, 1999), Wilkinson (1999) stresses the importance of this relative rather than absolute deprivation as an important factor underlying the inequalities in health that are associated with income inequality. He suggests that relative deprivation affects health in two ways: "through the direct psychosocial effects of low social status . . . (and) through the poorer quality of social relations found in more hierarchial societies." He further suggests that

> "issues to do with shame, inferiority, subordination, people being put down and not respected, etc., are extremely important - if largely unrecognized - sources of recurrent anxiety resulting from hierarchy."

He emphasizes the important relationship between inequality on the one hand and a less cohesive, less supportive and more conflictual society on the other. He notes that the combination of increased income inequality and the associated weakening of social bonds "can hardly fail to have a potent effect on health". As a consequence, "low social status and poor social relations are probably two of the most powerful risk factors influencing population health."

3.3.3.5 Poverty and material deprivation

The most obvious and most dramatic societal condition that adversely affects health is poverty, which is not merely a matter of how much income people have but is a complex set of issues that include level of education, location of housing, type of work, likelihood of employment and quality of working conditions, availability of and access to basic needs and a wide range of societal resources and services, sense of powerlessness and other attributes. In addition to influencing the settings in which people lead their lives, these broad psycho-social and socio-economic factors influence the behavioural patterns of groups and individuals, establishing norms of behaviour that in turn establish patterns of risk. The interaction of these risk environments, risk conditions and risk behaviours ultimately impact upon the individual's physiological and psychological functioning, thus influencing their level of health.

Material deprivation involves an inability to acquire the basic prerequisites for good health such as food and water, shelter, adequate clothing, safe living and working conditions,

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[27] The well-known 'pecking order' in chickens is but one of countless examples in the animal world of this phenomenon, which also applies to humans.

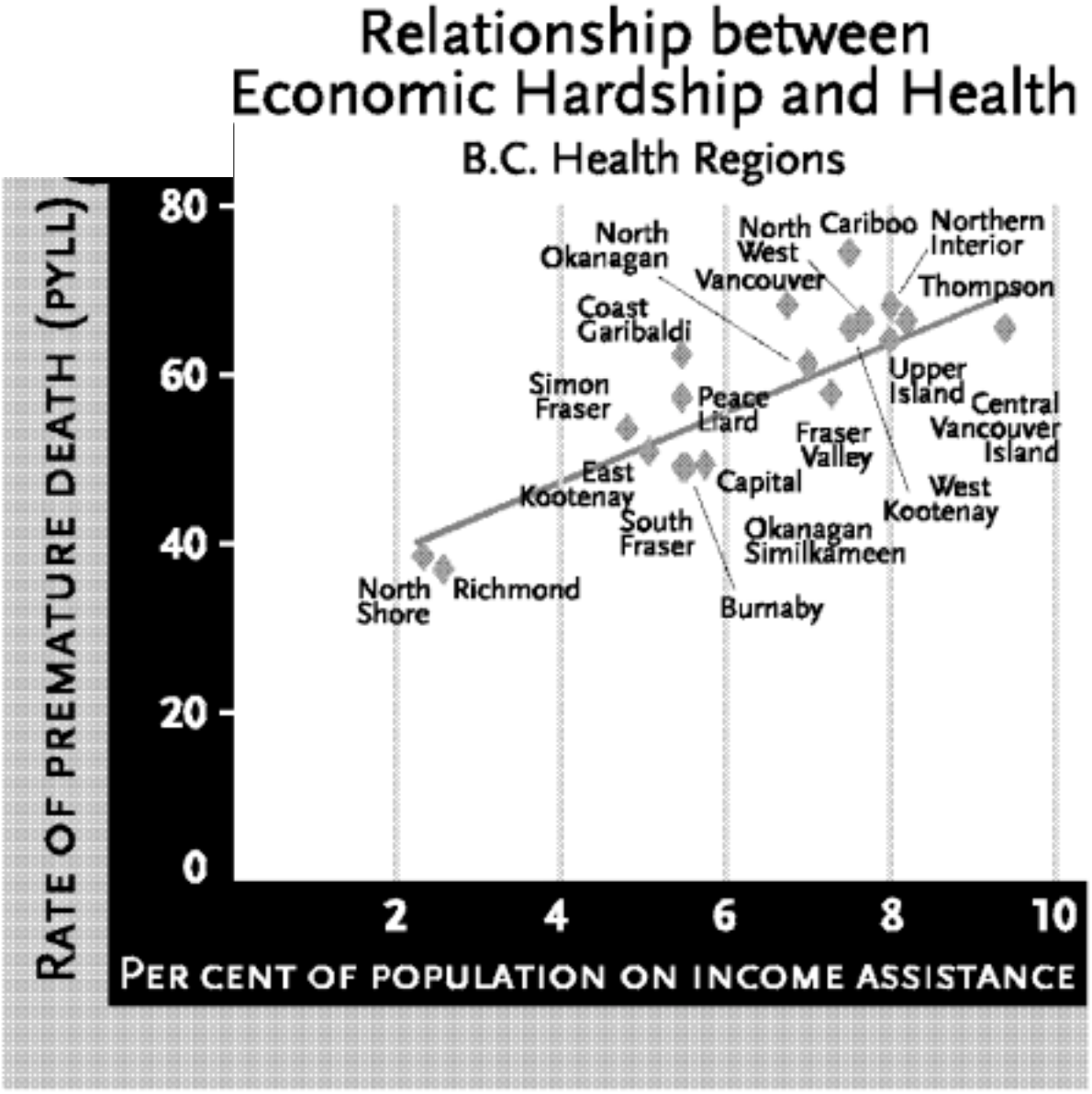
education and income. It is hardly surprising that homelessness, hunger, illiteracy, absolute poverty and dangerous living and working conditions have direct physical effects on people. For example, chronic under-nutrition contributes to small stature, which is clearly associated with lower health status in adults (Marmot, 1999).

In addition, there is also an inability - because of lack of income and personal and family resources - to access and benefit from a variety of societal resources, including in particular education, health services, recreation, arts and culture and so on. Lynch et al (cited in Marmot and Wilkinson, 2001) describe this "neo-material" deprivation as "a combination of negative exposures and lack of resources held by individuals, along with systematic under-investment across a wide range of human, cultural, and political-economic processes". Marmot (1999) also notes that the meaning of material deprivation has broadened over time, from being hungry, homeless or living in absolute poverty to the modern context in which material deprivation "may mean inability to participate fully in society and control ones life". This form of material deprivation is also related to relative deprivation, as described above.

Absolute poverty and material deprivation, in the sense of absence of the most basic determinants of health such as food, safe water, shelter, education and income, is rare in developed Western industrialized countries, but not non-existent. Hunger and homelessness are sadly not foreign to Canadian communities, while some First Nations communities experience close to absolute poverty. Not surprisingly, such levels of poverty have a dramatic impact on health status (Figure 8). But in Canada today, as in other Western industrialized countries, the greatest - but not the most severe - adverse impact of poverty and deprivation upon health likely results primarily from the relative deprivation described earlier.

Figure 8

Source: Provincial Health Officer, 2000b



Income Assistance: Per cent of the population age 0-64 receiving Basic BC Benefits, September 1999. Prepared by BC STATS, Ministry of Finance and Corporate Relations. PYLL: Potential years of life lost (age under 75 years), all causes of death, average annual rate (age standardized) per 1,000 population for 5-year period 1994-1998. B.C. Vital Statistics Agency, Ministry of Health. Unpublished tables.

3.3.4 The relative contribution of determinants to selected chronic diseases

What, then can we say about the relative contribution to chronic diseases of the wide variety of determinants reviewed here? First, of course, there is no simple relationship among the various determinants, no single factor or even a set of factors that predominates – it all depends. Nonetheless, the evidence summarized here indicates that:

- genetic factors contribute to some extent to these chronic diseases, as do other biological factors such as sex;
- a set of specific behaviours smoking, physical inactivity, poor nutrition and obesity, themselves determined by a wide variety of factors - may account for a quarter to a third of the burden of disease resulting from cardiovascular disease, cancer, chronic respiratory disease and diabetes;
- psychosocial factors in settings such as the home, the school, the workplace and the community have an effect that interacts with and influences behaviour; such factors in the workplace may acount for 25 – 35% of the gradient in sickness absence between high and low status workers;
- the physical environment contributes to some extent, particularly with respect to both indoor and outdoor air quality and the health impacts of urban design;
- societal factors, including relative deprivation, may account for another one third to one half of the overall burden of disease.

Second, it follows from the evidence presented here that there is no single intervention, and no simple remedy, that can reduce the burden of chronic diseases. As we have learned from our experience with tobacco, it requires a prolonged commitment of skills and resources in a multi-setting, multi-factor, multi-strategy approach. The evidence of the effectiveness of preventive intervention for chronic diseases is the subject of the next section.

4. Effective Chronic Disease Prevention - The Evidence

As clearly indicated in Figure 1, there is a wide range of interventions that can be expected to prevent chronic disease. These range from clinical interventions (screening, treatment of precursor conditions, immunization etc.) through behavioral change and changes in psychosocial settings such as schools and workplaces, to changing the built environment and the underlying economic, social and cultural conditions in society. Moreover, such interventions need to occur throughout the life course, from the health of mothers before birth through their pregnancy, and then from infancy through to old age, and should focus in particular on reducing the disproportionately high burden of chronic disease suffered by those who are most disadvantaged: First Nations people and people living in poverty.

In this section of the report, the evidence of effectiveness is reviewed for the main categories of intervention identified in Figure 1, beginning with a summary of recent general reviews of disease prevention and health promotion and the evidence regarding changing societal conditions through the development of healthy public policy. Next is a review of the evidence on the effectiveness of creating supportive physical and psychosocial environments in the key settings in which people lead their lives: communities, workplaces, schools and homes. This leads to a discussion of interventions to strengthen communities and build resilience, interventions that are often based in these settings. This is followed by a review of behavioural interventions that aim to help people adopt healthy behaviours and avoid – or give up – unhealthy behaviours; these interventions may be either population-wide or more narrowly focused on people at high risk or with the early signs of disease. Finally, the effectiveness of preventing infections linked to chronic diseases, early detection/screening and clinical interventions (immunization, prophylaxis, counseling, early treatment of precursor conditions) is reviewed.

But before reviewing the evidence, it is important to discuss the topic of evidence in public health, since what is taken as evidence in public health differs in some respects from the understanding of evidence in biomedical science, while the extent of evidence that is available is also problematic.

4.1 Evidence and practice in public health

Assembling the evidence of the effectiveness of preventive intervention is beset by problems, not the least of which is the availability of research findings. There are a number of reasons for this:

- First, the amount of funding devoted to public health services, and to research on population and public health issues, is eclipsed many times over by the amount spent on clinical services and clinical and basic research. Public health receives some 2.5 – 3 percent of the health care budget, and funding for research is similarly inadequate. This is reflected in the literature. For example, in a review of the literature on chemoprevention in cancer, Hrelia and Tanneberger (1997) found that in a six year period, there were 51,447 papers published world wide on chemotherapy of cancer, but only 1,496 papers were published on the chemoprevention of cancer, a ratio of 34:1

that is entirely consistent with the 1/40th to 1/30th of the health budget that public health receives.

- Second, the type of research that is carried out tends to fit with a somewhat older and more medicalised vision of public health and health promotion as being more concerned respectively with infectious diseases and with biological risk factors and behavioural change. For example, it is noteworthy that of the 239 Cochrane reviews and protocols deemed relevant to health promotion and public health, fully one quarter are concerned with infectious diseases, with a third of those for vaccines. Of the remainder:

    - 13.8% are about tobacco (with more than 40% of those related to primary care interventions)
    - 11.3% are about nutrition (with half of them concerned with pregnancy and breastfeeding),
    - 10% are about injuries
    - 7.9% are about mental and social health
    - 6.3% are about population screening
    - 4.6% are about cardiovascular disease.

  Interestingly, cancer does not even get a separate category, while respiratory disease and oral health each comprise 3.8% of the reviews and protocols, and diabetes, with 1 protocol and no reviews, accounts for only 0.4%.

- Similarly, a recently completed census of economic evaluations of primary prevention interventions in population health undertaken by the Centre for Health and Policy Studies at the University of Calgary (Rush, Shiell and Hawe, 2002) found that

    - 48% of the studies concerned infectious diseases, another 20% addressed tobacco control and cardiovascular disease, and 9% addressed injury prevention, which includes domestic violence. Only 6 percent addressed child development (including healthy birth), 4% concerned comprehensive risk factor interventions, and a mere 3 percent concerned cancers other than those related to tobacco use.
    - 89% of the studies addressed biological (45%) and behavioural (44%) risk factors, while only 10% addressed the environment and just over 1% addressed social and economic risk factors.
    - In terms of the type of health promotion strategy employed (based on the Ottawa Charter), while 21% of the studies addressed the creation of supportive

environments, only 1% addressed the strengthening of community action and the reorienting of health services; three quarters of the studies were concerned with clinical-preventive measures (42%) and the development of personal skills (34%).

- Third, the long time frame and large sample size needed to pursue intervention studies in public health present a challenge. Even for the major proximate causes described above, McPherson (2001) points out that if the criteria for evidence-based medicine are applied to preventive interventions, the sort of study that would show "a 10 percent improvement in disease rates while avoiding the confusion of type-II errors,[28] often needs 10,000 participants followed for 20 years". Since such long-term studies are expensive and comparatively rare, the result – not surprisingly - is that often the evidence on prevention interventions comes from "inadequate trials, commonly based on type-II errors, and on inadequate control, compliance, and follow-up".

- Fourth, the type of research that is required for population health intervention studies is different from the 'gold standard' randomized controlled trial of clinical medicine; it is worth noting the point made by the Independent Inquiry into Inequalities in Health (1998), that "The more a potential intervention relates to the wider determinants of inequalities in health . . . the less the possibility of using the methodology of a controlled trial to evaluate it."

  As a result of all these reasons, while we have comparatively good evidence about the "usual suspects" (tobacco, alcohol, physical inactivity, diet, etc.) for which such large long-term studies have been undertaken, we have little firm data about the contribution (specifically, the population attributable risk) made by societal or risk conditions to the burden of disease, be it heart disease or depression. Nor, as will become clear, do we have much "hard" scientific evidence about the effectiveness of specific environmental, psycho-social, socio-economic or cultural interventions as a means of reducing the burden of disease. So time and again we are driven back under the light to search for answers, [29] and time and again we turn to the biological risk factors and the risk behaviours for which we do have reasonable evidence. However, this does not diminish the importance of the broader determinants of health and the strategies need to address them. Absence of evidence is not evidence of absence of effect.

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28 "The error of not rejecting the null hypothesis when it is false". (Source: The Collins English Dictionary, 2000) A Type II error results in accepting that there is no difference when in fact there is a difference, often due to too small a sample when the difference is quite small; as a result, the study would not have the power to detect a real difference.

29. There is a story, much beloved by public health researchers, of the drunk who was found stumbling around looking for his car keys, which he had dropped. When asked where he had dropped them, he pointed to a spot about 50 feet away. 'So why are you looking here?', he was asked. 'Because this is where the light is', he replied!

4.1.1Economic evaluations of primary prevention

Even though the purpose of prevention is to save lives (or more precisely, to avoid premature death) and to prevent or reduce pain, suffering and disability (just as is the case for clinical medicine), there is frequently an interest on the part of policy makers in the health care system in the economic benefits of prevention.[30] So while the principal focus of this report is on the health benefits of prevention, a brief review of some of the economic evaluations of primary prevention that are available is provided here.

It is worth understanding what is meant by economic evaluation. Shiell et al (2002, cited in Rush, Shiell and Hawe, 2002) have identified four main forms of economic evaluation:

- cost-minimisation, in which the outcomes of the interventions being compared are assumed to be or can be shown to be equal
- cost-effectiveness, in which a single dimension of outcome is measured in a naturally occurring unit (e.g. life years saved)
- cost -utility, in which multi-dimensional health outcomes are expressed in a single index of quality-adjusted life expectancy
- cost-benefit, in which all costs and outcomes are expressed in commensurate units - usually money .

In a briefing document for policy makers on the topic of cost-effectiveness, the Washington - based Partnership for Prevention (2001) notes that "prevention does cost money" and that "the effectiveness of a policy is the extent to which the problem is reduced or the amount of improvement in health that results". A cost-effectiveness analysis answers the question "what policies, programs or services yield the greatest health benefits for any given amount of resources?".

In considering the costs and benefits of prevention, Musich, Burton and Edington (1999) point out that "nearly all measures of direct cost savings, cost-benefit and cost-effectiveness are biased against prevention" and they caution that it is "nearly impossible to find a single suitable cost measure for the relative cost -effectiveness comparison of prevention, acute treatment and long term disease management". This is because direct costs for acute treatment "are specific to the disease or injury and are targeted directly at those who have the event", while "direct costs allocated to primary prevention are spread over a large population of generally healthy individuals". However, when indirect costs or quality of life and health status are included, "prevention measures generally exceed those savings associated with disease treatments". This leads them to suggest that when the ratio of indirect to direct costs is high, there is "a major opportunity for prevention and disease management programs to greatly impact the cost-economics of health care services". Those conditions for which the ratio of indirect to direct costs in the USA is high include influenza

30 However, there is no more reason to expect prevention to save money than there is to expect cardiac bypass surgery to save money; if it does so, it is an added benefit.

(9.29), arthritis (3.26) cancer (1.97), and diabetes (1.22).

In BC, the ratio of indirect to direct costs is high [31] - greater than 1.5 - for the following categories of disease: [32]

- Musculoskeletal 6.22
- Cancer 4.87
- Injuries 3.45
- Nervous system 2.22
- Infectious diseases 1.99
- Respiratory diseases 1.88
- Cardiovascular diseases 1.68

This suggests that prevention of these diseases is likely to have a significant impact on the costs of health care in BC. Another complicating factor is that just as is the case for prevention research in general, as already noted, the vast majority of economic evaluations have been carried out for clinical interventions. For example, of the more than 1500 studies that have been subjected to a critical appraisal by the U.K.'s Center for Reviews and Dissemination, only around 10 percent relate to health-promoting interventions (Rush, Shiell and Hawe, 2002). Moreover, since it is "a pre-requisite for economic efficiency" that the intervention first be found to be effective, proper economic assessment is restricted to prevention and promotion interventions that have been shown to be effective - which narrows the field even further. A third complicating factor is that it is "far more difficult to evaluate the effectiveness of interventions designed to address multiple determinants of health" (Rush, Shiell and Hawe, 2002)

Of particular importance is a recently completed census of economic evaluations of primary prevention interventions in population health undertaken by the Center for Health and Policy Studies at the University of Calgary (Rush, Shiell and Hawe, 2002). They searched for studies published in English between 1990 and 2001 and of relevance to high-income countries and found 414 evaluations. Interestingly, and troublingly from the perspective of those looking for economic evaluations in the broad field of primary prevention of chronic disease, it is clear that the overwhelming majority of economic evaluations of primary prevention have focused on bio-medical and behavioral risk factors, and clinical and behavioral interventions, as noted earlier. There have been few studies that have looked at broader socio-environmental

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31 But not directly comparable to the American ratios due to different methods of measuring costs

32 Calculated from the website of Economic Burden of Illness, 1998 (Statistics Canada, 2003) at http://ebic-femc.hc-sc.gc.ca/select_options.php?Lang=e&stream=cd&v_or_c=v

conditions or the strengthening of community action (and none that have looked at healthy public policy), at the school setting, or at health problems such as mental health, alcohol and drug abuse, nutrition or physical activity. Thus there is a dearth of evidence with respect to the economics of some of the more important public health issues and health promotion strategies of our day; this makes it important to recall that absence of proof of economic impact is not proof of absence of economic impact.

Having said that, it is worth summarizing some of the economic evidence we do have. In a report on the cost-effectiveness of different key public health prevention interventions, the Centers for Disease Control and Prevention (1999b) reported with respect to several key chronic diseases as follows (in viewing these figures, it is worth noting that Musich, Burton and Edington (1999) suggest, based on two recent reviews, that cost-effectiveness ratios of less than $166,000 U.S. per life year or quality-adjusted life year gained are deemed acceptable):

- breast cancer - mammography screening costs approximately $60,000 per life-year gained (US$ 1984) with the range in one study using the combination of an annual mammogram and clinical breast exam of $22,000 to $84,000 per life year gained in women aged 55 to 65 years

- cervical cancer - screening average-risk asymptomatic women aged 20 through 75 years every three years costs $14,000 per life-year gained (US$ 1987). Annual screening of the same population costs approximately $40,000 per life-year gained.

- colorectal cancer - annual fecal occult blood testing in a 65 year-old population costs $35,000 per life-year gained (US$1989)

- smoking - brief advice and counseling on smoking cessation by a physician costs $705 to $988 per life-year gained for men, and $1,204 to $2,058 for women (US$ 1984), assuming a 2.7% cessation rate.

- coronary heart disease - a regular exercise regimen would cost $3,433 per life -year gained (US$ 1985), although this increases to $27,851 when the cost of time expended for exercise is considered.

Graham et al (1998), from the Harvard Center for Risk Analysis at the Harvard School of Public Health, reviewed the evidence on the cost-effectiveness of a number of clinical and public health measures, based on U.S. studies. However, they noted that " the methods used to derive the cost-effectiveness ratios . . . vary considerably . . . Greater uniformity of analytical practice will be necessary if cost-effectiveness analysis is to become a more influential tool in debates about resource allocation."

With that caveat in mind, the following is a summary of their findings with respect to the cost per life-year saved for selected cancer prevention interventions (all amounts are in 1995 U.S. dollars):

- restriction of cigarette sales to minors - $840
- Pap smear every four years among women aged 20 to 75 - $14,000
- annual fecal occult blood screen for colorectal cancer among adults aged 50 to 75 - $14,000
- mitigation of radon in homes - $47,000
- annual Pap smear for women over age 65 - $51,000
- annual mammography for women aged 55 to 65 - $120,000
- annual mammography for women aged 40 to 50 - $200,000
- annual Pap smear for women aged 20 to 75 - more than $1,300,000

Their findings with respect to selected coronary heart disease prevention interventions per life-year saved (also in 1995 U.S. dollars) were as follows:

- education to promote cholesterol reduction among the general population ages 35 to 84 - $3,400
- for treatment of hypertension among patients aged 35 to 64
    - beta-adrenergic blocker- $15,000
    - diuretic - $22,000
    - calcium channel blocker - $43,000
    - alpha-adrenergic blocker - $83,000
    - ACE-inhibitor - $96,500
- Lovastatin for treatment of men aged 45 to 74 with
    - prior coronary heart disease and cholesterol less than 250 mg/dl - $20,000 to $31,000
    - blood cholesterol > 300 mg/dl - $71,000 to $135,000
    - blood cholesterol > 250-299 mg/dl - $105,000 to $270,000

Finally, a recent Australian study (Department of Health and Aging, 2003) examined the costs and benefits of several public health programs in Australia. 33A life was valued at $1 million while each healthy life year was valued at $60,000. A discount rate of 5% per annum was applied to all benefits and costs. Societal benefits were defined as encompassing increased longevity, improved quality of life and reduced health care expenditures. Two of the programs that were reviewed focused on chronuic diseases and they are summarised here.

- Tobacco: Assuming that public health tobacco programs (other than tax increases, which account for much of the impact) accounted for a mere 10% of the decline in tobacco use – a conservative estimate according to the authors - the $176 million invested in those programs since 1971 yields:

    - total societal benefits from 1971 - 2010 of $8.6 billion and a net societal benefit of $8.43 billion, a benefit - cost ratio of nearly 50:1.

    - total government savings for health care expenditures are estimated to be $344 million, a benefit – cost ratio of 2:1.

    - Current public health expenditures on tobacco control in Australia are estimated to be $18.3 million (2000 $s) in 1996/7, while the net societal benefit in 1998 alone from public health tobacco control expenditures was $1.182 billion. If expenditure on public health tobacco control programs continues to be at the level of $18 million annually, it is projected that the net societal benefit in 2010 will be $2.159 billion.

  In 1998, overall societal benefits from reduction in smoking amounted to $12.3 billion ($9.6 billion for increased longevity, $2.2 billion for improved health status, $0.5 billion for lower health care costs).

- Coronary Heart Disease: Assuming that public health programs to reduce coronary heart disease accounted for a mere 10% of the decline in tobacco use (as above), 30% of the reduction in blood cholesterol and none of the reductions high blood pressure – the latter being attributed entirely to clinical treatment (again, a conservative assumption) - the $810 million invested in those programs since 1971 yields:

    - total societal benefits from 1971 – 2010 of $9.29 billion and a net societal benefit of $8.48 billion, a benefit - cost ratio of more than 11:1.

    - total government savings for health care expenditures are estimated to be $577 million, which is less than the expenditures for the public health programs.

[33] Five public health interventions were reviewed - programs to reduce tobacco consumption, programs to reduce coronary heart disease, public health programs to reduce HIV/AIDS, immunisation programs and road safety programs and road trauma. Only the first 2 are summarized here.

- Current public health expenditures on programs to reduce risk factors for coronary heart disease in Australia are estimated to be $60 million (2000 $s) in 1996/7, while the net societal benefit in 1998 alone from public health coronary heart disease risk reduction expenditures was $934 million. If expenditure on public health tobacco control programs continues to be at the level of $60 million annually, it is projected that the net societal benefit in 2010 will be $1.078 billion.

In 1998, overall societal benefits from reduction in coronary heart disease due to the reduction in smoking, cholesterol levels and blood pressure amounted to $8.9 billion ($7.4 billion for increased longevity, $980 million for improved health status, $530 million for lower health care costs).

4.1.2 Better and best practices

The concept of "best practices" has become almost an article of faith in evidence-based medicine and public health. But it is in some ways a troublesome concept, since it seems to imply there is a single "best" way to do something, which almost seems to discourage further progress, or adaptation to the local situation. In a recent and as yet unpublished report discussing better solutions for complex problems, Moyer et al (2001) draw an important distinction between better practices, which are "actions and processes - plausible, appropriate, evidence-based and well-executed - that will reduce the current and future burden of disease" and best practices - "those actions - policies, research, programs and services - that will have the greatest impact on reducing the current and future burden of disease". In other words, better practices will have some effect, while best practices will have the greatest effect.

They suggest that 'best' practices are "subjective, situational, and time-sensitive" because new knowledge is always advancing our understanding of what constitutes 'best' and because what is best in one situation may not work well in another. They suggest that a 'better practices' approach is about an adaptive systems approach, not a prescriptive "one-size-fits-all" prescriptive approach with a single endpoint. Their 'better practice' model combines "evidence-based, contextually appropriate activities" with the processes of research and evaluation which "inform, support and grow from these activities" and which adhere to the following core principles:

- good solutions to complex problems draw upon both science and experience;
- they build on the past, make sense in the present, and contribute to better solutions in the future;
- they are subjective, situational , and evolving.

In the field of chronic disease prevention – indeed, in disease prevention and health promotion in general, there is often no single 'best' practice that can be universally applied. Rather, there are a number of practices for which we have some reasonable evidence (including

evidence based in experience) of effectiveness. These better practices should be identified for public health staff and others so they can be adopted if they seem feasible and appropriate, adapted to the local situation, and then evaluated.

4.1.3 Acting in the face of uncertainty

As noted earlier, it is important to understand that absence of evidence of effectiveness is not the same as evidence of absence of effectiveness. The lack of evidence reflects the complexity of the issues, which makes research challenging; the relatively recent and still emerging understanding of these broad and complex issues; and the very long time frame, perhaps spanning several generations, over which effects of interventions may occur.

But lack of 'gold standard' evidence (and many would argue that we will never have such evidence) cannot and must not be an excuse for failing to act on what we already know or for which we have reasonably strong evidence. The reality is that uncertainty is a characteristic of the science of population health - just as it is in the field of environmental science - but we still have to make policy decisions in the face of that uncertainty. The 1974 Lalonde Report itself addressed precisely this issue, looking to the Chinese concept of 'moi sui' (meaning "to touch, to feel, to grope around") to provide encouragement to the scientific community to take “innovative and creative action even when scientific certainty and predictability are in question” (Health and Welfare Canada, 1974). Today, we need to refer to and be guided by concepts such as the weight of evidence and the precautionary principle.[34]

4.3 General reviews of disease prevention and health promotion

Despite the gaps in our knowledge, there is evidence of the effectiveness - or ineffectiveness - of a wide range of strategies for the prevention of chronic diseases. Some of this evidence is being compiled in large and systematic review processes. The evidence on effectiveness from these and other sources is reviewed below in a hierarchical manner, starting with broad structural or socio-political interventions, where the intervention is complex and the evidence is not straightforward, but the population health effect may be great, to interventions in the clinical setting, where the intervention - for which we often have 'hard' scientific evidence - may be comparatively simple, but where the population health benefits may be somewhat less. Their key evidence-based findings concerning interventions are highlighted in ***bold italics.***

But first, two major reviews of the psycho-social and socio-economic determinants of population health which have recently been carried out under the auspices of the Institute of Medicine in the USA, and the 1998 Acheson report on inequalities in health in the UK (Independent Inquiry . . . 1998) are summarized, since they provide an overview of the evidence for the need for a comprehensive and multi-faceted approach to preventing disease and promoting health. All three reports came to very similar conclusions that are congruent

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34 The Wingspread Statement on the Precautionary Principle (January 1998) states “When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically”, while the “Rio Declaration” signed by hundreds of world leaders in 1992 contains as its Principle 15 “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

with the findings of a report on the evidence of the efectiveness of health promotion prepared for the European union by the International Union for Health Promotion and Education (IUHPE), the results of which are used in several places in this report.

In addition, the Cochrane Collaborative's Reviews on public health and health promotion, the work of the US Task Force on Community Preventive Services (the Community Guide), and the reviews by the Hamilton-based Effective Public Health Practice project are also summarised, with specific reviews from their work summarised as appropriate in later sections. Major and on-going reviews of the effectiveness of preventive clinical services are also available both in Canada (the Canadian Task Force on Preventive Health Care) and the US (US Preventive Services Task Force). Their evidence is reviewed mainly in section 4.9.

4.2.1 "Health and Behaviour" (US Institute of Medicine report)

This Institute of Medicine report discusses health-related interventions at the individual, family, organization, community and societal levels. Among the key findings of the report are the following:

> "Interventions must recognize that people live in social, political and economic systems that shape behaviours and access to the resources they need to maintain good health."

while

> ***"A fundamental finding of the report is the importance of the interaction of psychosocial and biological processes in health and disease."***

Among the factors that the report cites are socio-economic status, social inequalities, social networks and support, work conditions, depression, anger, and hostility.

> ***"Existing research suggests that interventions at multiple levels . . . are most likely to sustain behavioural change."***

and

> "While biological interventions and exhortations to individuals to change their behaviours are easier to administer, ***changes in social factors, policies, and norms are necessary for improvement and maintenance of population health."***

4.2.2 "Promoting Health: Intervention Strategies from Social and Behavioural Research"

> ***"The Committee finds the evidence compelling that coordinated, multi-level interventions offer the greatest promise to address most public health needs." (Smedley and Syme, 2000)***

In their overview of the work of a Committee of the Institute of Medicine that reviewed social and behavioural intervention strategies for promoting health, Smedley and Syme note that neither population-based interventions nor public policies have "received the same degrees of scientific attention as individual-level phenomena, due in part to their inherent

challenges". Those challenges include both the complexity of population or societal-level research and the "social, political and ethical questions regarding attempts to change social conditions" that are involved. On the other hand, as they also note, there is growing evidence that "societal-level phenomena are critical determinants of health".

They conclude that such factors as "stress, insufficient financial and social supports, poor diet, environmental exposures, community factors and characteristics, and many other health risks", which contribute significantly to the risk of disease and death, are probably more effectively addressed at the level of community and environmental interventions than through individual-level interventions.

The Committee identified a number of interventions for which there was compelling evidence, as follows:

- ***paying more attention to the conditions that affect the health of women over their life course can help them deliver healthier children*** [35]
- ***comprehensive, high-quality services that address basic needs of children and families can improve the health of infants and assist children to enter school ready to learn***
- ***greater attention paid to the environmental and social contexts in which young people operate can improve their health and prevent future health problems***
- ***coordinated efforts addressing adolescents and adults in the various settings in which they live their lives can improve their health***
- ***institutions and public policies that address not just the physical but also the social, cognitive and psychological needs of older adults can help them to age more successfully***
- ***paying special attention to the contexts which influence the health of population groups, including those of different socio-economic, racial and ethnic backgrounds***
- ***paying attention to the "broader social, economic, cultural, and political processes that determine and maintain . . . disparities" in health***
- ***fully engaging members of the community in the planning, design and implementation of efforts that seek to enhance the social and environmental conditions of the community***
- ***coordinated, multi-faceted, multi-level interventions that are funded over the long term.***

[35] Of course, improved women's health is an important priority in its own right, and not just because it can help them deliver healthier children.

4.2.3 *The Independent Inquiry into Inequalities in Health*

This Inquiry was established by the UK's Minister for Public Health and chaired by Sir Donald Acheson, the former Chief Medical Officer for the UK. Its task was to both summarize the evidence on the determinants of inequalities in health and to identify priority areas of future policy development to reduce such inequalities. ***The report's authors considered their work to be scientific and thus limited their recommendations "to those based on scientific and expert evidence".*** The authors note that in the UK

> "Data identifying differences in longevity by position in society have been available for at least 200 years. These differences have persisted despite the dramatic fall in mortality rates over the last century."

Moreover, the determinants of these inequalities "are deeply ingrained in our social structure". The authors consider that these inequalities in health "reflect differential exposure - from before birth and across the life span - to risks associated with socio-economic position". Social structure, expressed as socio-economic status, is related to health through a range of factors including early life, the social environment, work and other material and psycho-social factors. These in turn influence health behaviour and psychological and physiological states which are also influenced by such factors as genes and culture.

In terms of policy interventions, the authors take the view that "major gains in attacking health inequalities are most likely to derive from addressing those health problems which occur reasonably frequently . . ." and that it is necessary to intervene on a broad front because, once again***, the scientific evidence indicates that "health inequalities are the outcome of causal chains which run back into and derive from the basic structure of society".*** Thus policies need to be broad-based and to be both "upstream" and "downstream". They address a number of ***key policy areas where they feel interventions are most justified, based on a combination of "the scale of their potential impact on health inequalities, and the weight of evidence". These policy areas include:***

- ***poverty, income, tax and benefits***
- ***education***
- ***employment***
- ***housing and environment***
- ***mobility, transport and pollution***
- ***nutrition.***

For each of these policy areas, the report discussed the extent of inequality, the evidence for the effectiveness of policy interventions, the likely benefits that would result, and then made recommendations for future policy development. Their findings and recommendations are

considered in the appropriate sections later in this report.

The authors also suggest three crucial areas for future work to reduce inequalities in health:

- an assessment of the impact on health inequalities of all policies that are likely to have an impact on health;
- a high priority on the health of families with children. The importance of focusing priority attention on parents and children is based on research that shows that the period from conception through childhood "is a critical and vulnerable stage" that can have a lifelong effect on physical and mental health, and that such inequalities are in fact inter-generational.
- a focus on reducing income inequalities and improving the living standards of poor households.

The authors note that it is just as important to reduce social inequalities and promote social networks as it is to reduce economic inequalities or improve the physical environment of disadvantaged communities.

4.2.4 The Cochrane Collaborative

The Cochrane Collaborative is an international network of researchers that apply rigorous scientific standards - the randomised controlled trial, or RCT, is their 'gold standard' - to the evaluation of medical and public health procedures. While much of the focus of the Cochrane Collaborative is on clinical epidemiology, there is also a public health and health promotion field and thus a (surprisingly small and quite circumscribed) number of reviews relevant to the topic of chronic disease prevention – 15 in all, listed below in Table 6 - are included in the Cochrane library (www.vichealth.vic.gov.au/cochrane). While some of these reviews and protocols (reviews under way but not yet completed and thus not available) deal with broader risk environments and risk conditions, many of them are focused on biological risk factors and behaviour modification. A summary of the reviews listed in Table 6 that are relevant to the topic of primary prevention of chronic disease and are available is shown in more detail in Appendix 1. [36] The relevant findings are used later in the appropriate sections of this report.

36 A large number of other Cochrane Reviews in public health were concerned with various aspects of tobacco use and as such are not included here since they are superseded by the more comprehensive recent American reports, discussed later.

Table 6: The Cochrane Collaborative reviews on primary prevention of chronic diseases (excluding tobacco)

Daycare for preschool children

Multiple risk factor interventions for primary prevention of coronary heart disease

Reduced or modified dietary fat for preventing cardiovascular disease

Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterols, and triglyceride

Reduced dietary salt for prevention of cardiovascular disease

Interventions for preventing obesity in children

Advice on low fat diets for obesity

Reduced or modified dietary fat for preventing overweight and obesity

Dietary fibre for the prevention of colorectal adenomas and carcinomas

Screening for lung cancer

Screening for colorectal cancer using the fecal occult blood test

Screening for breast cancer with mamography

Strategies for increasing women's participation in community breast cancer screening

Interventions targeted at women to encourage the uptake of cervical screening

Personalised risk communication for informed decision-making about entering screening

As might be expected, given the rigorous – and in some respects inappropriate – adherence to a standard of evidence not necessarily appropriate to public health, their reviews are fairly critical. However, it should be noted that other reviews of the evidence by respected public health and preventive medicine organizations and experts may be less severe and arguably more appropriate.

4.2.5 The Taskforce on Community Preventive Services

This US project is summarizing what is known about the effectiveness and cost-effectiveness of population-based interventions designed to promote health and to prevent disease, injury, disability and premature death as well as exposure to environmental hazards (www.thecommunityguide.org). There are three broad categories of issues that are being addressed - changing health risk behaviours, addressing specific health conditions, and addressing the environment - and within these categories a number of specific issues. There is considerable emphasis on the conventional risk factors and on primarily behavioural and quasi-clinical interventions, although policy, social support, physical environmental changes, community-wide programs and laws are also discussed.

Each review published by the project contains the following caveat:

> "Each recommendation is based on the strength of the evidence of effectiveness found during the systematic reviews. ***A determination that evidence is insufficient should not be confused with evidence of ineffectiveness. A recommendation of insufficient evidence may reveal gaps in the findings where future prevention research is needed."***

The results from this large and important review process will be very valuable. Unfortunately, for the purposes of this report, while several reviews have been completed, many of the reviews will not be available until later on in 2003 or even 2004. Of the reviews completed so far, the only relevant ones for this report are on tobacco, physical activity, diabetes (but focused on self-management and professional management after diagnosis, so not really about primary prevention), the prevention of skin cancer, and the social environment, specifically with respect to pre-school programs and to housing issues. In addition, some work has been done on some aspects of cancer screening, and a start has been made on prevention of depression and the co-occurrence of depression with other mental and physical conditions. Work has yet to start on reviews of the evidence regarding nutrition, and alcohol abuse and misuse.[37] The evidence from the available relevant reviews is presented in the appropriate sections of this report.

4.2.6 The Effective Public Health Practice Project

The Effective Public Health Practice Project [38] is a key initiative of the Public Health Research, Education and Development (PHRED) Program. It is jointly funded by the Ontario Ministry of Health and Long-Term Care and the City of Hamilton, Social and Public Health

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37 Reports on conditions that are not relevant to this report include pregnancy, immunization, oral health, substance abuse, sexual behaviour, violence and the prevention of injuries from motor vehicle accidents.

38 (http://www.hamilton.ca/PHCS/EPHPP/default.asp)

Services Department. The EPHPP involves public health researchers, practitioners, and policy-makers from across the province who conduct systematic reviews on the effectiveness of public health interventions, and summarizes recent, high quality reviews produced by others. Of the 61 reviews currently available, 16 are relevant to chronic disease prevention. They are listed in Table 7 and the findings are presented in the appropriate sections of this report.

Table 7: Effective Public Health Practice project reviews relevant to the prevention of chronic disease

Coalition Effectiveness in Heart Health Promotion, Tobacco Use Reduction and Injury Prevention

Community-Based Heart Health Programs

Enhancing Fruit and Vegetable Consumption in People Four Years of Age and Older

Effectiveness of Interventions to Promote Healthy Eating in Pre-school Children Aged 1 to 5 Years

The Effectiveness of the Health Promoting Schools Approach and School-based Health Promotion Interventions

The Effectiveness of School-based Interventions in Promoting Physical Activity and Fitness Among Children and Youth: A Systematic Review

Using School-Based Programs to Reduce Adolescent Risk Behaviour

Using School-Based Programs to Improve Heart Healthy Eating Behaviours of Children

The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes: a review of reviews.

The effectiveness of health promotion interventions in the workplace

The Effectiveness of Workplace-based Health Risk Appraisal in Improving Knowledge, Attitudes or Behaviours

The Effectiveness of Interventions for Preventing Tobacco Smoke in Public Places

The Effectiveness of Smoking Cessation Interventions

Smoking Cessation During Pregnancy

Effectiveness of Strategies To Increase Cervical Cancer Screening in Clinic-Based Settings

A Meta-Analysis of Fear Appeals: Implications for Effective Public Health Campaigns

4.3 Changing social, economic and cultural conditions

In many cases, the interventions to change behaviour that have proven to be most effective in preventing disease or injury are in fact societal level interventions that use public policy to require behavioural change on the part of citizens or corporations and that, in the process, change societal norms and values. Examples include the banning of smoking in public places, workplaces and restaurants; seat-belt and motorcycle helmet laws; strict enforcement of drinking and driving laws and so on. Emmons (2000, in Smedley and Syme) suggests an "ecological framework" for changing behaviour, recognizing that it is affected by the following levels of influence:

- intrapersonal factors (eg., motivation, skills, knowledge)
- interpersonal processes (eg., social support, social network, social norms)
- institutional or organizational factors (eg., company management characteristics, workplace policies)
- community factors (eg., social capital, neighbourhood effects)
- public policy (eg., regulatory laws, tobacco taxes).

But the evidence on the effectiveness of changing broad societal conditions as a means of preventing major diseases is less rigorous than that available to assess the effectiveness of changing behaviour. While there is considerable evidence of the relationship between health and broad societal factors, as noted in section 3.3.3, and much expert opinion as to what needs to be done to address these issues so as to improve health, few intervention studies have been done at this scale. And of course, interventions in early childhood would need to be followed for decades in order to determine the outcome in terms of chronic disease in later adult life. Moreover, what evidence there is tends to address health status in general rather than chronic diseases specifically, although since they are such a high proportion of the total burden of disease, this is probably not of major concern.

But while the evidence of the effectiveness of broad strategic approaches may not be as strong as the evidence for discrete behavioural change strategies, it is not absent. Much of the evidence that does exist comes from historical comparisons or retrospective studies, or from comparisons across nations, states or provinces. Such observations are interesting, but they seldom can meet the scientific criteria applied to the large studies of behavioural change; indeed, such criteria are not necessarily even appropriate, as already noted. Nonetheless, ***there is some evidence of the effectiveness of interventions in these societal conditions, much of it summarized in the report of the Independent Inquiry into Inequalities in Health (1998). Importantly, they limited their recommendations "to those based on scientific and expert evidence".*** Their recommendations are summarised below, along with other evidence where available.

4.3.1 Reducing poverty and inequalities

Black and Mittelmark (2000) review the evidence for the relationship between equity and health. They note that a recent WHO Europe review of health in Europe had observed that

> "Health is best where active steps are taken to address the social determinants of health (such as poverty, homelessness, unemployment)"

and they cite ***evidence that improving equity in health (which means "a focus on the ideal of providing a fair opportunity for all people to enjoy health to their fullest potential") has a positive impact on peoples' health status, the strengthening of community and families, and a more productive - and thus economically "healthy" society.***

With respect to poverty and income and its relationship to inequality in health, the authors of the Independent Inquiry . . .(1998) note ***that while the "available evidence is insufficient to confirm or deny cause or underlying causal relationship" they nonetheless "take the view that these changes are likely to be related"*** and they conclude that

> ***"without a shift of resources to the less well off, both in and out of work, little will be accomplished in terms of a reduction of health inequalities by interventions addressing particular "down stream" influences".***

This would mean "shifting the tax burden from regressive to more progressive forms of taxation", paying attention to the ways in which both direct and indirect taxation together impact on the living standards of lower income groups, and - since it is benefits rather than taxes that are the principal determinant of living standards for the least well off, ensuring that benefit and pension levels are set at adequate levels to ensure access to the basic determinants of health.

These requirements are particularly important for children, on whom the burden of poverty disproportionately falls. However, the authors point out that "there is a lack of experimental evidence that increasing financial resources results in measurable health gain", with the single exception of a randomized controlled trial carried out in the United States between 1970 and 1974. Nonetheless, ***the authors conclude that***

> ***"policies which increase the income of the poorest are likely to improve their living standards, such as nutrition and heating and so lead to improvements in health".***

4.3.2 Reducing unemployment

In terms of policy, the Independent Inquiry recommended steps both to increase employment and to reduce the impact of unemployment on health. Increasing employment calls for policies that increase employment opportunities, remove barriers that prevent parents of dependent children from working, and that improve the levels of education and training, particularly for both young and long-term unemployed people. They also call for policies to improve financial support during unemployment to ensure that unemployed people and their families have

adequate access to such basic requirements for health as food, shelter and heating.

4.3.3 Improving educational status

Citing ***evidence that low levels of educational achievement are associated with poor adult health, and that "children from disadvantaged backgrounds . . . have lower educational achievement than other children",*** the Independent Inquiry . . . (1998) suggests that "logic and equity argue that children most in need should receive increased resources for their education". They therefore ***recommend that additional resources be provided to schools serving children from disadvantaged communities.***

4.3.4 Enhancing child development

> ". . . recent research in child health shows that early life health is, for each child, the basis of health in adult life. Therefore investment in health in early life has beneficial effects, specifically on the future health of a nation as well as on the future functioning of its citizens." (Wadsworth, 1999)

The Community Guide to Preventive Services has reviewed the evidence for the effectiveness of a selected set of interventions for building healthy communities by promoting health-enhancing social environments. ***The Guide found strong evidence to support comprehensive pre-school programs for low-income children aged 3 - 5 years.*** In 12 of 17 studies, children were less likely to be held back a grade (median 13%) and less likely to be placed in special education classes in the future (median 14%). Follow-up for periods as long as 15 - 20 years showed higher rates of high school graduation, decreased teen pregnancy, decreased rates of delinquency and higher rates of employment in these disadvantaged children.

The Independent Inquiry . . . (1998) also examined the issue of pre-school education, concluding that

> ***"overall the evidence suggests that pre-school education or day care may be especially effective in improving the achievement and health of the most disadvantaged children"***

and thus recommended further development of such programs, particularly for disadvantaged families.

Similarly, a Cochrane review found that ***"Daycare has beneficial effect on children's development, school success and adult life patterns***, although noting that "to date all randomized trials have been conducted among disadvantaged populations in the USA. The extent to which the results are generalizable to other cultures and socio-economic groups has yet to be evaluated." (May 2000)

4.4 Changing environmental and psycho-social living conditions

The key settings that have been used as the basis for disease prevention and health promotion programs are the home, the school, the workplace and the community. The European Region of WHO, which leads internationally in the development of modern health promotion, has developed programs for all of these settings except the home. In reviewing the evidence,

it is clear that two settings in particular stand out; the school and the workplace. Accordingly, the evidence pertaining to these settings is reviewed here in more detail than for the other settings. However, in practice it is best to take a comprehensive approach in which a healthy community program includes projects for healthy homes, healthy schools, healthy workplaces, and so on.

4.4.1 Healthy homes

The home as a setting for prevention, important though it is, is challenging. For one thing, there are so many more homes than there are schools or workplaces, so it is hard to marshal the resources to reach into all of them with a program. For another, as noted by Fisher (2000), access to the home may be more protected, making it less easy to enter and get involved. Reporting on the California Family Health Project, for which he was a lead investigator, Fisher (2000) notes that families are very different in the way they work, and this has implications for the design of programs intended to change health-related behavior in families. He also notes that ***family values, the values of the community and their culture, can or interfere with efforts to change health behaviors; conversely, identifying and aligning with powerful family figures can often produce change***. He also notes that ***"improving the family setting is health-enhancing in and of itself", but that research indicates this is not easy, and that a systematic and fairly intense approach based on family theory is needed.***

So while the evidence suggests that the home and family are very important determinants of an individual's health, there is less evidence on effective ways to intervene so as to reduce chronic disease. However, in their chapter on the home and family as a health promotion setting, Soubhi and Potvin (2000) cite ***evidence that shows that:***

- ***interventions focused on physical activity and diet tend to spread throughout the family, especially among those of the same generation***
- ***parental involvement with their children's school health and other programs can benefit both children and parents, in areas such as smoking, dietary change and weight loss***
- ***changes in the social and community context, by shaping opportunities and/or resources for families, can support or limit healthy changes.***

Encounters with public health nurses and other health care providers, particularly in the context of pregnancy, infancy and childhood, constitutes another important avenue for disease prevention and health promotion in the home, while the media also provide an important avenue.

4.4.2 Healthy Schools

The Independent Inquiry (1998) focused a lot of attention on the need to develop health-promoting schools, in line with the World Health Organization's definition of such schools. ***They concluded, based on recent evaluations, that such schools can "lead to gains in***

people's knowledge, attitudes, self-esteem and health behaviours, particularly in primary schools". They paid particular attention to the promotion of life management skills, substance misuse and sex education, all of which had been evaluated and shown to be generally effective, particularly when they focused on early education, a broad approach to wider influences on health-related behaviour, a supportive school setting, quality programs and a comprehensive approach linked to broad life management skills. They conclude that

> ***"successful health promotion at school should increase "life skills" with resultant improvements in many aspects of physical, mental and social health".***

In the IUHPE review carried out for the European Union, St. Leger and Nutbeam (2000) state that ***school-based interventions would be more effective if***

- ***the focus is on cognitive and social outcomes as a joint priority with behaviour change***
- ***programs are comprehensive and 'holistic', linking the school with agencies and sectors dealing with health***
- ***the intervention is substantial, over several school years, and relevant to changes in young people's social and cognitive development***
- ***adequate attention is given to capacity building through teacher training, and provision of resources.***

They put particular emphasis on the concept of the health-promoting school as an holistic approach, since ***the evidence suggests that effective school health programs address a combination of the curriculum, the environment, health services, community partnerships and school policies.***

In terms of the curriculum, they state that ***the evidence points to the following key factors for success:***

- content-related factors such as well planned programs based on relevant learning theories; programs that enrich students' skills in a range of social-emotional competence issues
- learning and teaching factors including at least 40-50 hours per year of dedicated health teaching; problem solving approaches; and placing health issues in the context of the community
- resources and staff development, including having educational outcomes as the primary focus, not biological or health behavioural change, and ensuring an integrated and comprehensive professional development program for teachers.

They also note that the school environment is a major factor in school health promotion, including the physical environment, the psychosocial environment and the organizational structure of the school.

Unusually - and very usefully - they point to ***some approaches to health promotion in schools that have been shown to be ineffective and should not be used, including:***

- programs which are developed in response to a perceived crisis (especially if accompanied by scare tactics and preaching)
- broader school involvement which was spasmodic and uncoordinated
- programs based largely on external speakers and resources with little involvement of school staff
- little or no investment in teacher training, and provision of support resources.

Finally, they point out that although integrated, comprehensive school health promotion programs are needed, much of the research has concentrated on achieving specific behavioural outcomes. ***The evidence shows that:***

- ***nutritional practices can be improved, particularly through multifaceted (skill development, policy supported) programs***
- ***positive changes in physical activity can be achieved if the intervention is comprehensive and integrated, uses properly trained personnel, ensures adequate time (60-80 minutes per week), provides quality facilities and resources and occurs regularly during the week***
- ***even well designed and implemented health promotion programs aimed at tobacco, alcohol and drug use have "only a modest effect on behavioural goals", and then only if they meet the same criteria as for nutrition and physical activity programs.***

In a chapter on school health programs in its report on promising practices in chronic disease prevention (Centers for Disease Control and Prevention, 2003), the authors note that ***"rigorous studies in the 1990's showed that health education in schools can reduce the prevalence of health-risk behaviors among young people", including smoking, obesity, alcohol and marijuana use. A set of promising practices for school health incorporate four key concepts:***

- ***the coordination of multiple components and the use of multiple strategies***
- ***the coordination of health and education agencies and other organizations***
- ***the implementation of CDC's school health guidelines, and***

- ***the use of a program planning process to achieve health promotion goals.***

Eight priority actions are identified:

- monitor critical health-related behaviors among young people and the effectiveness of school policies and programs
- establish and maintain dedicated program-management and administrative support systems at the state level
- build effective partnerships among state-level governmental and non-governmental agencies and organizations
- establish policies to help local schools effectively implement coordinated school health programs
- establish a technical assistance and resource plan that will provide local school districts with the help they need
- implement health communications strategies to informed decision makers and the public about the role of school health programs
- develop a professional development plan for school officials and others responsible for establishing coordinated school health programs
- establish a system for evaluating and continually improving state and local school health policies and programs. (CDCP, 2003)

A systematic review of 18 strong quality published reviews on the topic of using school-based programs to reduce adolescent risk behaviour (eight related to smoking/drug use prevention, six related to sexual risk behaviour prevention, and four related to emotional/behavioural problem prevention – EPHPP, 2003) ***found that***

- ***Knowledge based didactic programs have no effect on behaviour.***
- ***Interactive programs are more effective than non-interactive ones.***
- ***Interactive programs based on social learning theory, including developmental, social norms and social reinforcement are most effective.***
- ***Results are modest.***
- ***Some programs work for some subgroups of youth (e.g. programs focused on delaying initiation of sexual activity among the uninitiated).***

Finally, ***a review of 12 primary studies regarding the health promoting schools approach and 32 reviews of studies on the effectiveness of school health promotion (EPHPP, 2003) found that***

> ***"Although the evidence supporting the health promoting schools approach is limited, this approach is demonstrated to have an impact on the social and physical school environment in areas of staff development, school lunch program, exercise, and social context. In some studies, this approach had a positive impact on nutrition, physical activity, and mental and social well-being."***

and the reviewers concluded that:

- ***"Health promotion interventions are most effective when they entail a multifaceted approach.***
- ***Classroom education should be implemented in combination with changes to the school environment and/or family/community participation.***
- ***When initiating the health promoting schools approach, it is important to implement all components inherent to this approach."***

4.4.3 Healthy workplaces

There are three broad areas of focus for a comprehensive workplace health promotion program:

- workplace behaviour change
- health-promoting job and organizational design
- internal communication and marketing/policy development.

In their chapter on the workplace as a setting for health promotion, Polanyi et al (2000) concur with the view that workplace health promotion has mainly focused on changing individual behaviour, "with little consideration of the conditions that shape such behavior". Moreover, they note that it is difficult to measure the impact of workplace health promotion (WHP) and that while there is some evidence to support the impact of such programs on blood pressure control, smoking, reduced health costs, and improved morale and productivity, the quality of the research is weak and the evidence is thus poor. They go on to identify a number of weaknesses in the workplace health promotion approach, including

- little or no attention is paid to the social and economic determinants of health
- lifestyle change is limited in its ability to impact upon health, compared to socio-economic status

- lifestyle change tends to be short-term unless there are "concurrent changes to the social and cultural context that shapes individual behavior"

- WHP programs tend to focus on full-time, white-collar employees in large workplaces, thus missing large portions of the work force

- the emphasis on individual change and responsibility ignores the employer's responsibility for workplace conditions, and can become victim-blaming.

They thus propose a focus on an approach known as ' promoting workplace determinants', which "focuses on organizational-level interventions to reduce stress and improve employee wellness". This can involve changes to work hours (making them more flexible), supervisor attitudes and practices, communications, work site redesign and similar actions. Noting that research has shown a correlation between health and such job-related and firm-level factors, they recommend such an approach be applied, thus "creating the working conditions necessary for good health".

In the IUHPE review, Breucker and Schroer (2000) state that "workplace health promotion comprises all joint measures of employees, employers and society to improve the health and wellbeing of people at work." ***Essential factors for effective workplace health promotion programs include:***

- ***interdisciplinary effort involving many different players in the company***

- ***participation and cooperation of all players***

- ***a comprehensive approach, combining activities that focus on the individual with those that address the design of the working and organizational conditions.***

They indicate that ***there is strong evidence for the health effectiveness of both behavioural and structural approaches and for the importance of combining them in a comprehensive program of workplace health promotion.*** Benefits move beyond positive health effects to improve productivity and the quality of both product and process in the work site, making workplace health promotion a positive competitive factor.

This is well illustrated by Health Canada's "Business Case for Active Living at Work" (www.activelivingatwork.com) which helps companies develop active living programs by, among other things, providing Canadian evidence of the return on investment from developing active living programs in the workplace and even provides a template for companies to develop their business case. Together with the National Quality Institute, Health Canada has also developed the Canadian Healthy Workplace Criteria that identifies three key elements of a healthy workplace (the physical environment, the social environment and personal resources, and health practices) and a set of key "drivers" which are essential to developing and sustaining a healthy workplace. These are leadership, planning, a focus on people, management of the process, and evaluation of outcome.

In a review of 15 studies of health promotion interventions in the workplace (EPHPP, 2003),

the reviewers found that ***"data supporting workplace programs are still not definitive. Most evaluations were considered methodologically flawed due to the absence of a control or comparison group" and that "no clear trends in effectiveness could be identified in relation to certain types of interventions, health topics or category of service provider." In a separate review, EPHPP reviewers also conclude that there is little evidence that workplace-based health risk appraisal alone can produce sustainable changes in individual health behavior or risk status. However, they provided a number of examples where specific interventions were found to be effective and concluded that***

- ***"A sustained program based on principles of empowerment and/or a community-oriented model using multiple methods, visibly supported by top management and engaging the involvement of all levels of workers in an organization, is likely to produce the best results.***

- ***A focus on a definable and modifiable risk factor, which constitutes a priority for the specific worker group, can make an intervention more acceptable and increase their participation.***

- ***Interventions should be participatory and tailor-made to the characteristics and needs of the employees."***

All of these points are relevant to the next topic, which addresses the evidence that suggests that changing working conditions can be beneficial for the health of employees.

4.4.3.1 Improving working conditions

The authors of the Independent Inquiry (1998) addressed two broad areas in which employment affects health, namely the impact of unemployment on health and the impact of unhealthy working conditions. The former was dealt with earlier, since it relates more to reducing poverty.

With respect to the quality of work, the authors note that recent changes in the labour market have led to a higher degree of job insecurity, particularly for less skilled manual workers. In addition, they note ***the substantial evidence relating psycho-social factors in the workplace (particularly the imbalance between psychological demands and control, and lack of control at work) on a variety of physical and mental health problems.*** They also note that ***there is evidence of successful interventions to improve working conditions in ways that both improve health and, in some cases, improve productivity at the same time. In essence, such interventions "follow principles of good management practice" and include the following features:***

- ***appropriate commitment and effort from management***

- ***support by management and the workforce***

- ***workforce participation in planning and implementation***

- ***the creation of trust.***

They also noted that such management practices as attempting to treat only the symptoms, imposing technical solutions alone, retaining management control over the dialogue, and directing attention away from poor working conditions were likely to reduce the probability of success.

The authors specifically recommend that "employers, unions and relevant agencies take further measures to improve health through good management practices which leads to an increased level of control, variety and appropriate use of skills in the workforce", and they note the need to assess the impact of such policies on both health and inequalities in health.

4.4.4 Healthy communities – the built environment

As with the other settings, communities are both physical places and social spaces. The physical environment is considered here, the social environment in the next section, which addresses the topic of strengthening communities. Many of the health impacts of the urban built environment are related to the relationship between the built environment and land use and transportation decisions, which has been the topic of growing concern in health policy circles, because of the growing evidence of the relationship between air pollution and a wide variety of health impacts, as discussed earlier.

One important initiative has been the adoption at the Third European Ministerial Conference on Environment and Health in 1999 of the (London) "Charter on Transport, Environment and Health" (http://www.who.dk/london99/transport02e.htm). Adopted by Ministers and representatives of the European Member States of WHO responsible for transport, environment and health, the Charter sets out the principles, strategies and a plan of action to guide policies towards achieving transport sustainable for health and the environment. The following constitute some of the key elements of the strategy:

- reducing the need for motorized transport by adaptation of land use policies and urban and regional planning;
- shifting transport to environmentally sound and health-promoting modes;
- relating the costs of transport more closely to mileage travelled and internalizing transport-related environmental and health costs and benefits.

The authors of the Independent Inquiry make four similar broad policy recommendations:

- ***the further development of a high quality public transport system which is integrated with other forms of transport and is affordable to the user***
- ***further measures to encourage walking and cycling as forms of transport and to ensure the safe separation of pedestrians and cyclists from motor vehicles***

- ***further steps to reduce the usage of motor vehicles to cut the mortality and morbidity associated with motor vehicle emissions***

- ***further measures to reduce traffic speed, by environmental design and modification of roads, lower speed limits in built-up areas, and stricter enforcement of speed limits.***

A recent report (Jackson and Kochtitsky, 2002) co-authored by the Director of the USA's National Center for Environment Health has reviewed the issue of the relationship between the built environment and health and proposed some policy directions. They conclude that

> ***"It seems imperative that new transportation options be developed and implemented in order to help alleviate the public health problems related to worsening air quality in the United States."***

Evidence of the effectiveness of changing transportation patterns can be seen in the example they cite that, ***as a result of a 22.5 percent reduction in peak weekday morning traffic during the 1996 Olympic Games in Atlanta, there was a 27.9 percent reduction in peak daily ozone concentration and a 41.6 percent reduction in the number of asthma acute care events, with no significant reduction in non-asthma medical events during the same time period*** (Friedland, 2001).

Jackson and Kochtitsky conclude that planners and urban designers need to give more consideration to the health impacts of land use decisions, design communities for people rather than cars, encourage smart growth and new urbanism, encourage green space development so as to promote mental as well as physical health, and in general recognize that "the end result of urban design should be improved quality of life".

A second important transport-related impact on chronic disease is that our car-dependent way of life contributes to physical inactivity, an issue that Jackson and Kochtitsky (2002) also address. Physically active commuting to work, for example, has some real benefits: ***a Finnish study found that in a group of 68 inactive middle aged men and women, one hour of physically active commuting to work for 10 weeks resulted in a 4-5 percent increase in their VO_2 max (a cardiovascular function test), a 5 percent increase in their HDL (or "good") cholesterol, and a 10.3 percent increase in their maximum treadmill time - quite a dramatic impact, given that this was only a 10 week- long intervention*** (Vuori, Oja and Paronen, 1994).

Moreover, there is an important environmental health co-benefit to active commuting. It has been estimated that

> "If half the people in Canada who live within walking distance of their work left their cars at home, their efforts would save approximately 22 million litres of gasoline per year." (Go for Green)

And of course, there would be a concomitant reduction in the associated air pollution and greenhouse gas emissions. Perhaps at the very least we could persuade drivers to park a few

blocks from work and walk to and fro - it might add a few minutes to their trip, but it might also get them cheaper parking!

Similar benefits may result from implementing more widely the “Active and Safe Routes to School” program, including such initiatives as the "walking school bus" idea for school children (Go for Green, 1999)

4.5 Strengthening community action

> “It has been increasingly recognized in public health that the preventative approaches that hold the greatest promise are community-based and community-wide, and focus on both individual behaviour and environmental influences”. (Anderson, 2000)

There is general agreement that comprehensive, community-based approaches are needed that combine several different risk factors in a single 'healthy living' package in the settings in which people lead their lives. Studies that have taken a broad , integrated approach have shown some success, most notably in the North Karelia project in Finland, but the results of integrated behavioural strategies have often been disappointing, as in the case of the MRFIT program in the USA., which deployed significant resources in an attempt to change the risk behaviours of a group of 6,000 men who were at high risk because of their high rates of cigarette smoking, hypertension and hyperlipidaemia. In commenting on this, Smedley and Syme (2000) note that:

> "It is clear that behaviour change is a difficult and complex challenge. ***It is unreasonable to expect that people will change their behaviour easily when so many forces in the social, cultural, and physical environment conspire against such change."***

This may help to explain why ***a Cochrane review of multiple risk factor interventions for primary prevention of coronary heart disease, which examined 10 trials which reported clinical data for intervention studies using counselling or education to modify more than one cardiovascular risk factor over a period of at least six months, found that for this form of intervention "The pooled effects suggest multiple risk factor intervention has no effect on mortality." Changes in risk factors were relatively modest, and those using personal or family counselling and education appeared to be more effective at achieving risk factor reduction.*** (See Appendix 1)

Reppucci, Woolard and Fried (1999), in a review of social, community and preventive interventions in mental health that has wider implications for community-wide prevention efforts, focus on “competence promotion” across the lifespan (see next section for a discussion of this issue). They suggest three principles for community-based prevention:

- multilevel prevention efforts that are “based on an ecological model that redirects the focus beyond the individual to include community- and policy-level factors”;
- community revitalization to address issues of poverty and the promotion of healthy behaviours in all members of the community;

- the use of multiple settings, together with an emphasis on such mediating social structures as churches and neighbourhood organizations, as well as those "linking agents" who establish connections between residents (especially those who are isolated or disadvantaged) and health care and other services.

In addressing the prevention of alcohol and drug abuse specifically, they focus on the importance of community empowerment and community mobilization, particularly through the development of community-based coalitions intended to reduce risk and promote positive social development. They note that

> ***"Programs focused solely on the individual seemed destined to failure if they do not take into account community context".***

As other reviewers have done, they support programs that are multilevel, focus on multiple settings and address societal norms. They suggest that "more responsibility for prevention should be directed at socialization agents, such as parents, schools, churches and service providers . . .". However, they also note that social change in these areas and the accompanying attitude change usually requires social policies and legislative action to "provide an ongoing framework in which such changes can occur." Finally, they caution that

> ***"Such changes take a long time to accomplish, and the end result is seldom complete alleviation of the problems. Rather, such social problem solving must be conceived as never being solved in a once-and-for-all fashion."***

Similarly, in a review of community-based approaches for the prevention of alcohol, tobacco and other drug use, Aguirre-Molina and Gorman (1996) identified ***several key principles of community action for social change:***

- comprehensive approaches that target multiple systems, sectors and communities and employ multiple strategies***. Particularly promising strategies are those that involve community organization, coalition development, media advocacy and policy advocacy***.

- community empowerment, which among other things requires that empowered professionals give up some of that power and listen to and work with the community

- community development, which is "the ultimate goal of prevention strategies". They define community development as a process whose purpose is to "change the social, political and economic systems that contribute to neighbourhood deterioration and community disorganization".

- application of the public health model, with a focus on host, agent and environment.

Strategies to change the host (the potentially addicted individual) include mass media interventions that are supplementary to a broader community development strategy and/or are focused on specific groups, as well as community-based skills training. Strategies to change the agent (the substance that is abused) focus primarily on influencing the availability

of and access to the substance through regulating sales to minors, sales through vending machines, etc. The principal focus, however, is on strategies to change the environment. This involves strengthening community organizations and neighbourhood institutions such as law enforcement and local media as well as other strategies for broad-based community change.

In recent years, there has been considerable interest in developing community-based coalitions to address a variety of chronic disease-related issues, as well as injuries and other important public health concerns. ***In a review of 15 studies using a strong or moderate methodology (EPHPP, 2003), statistically significant changes were found in health status (nine studies), in health risk behaviours (five studies) and knowledge changes (one study). However, the reviewers note that many of these coalitions were supported by research or special project funding, and this might limit the generalizability of the findings to routine public health work.*** They also note that

> "Effective public health partnerships are possible between professionals and specific populations, but such partnerships are generally established within a commitment to building a long-term relationship. This requires resources and time"

and they conclude that

- ***"Community-based public health coalitions can be effective, and may be a prerequisite for working with certain populations***
- ***Initiating and maintaining coalitions requires substantial skill and human and financial resources."***

4.6 Building social-emotional competence and resilience

The evidence of the important salutogenic effects of social-emotional competence and resilience for overall health and wellbeing, as well as for their role as protective factors for chronic diseases, has been discussed earlier. It is clear that the development of these and other positive attributes depends to a significant extent on what happens to people during their infancy and childhood, and the psycho-social and physical environments in which they develop.

Having reviewed the research evidence that suggests that social-emotional competence is one factor contributing to the reduction of health-damaging behaviour in adolescents, and the evidence relating social-emotional competence to physical health - including evidence that has demonstrated associations with immunological health in young children and cardiovascular health in adolescents - ***Wallander (2000) concludes that it is reasonable to suggest that the enhancement of social-emotional competence***

- ***in childhood can improve the health of the population over the life span***
- ***in childhood can prevent the development of biological pathology before it leads to disease and thereby prevent some physical health problems over the life span***

- ***in adults can improve biological functioning, thereby preventing or reducing some physical health problems over the life span.***

Weisberg, Caplan and Harwood (1991) reviewed the promotion of competence among young people in competence-enhancing environments as a systems-based approach to primary prevention. Competence "refers to the behaviourial effectiveness of one's transactions with the environment, as well as one's sense of personal wellbeing in diverse aspects of life." Competence deficits reveal themselves in a variety of mental disorders and other psychosocial problems, including problems with social relationships, school failure, low self-esteem and involvement in health-damaging risk behaviour. They suggest that

> ***"Family-, school-, and community-based prevention programs will be most effective when they attempt both (a) to enhance children's capacities to coordinate skills, prosocial values, and information in order to cope adaptively with society's social tasks, challenges, and stresses and (b) to create environmental settings and resources that support the development of young people's positive personal, social and health behaviour."***

As have other reviewers, they note that short-term, poorly implemented prevention programs that focus solely on the individual and do not pay attention to the social context do not produce lasting behaviour change. On the other hand, comprehensive programs that focus on family support, early childhood education and a comprehensive, school-based approach to the promotion of social competence do have long term effects. They make a case for "multiyear, multicomponent prevention programs that address multiple problem behaviours", and suggest that there is "substantial evidence" that shows that attempts to "promote competent young children and competence-enhancing environments . . . can produce lasting behaviourial benefits for young people".

With respect to resilience, Rutter also notes that there are significant variations in individual susceptibility, and that environmental interactions may be most important for those people who are also genetically at risk. Three key experiences that are protective are

- secure intimate relationships
- the experience of pleasurable success
- previous experience of success in dealing with a challenge

Thus in both the school and home, ***the evidence indicates that it is important to offer children***

- ***the opportunity to exercise responsibility and autonomy***
- ***the opportunity to experience success in some area of their lives***
- ***good teacher/pupil (and parent/child) relationships***

- ***encouragement and reward***
- ***a focus on positive features***
- ***appropriately high expectations.***

In addition, ***the evidence indicates that warm and supportive relationships in the home and parenting programs for high risk groups are important, while school programs on effective social problem-solving are important. The research also indicates that it is not simply general family discord and conflict that reduces resilience, but hostility, criticism, negative feelings towards others in the family, and "scapegoating". The policy implications are that therapeutic interventions are needed with troubled families that focus on avoiding scapegoating and negativity, and avoid bringing children into family conflicts.***

4.7 Supporting healthy living and behavioural change

As noted earlier, there is a wide range of promotive, protective and preventive behaviours that contribute to healthy living. Common to all of them is the widespread and well-accepted evidence that behaviour is significantly influenced by a wide variety of psychological, social, environmental, cultural and other factors, and that this requires a comprehensive approach to changing behaviour.

The focus here is on a set of three particular behaviours that are significantly associated with the four categories of disease (cardiovascular disease, cancer, chronic respiratory disease, diabetes) that are the focus of current national and provincial chronic disease prevention initiatives. These three behaviours are not smoking, eating healthily, and being physically active; the latter two are strongly related to maintaining an ideal body weight. While there is often a focus on addressing such behaviours in a positive way and encouraging positive lifestyle chioices, there is nonetheless a place for negative or 'fear' messages, as an EPHPP review found. In a meta-analysis of the literature that reviewed 98 studies , the key findings were

- ***"The stronger the fear appeal, the greater the attitude, intention, and behaviour changes."***
- ***"The stronger the severity and susceptibility in the message, the more attitude, intention, and behaviour change."***
- ***"The stronger the response efficacy and self-efficacy in a message, the stronger the attitudes, intentions, and behaviours toward the recommended response."***
- ***"Higher levels of both threat and efficacy, in their various combinations, lead to more persuasion.***
- ***Response to fear appeals is not affected by personality or demographic traits."***

- ***However, "fear appeals produce one of two competing responses: self-protective actions or defensive responses.", and "as fear appeals increase in strength so do defensive responses."***

The UK's Health Development Agency (HDA) recently proposed an overall strategy to reduce smoking, promote healthy eating, increase physical activity and reduce overweight and obesity. The report summarizes the features of effective interventions in these four areas. Of particular value are the tables (reproduced in Appendix 2) of suggested activities to support local action for the reduction of smoking prevalence, the improvement of diet and nutrition, increasing physical activity, and reducing overweight and obesity, that are included in their "Guide Book for Coronary Heart Disease" (Health Development Agency, 2001). For each suggested intervention, ***the tables provide evidence of the effectiveness of the intervention,*** the proposed intervention, expected outcome, suggestions for who could be involved, the necessary skills and resources, some key points to consider, and key sources of further information. The main components in three of the intervention categotries are shown in Table 8; no specific components were identified for reducing overweight and obesity, although the report suggested that effective strategies include reducing sedentary behaviour

Table 8: Components of Effective Local Strategies for Reducing Coronary Heart Disease

(Source: "Guide Book for Coronary Heart Disease", Health Development Agency, 2001)

- Reducing smoking prevalence
    - develop smoking cessation services
    - reduce smoking in public places including workplaces
    - support national media campaigns
    - use media advocacy
    - reduce sales of cigarettes to children under 16 years old
    - encourage the introduction of smoking policies in schools
- Improving diet and nutrition
    - school programs
    - local/community projects
    - workplace programs
    - health care programs
- Increasing physical activity
    - health care interventions
    - exercise referrals schemes
    - workplace programs
    - mass media
    - school programs
    - older people
    - physically active transport

in children, using a combination of diet, physical activity and behavioural strategies in adults, and using a prolonged and gradual approach.

The EPHPP (2003) examined 13 heart-health community-based initiatives and concluded that

- ***"Compared to usual care, community-based heart health interventions are effective in reducing smoking prevalence in men, adolescents and certain high-risk groups, and in reducing the proportion of the population with an elevated body mass index.***

- ***Compared to routine cardiovascular disease preventive care, heart health interventions are effective in reducing the proportion of the population with elevated blood cholesterol, increasing awareness of blood cholesterol levels, and increasing individual's awareness of their risk for cardiovascular disease.***

- ***When measured at the community level, heart health interventions are not effective at changing outcomes such as smoking prevalence, physical activity level, mean systolic and diastolic blood pressure, blood cholesterol, CVD risk factor score and CVD mortality. However, there is evidence suggesting these interventions do have an effect on high-risk groups that is masked when community level data is used for analysis."***

And they conclude that

> ***"Community-based heart health interventions directed at smoking, physical activity, blood pressure, blood cholesterol, CVD risk factor score and CVD mortality should be targeted at specific high-risk populations."***

4.7.1 Non-smoking

Several recent reports in the US have extensively reviewed the prevention or reduction of tobacco use. While some of their findings may be specific to the US, particularly with respect to issues of policy and legislation, many of their recommendations are broadly applicable to Canada. The reports are:

- a review of interventions to reduce tobacco use and exposure to environmental tobacco smoke by the Taskforce on Community Preventive Services, as part of the forthcoming Guide to Preventive Services (2001)

- a Surgeon General's report on Reducing Tobacco Use (December 2000)

- a 1999 report from the Centers for Disease Control on Best Practices for Comprehensive Tobacco Control Programs (http://www.cdc.gov/tobacco/bestprac.htm).

According to the CDC (1999b), the goal of comprehensive tobacco control programs is to reduce disease, disability, and death related to tobacco use by

- Preventing the initiation of tobacco use among young people.
- Promoting quitting among young people and adults.
- Eliminating nonsmokers' exposure to environmental tobacco smoke (ETS).
- Identifying and eliminating the disparities related to tobacco use and its effects among different population groups.

The report was ***based on the evidence in the published literature and the experience of the two best state programs - Massachusetts and California. The best practices address nine components of comprehensive tobacco control programs*** (see Appendix 3 for details):

- ***Community programs to reduce tobacco use***
- ***Chronic disease programs to reduce the burden of tobacco-related diseases***
- ***School programs***
- ***Enforcement***
- ***Statewide programs***
- ***Counter-marketing***
- ***Cessation programs***
- ***Surveillance and evaluation***
- ***Administration and management***

Several of these are dealt with in more detail elsewhere in this report.

According to the Centers for Disease Control, ***approximate annual costs to implement all of the recommended program components have been estimated to range from $7 to $20 per capita in smaller States (population under 3 million), $6 to $17 per capita in medium-sized States (population 3 to 7 million), and $5 to $16 per capita in larger States (population over 7 million)*** – see Appendix 3 for details of financial costs. ***For BC, with a population of some 4 million, implementing this set of evidence-based, effective tobacco control policies would require an annual expenditure of a minimum of $24 million and as much as $68 million.***

Not surprisingly, the Community Guide came to similar conclusions, finding ***strong evidence for the effectiveness of***

- ***increasing the unit price of tobacco, and mass media education campaigns (when combined with other interventions) as strategies to reduce the initiation of tobacco use by children, adolescents and young adults;***

- ***smoking bans and restrictions to reduce exposure to environmental tobacco smoke;***

- ***increasing the unit price of tobacco, mass media education campaigns (when combined with other interventions), provider reminder and education (with or without patient education), and patient telephone support (quit lines) when combined with other interventions as strategies to increase tobacco cessation.***

The Guide also found ***sufficient evidence to recommend as strategies to increase tobacco cessation:***

- ***reducing patient out-of-pocket costs for effective treatments for tobacco use and dependence***

- ***provider reminder systems.***

Anderson (2000) also reviews the evidence with respect to prevention and control of tobacco, alcohol and illicit drugs. His ***summary of the proven effective health promotion and disease prevention strategies with respect to tobacco use,*** which also summarises well all the other reports reviewed, is as follows:

- ***market regulation***

    - ***increased taxes on tobacco and alcohol***

    - ***restricting access to tobacco products for young people***

    - ***advertising controls, in particular banning all forms of direct and indirect tobacco-related advertising and sponsorship***

    - ***litigation and product liability***

    - ***legislation to control smoking in public places to reduce involuntary exposure to tobacco smoke***

- ***interventions by primary health care providers***

    - ***counselling during primary care encounters, coupled with the use of nicotine replacement therapy and other treatment products are effective in encouraging smokers to quit***

- ***education and public information interventions***, although "The general conclusion is that although information can increase knowledge, such activity alone rarely influences behaviour".

- ***school-based interventions***

    - ***the influence of school-based education on attitudes and behaviour is uncertain, although peer-led sessions and skill-based learning have been shown to be effective***

    - ***such education needs to be integrated into the concept of the health-promoting school***

    - ***education level itself is "a very strong predictor of making healthy choices in relation to the use of tobacco and alcohol products"***

- ***workplace interventions***

    - ***legislation to control smoking in the workplace***

- ***the community approach***

  "It has been increasingly recognized in public health that the preventative approaches that hold the greatest promise are community-based and community-wide, and focus on both individual behaviour and environmental influences".

The UK's Health Development Agency (2001) reviewed the effectiveness of interventions to reduce smoking prevalence and concluded that ***the best approach is a comprehensive, community-wide one that includes direct smoking cessation, help lines, training and resources for health professionals, development of policies to reduce smoking in public places, media campaigns and advocacy, reducing sales to minors, and work in schools.*** The overall purpose is to influence both individual behaviour and the environmental, social and cultural conditions that affect tobacco use.

Finally, a review of the effectiveness of interventions for preventing tobacco smoke in public places was undertaken (EPHPP, 2003) that examined 11 studies - six population-based and five individually targeted. The reviewers concluded that ***"the most effective strategies used population-based multi-component approaches within institutions", that the impact of enforcement was not clear, that educational material had only a modest effect, and that regulations or signage not backed up by other measures have little effect".***

4.7.2 Healthy eating

The UK's Health Development Agency (2001) reports that the UK's Committee on the Medical Aspects of Food and Nutrition Policy, recognizing the role that diet plays in heart disease, cancer, obesity and diabetes, has ***recommended the following dietary changes:***

- ***reducing the amount of fat, and in particular, the amount of saturated fat***

- ***increasing the amount of fruit and vegetables eaten to at least five portions each day***

- ***increasing the intake of fibre-rich, starchy foods, such as bread, potatoes, pasta and rice by half as much again***

- ***reducing the average salt intake by around one-third***

- ***increasing the amount of fish eaten to at least two portions each week, one of which should be an oily fish.***

The report cites a review (by Rowe et al, 1997) that found ***the following characteristics for effective interventions to promote healthy eating:***

- ***a focus on diet alone, or diet plus physical activity, rather than addressing a range of risk factors***

- ***clear goals for dietary change, linking improvements in knowledge with development of skills and the provision of opportunities to put the knowledge into practice***

- ***personal contact with individuals or small groups sustained over time***

- ***personalized feedback to participants on changes in their behaviour and risk factors***

- ***changes in the local environment, including shops and catering outlets, that help people choose a healthy diet.***

Schuit (2000) also reviewed the evidence with respect to proven effective health promotion and disease prevention strategies related to nutrition and found that:

- ***Community intervention programs have had limited success***, particularly in the general population, who are more likely to change their diets on the basis of short-term benefits (such as better taste) rather than intermediate or long-term benefits.

- ***While school-based programs that use an integrated approach (education, healthy food in the school, education of staff, involvement of parents and community) have been effective,*** and while schools provide an ideal setting for such programs, dietary choices in the home and community and cultural beliefs and values play an important role in establishing food choices. A similar situation pertains to work site-based programs as well.

- Because of the many opposing forces in people's daily lives (time pressures, economic constraints, food advertising, limited access - economically or socially - to healthy foods, etc.) ***an integrated approach is needed that combines education with structural measures, environmental and social changes that reinforce behavioural change, and involvement of the food industry.*** A community coalition may be a useful strategy to apply.

A number of more specifically focused reviews of the evidence around healthy eating are also available:

- In a 1998 review of 12 studies of the effectiveness of interventions to promote healthy eating in pre-school children aged 1 to 5 years (EPHPP, 2003), the reviewers found that ***while rewards targeted at individual children are not effective once the reward is removed, "traditional, video or computer-based teaching methods were successful at increasing nutrition knowledge."*** They also found that ***parental involvement with children in learning about healthy eating, as well as via one-on-one parental counseling, workshops and newsletters, enhanced the effectiveness,*** and that "pre-school and day-care centres are likely to be appropriate settings for nutrition interventions."

- A Cochrane review examined 27 randomized clinical trials of reduction or modification of dietary fats over a period of at least six months. Overall, there was "no significant effect on total mortality, a trend towards protection from cardiovascular mortality, and significant protection from cardiovascular events", although on sensitivity analysis this effect became non-significant. However, ***"trials where participants were involved for more than two years showed significant reductions in the rate of cardiovascular events".*** It was concluded that "lifestyle advice to both those at high risk of cardiovascular disease and to lower risk population groups should continue to include permanent reduction of dietary saturated fat and partial replacement by unsaturates."

- A review of interventions to enhance fruit and vegetable consumption in people four years of age and older (EPHPP, 2003) examined 18 strong or moderate quality studies of community intervention programs that were intended to increase fruit and vegetable consumption by school children, adolescents and adults with no diagnosis of disease. They found that ***the most effective interventions:***

    - ***gave clear messages about increasing fruit and vegetable consumption;***
    - ***incorporated behavioural theories and goals, providing a consistent framework for implementation and evaluation;***
    - ***provided longer, more intensive interventions rather than one or two contacts;***
    - ***actively involved influential people such as family members; and,***
    - ***had a greater impact on those whose knowledge or intake were lower at the beginning.***

4.7.3 Physical activity

The Community Guide to Preventive Services has reviewed the evidence for the effectiveness of interventions to promote physical activity. The following were recommended on the basis of ***strong evidence***

- ***Social support in community contexts,*** including the creating, strengthening and maintaining of social networks, the use of 'buddy' systems, contracting, and walking groups. Nine studies reviewed for a variety of socio-economic groups and settings showed a 44 percent increase in time spent being physically active and a 20 percent increase in the frequency of physical activity, as well as improved fitness levels, reduced percentage of body fat, and increased knowledge of health.

- ***Individually adapted health behaviour change,*** including goal setting and self-monitoring, building social support, behavioural reinforcement, structured problem-solving, and relapse prevention. Of the 18 studies reviewed, there was a median increase in minutes of activity of 35 percent and a median increase of energy expenditure of 64 percent, with a weight loss averaging approximately 6 percent.

- ***Community-wide campaigns,*** involving large scale, high intensity, high visibility programs; the use of TV, radio, newspaper and information sites; and multi-component, multi-site, "combined package" interventions. Based on 10 studies in a mix of urban and rural communities, these campaigns have resulted in increases in physical activity in the range of 0-25 percent, with the median estimates of a 5% increase in the proportion of people who are physically active and a 16% increase in energy expenditure.

- ***Modified physical education in school,*** including modified curricula and policies, modified amounts of physical activity during physical education and modified, more active activities and games. Based on 14 studies, such activities have increased aerobic capacity by a mean of 8 percent. (A separate study found no harmful impact on academic performance).

- ***Creating or enhancing access to places for physical activity***, including trails and/or facilities access, reduced safety and affordability barriers, training and incentives, and site-specific programs. Based on 10 studies that were reviewed, the median increase in people exercising at least 3 times a week was 25 percent, with weight loss or decreases in body fat documented in most studies.

In addition to these strongly recommended interventions, ***one intervention was recommended on the basis of sufficient evidence, namely "point of decision prompts" including motivational signs placed by elevators and escalators, and the encouragement of stair use for health or weight control purposes.*** Six studies in a variety of settings showed a median increase in stair climbing of 54 percent.

Two other interventions are still under review, namely transportation and infrastructure change, and urban planning, zoning and land use. There was insufficient evidence to make

judgements on the value of health education, TV and video game turn-off interventions, college health education, family-based social support, and mass media interventions.

The UK's Health Development Agency (2001) has recently reviewed the evidence with respect to physical activity and concluded that ***effective interventions are those that***

- ***encourage walking and do not require attendance at a facility; brisk regular walking can achieve most of the health benefits associated with physical activity***
- ***involve environmental modifications such as signs posted to increase stair climbing.***

There has been a long history of activity in Canada aimed at increasing physical activity, sparked in no small part by the famous observation in the 1970's that the average 60 year old Swede was fitter than the average 30 year old Canadian. ParticipAction and other programs have worked with some success to increase the level of physical activity among Canadians. Over time, the focus has shifted from fitness campaigns emphasizing exercise programs to more broad-based initiatives focused on "active living" - walking, biking, gardening, using stairs etc - and an increasing focus on identifying and addressing the environmental barriers to active living such as urban and suburban design that makes walking, biking and other forms of active living more difficult (www.hc-sc.gc.ca/hppb/fitness/activeliving.htm).

The American Heart Association has recently issued a scientific statement on exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease (Thompson et al, 2003). They find “conclusive evidence that physical activity reduces the incidence of CAD” by preventing or helping to treat such risk factors as high blood pressure, insulin resistance and glucose tolerance, high levels of triglycerides, low levels of HDL cholesterol, and obesity. The effect of exercise is related to the intensity of the exercise and, and can be “significantly magnified by other lifestyle changes” such as low-fat diets and weight loss. Based on this evidence, the AHA recommends that

> “health care providers support the implementation and maintenance of exercise programs for their patients across the life span”.

Such support includes engaging personally in an active life style, using their influence to encourage and support schools in providing physical education programs, advocating for “changes in organizational practices within worksites and civic and recreational settings that encourage active living, including encouraging the availability of facilities and the engineering of environments to make them safe for physical activity. In their offices, health care providers should take a physical activity history and include it as part of the medical record, and should prescribe 30 minutes or more of moderate-intensity physical activity on most and preferably all days of the week.

Attention has also focused on the importance - and the benefits - of physical activity at work (www.activelivingatwork.com), and of the benefits of physically active commuting to work and to school. As noted earlier, Vuori, Oja and Paronen (1994) demonstrated that ***physically active commuting to work can be successfully promoted by low-cost measures and concluded that it may offer substantial potential benefit as a health and fitness enhancing***

measure, while Tudor-Locke, Ainsworth and Popkin (2001) suggest that active commuting should apply to children going to school as well as adults going to work. While they note that this "potential source of continuous moderate activity" has been largely ignored, and thus has little supportive evidence, and while parental concerns with respect to personal and pedestrian safety for their children must be taken into account, they suggest ***there is good reason to believe that active commuting to school would be beneficial,*** and numerous examples of the implementation of such activities exist.

Finally, the school is a setting where physical activity is of concern. ***A review of 19 evaluation studies of the effectiveness of school-based interventions in promoting physical activity and fitness among children and youth aged 6 to 18 (EPHPP, 2003) found that such programs "are moderately effective in promoting physical activity and duration of physical activity in children and adolescent girls", and that adults who participated in such programs in childhood were more active as adults.*** However, such programs were not effective in altering blood pressure, BMI or most other physiological functions, and these are likely inappropriate measures of effectiveness. The reviewers ***concluded, based on the evidence, that***

- "Since school-based physical activity interventions do not cause harm and do have some positive effects on activity rates, and their duration, and on television viewing among children and adolescents, such activities should continue and be encouraged by local public health unit staff to local schools and school boards.

- At a minimum, school-based interventions should include printed educational materials distributed to children, adolescents, and parents, as well as changes to other school curricula (including recess, lunch, and activity events) that promote an environment more conducive to increased daily activity.

- School-based physical activity interventions should focus on fostering positive attitudes toward physical activity and be geared toward the developmental level of the participants.

- Teachers and school staff should be encouraged to act as role models by demonstrating more physical activity during the course of the school day.

- Public health staff should work in collaboration with teachers, schools, and school boards to lobby local and provincial policy makers to increase resources for the promotion of physical activity within the school system."

4.7.4 Maintaining an ideal body weight

The impact of overweight (BMI = 25 - 29.9) and obesity (BMI >30) on life expectancy has recently been calculated for the first time, examining the 3457 participants in the Framingham Heart Study who were aged 30 - 49 at baseline (1948) and followed through to 1990 (Peeters et al, 2003) . The impact is dramatic; a decrease of more than seven years for women who are obese, whether smokers or non-smokers, compared to their respective normal

weight group, and a decrease of 6.7 years and 5.8 years for obese male smokers and non-smokers compared to their respective normal weight groups. Overweight non-smokers, both male and female, and experienced a decrease in life expectancy of more than three years compared to the normal-weight, non-smoking group. The authors point out that "these decreases are similar to those seen with smoking" and conclude that the prevention and treatment of obesity "should become high priorities in public health".

Four key behavior change strategies recommended by the Centres for Disease Control and Prevention (2003) to reduce obesity are to:

- ***promote increases in physical activity***
- ***promote breast feeding***
- ***increase fruit and vegetable consumption***
- ***reduce television viewing time***

to which should be added

- reduce intake of calories.

With respect to community-based programs to increase physical activity and encourage healthy eating, the CDCP report notes that ***multiple approaches are needed that engage a wide range of community partners in "a comprehensive approach that addresses the physical, social, political, and cultural environments affecting community members."***

The CDCP report notes that "few studies have explored strategies for reducing children's TV viewing, and more testing and development of such strategies is needed before firm recommendations can be made." However, the report does note that school-based programs have shown promise. In a review of interventions for weight loss and weight gain prevention among youth, Fulton et al (2001) note that one study that specifically worked to reduce time spent viewing television showed significant mean decreases in body mass index in both boys and girls. While they are uncertain whether this is due to reduced food intake or increased physical activity, Dietz and Gortmaker (2001) comment that "television viewing affects both energy intake and energy expenditure, and therefore represents a logical target for interventions".

The UK's Health Development Agency (2001) has recently reviewed the evidence with respect to obesity and concluded that ***effective strategies to reduce obesity include:***

- ***reduce sedentary behaviour (or promote active living) in obese children***
- ***use diet, physical activity and behavioural strategies for adults, in combination where possible***
- ***use maintenance strategies such as continued therapist contact***

- ***use a gradual, incremental stepwise approach***
- ***integrate lifestyle changes over a long period of time***
- ***family therapy is essential in treatment with younger children***
- ***habitual physical activity is important both for losing weight and for keeping weight off.***

The National Institutes of Health in the USA, through the National Heart, Lung and Blood Institute (2003), has recently released an evidence-based report on clinical guidelines for the identification, evaluation and treatment of overweight and obesity in adults. They reviewed almost 400 randomized controlled trials and used the results from 236 of these trials in arriving at the recommendations in three broad categories: Identifying the benefits of weight loss, who is at risk, the goals for weight loss, how to achieve these goals, and how to maintain weight loss.

Their recommendations are as follows:

- the benefits of weight loss
    - blood pressure - ***strong and consistent evidence that weight loss produced by lifestyle modifications can reduce blood pressure levels; this can be aided by increased physical activity*** (but not by sibutramine, the only weight-loss medication currently approved by the FDA)
    - serum lipids - ***strong evidence that weight loss produced by lifestyle modifications can reduce serum triglycerides and increase HDL cholesterol, and produce some reduction in total cholesterol and LDL cholesterol; this can be aided by increased physical activity*** but not by pharmacotherapy.
    - ***blood glucose - strong evidence that weight loss produced by lifestyle modifications can reduce blood glucose levels in people without diabetes, and in some patients with type 2 diabetes.***
- identifying those at risk
    - the BMI should be used both to assess and to classify overweight (BMI > 25) and obesity (BMI > 30) , and sex-specific waist circumference cutoffs (102 cm or 40 in. for men, 88 cm or 35 in. for women) should be used in conjunction with BMI to identify increased disease risks.
- goals for weight loss
    - there is ***strong and consistent evidence that weight loss of as much as 10% of baseline can be achieved in well-designed programs, and suggestive***

evidence that this can be achieved at the rate of 1 to 2 lbs. per week (a calorie deficit of 500 to 1000 kcal/day) for up to six months.

- achieving weight loss

    - there is ***strong and consistent evidence that a low-calorie diet (which can be facilitated by a low-fat diet) can result in an average weight loss of 8% over three to 12 months.***

    - ***there is strong evidence that physical activity on its own results in modest weight loss and that the combination of a reduced-calorie diet and increased physical activity produces greater weight loss than either alone.*** Physical activity thus should be included as part of a comprehensive weight loss therapy and control program

    - there is ***strong evidence that behavioral strategies can increase the weight loss resulting from dietary change and physical activity; no one therapy is clearly superior and multi-modal strategies appear to work best,*** with greater weight loss associated with greater intensity.

    - in summary "weight loss and weight maintenance therapy should employ the combination of low-calorie diets, increased physical activity, and behavior therapy".

    - while there is ***strong evidence that pharmacological therapy, generally studied along with lifestyle modification, results in weight loss, only one such drug still on the market is currently approved by the FDA(sibutramine), and it may cause increases in blood pressure and heart rate and is contra-indicated in patients with cardiovascular problems, including hypertension.*** In particular, the report notes that ***"weight-loss drugs should never be used without concomitant lifestyle modifications".***

    - their is ***strong evidence that surgical interventions in those with clinically severe obesity (BMI > 40 or BMI > 35 with co-morbid conditions) results in substantial weight loss.***

- maintaining weight loss

    - most people who lose weight regain it, once they are no longer in a treatment program. ***The evidence suggests that an on-going weight maintenance program incorporating dietary therapy, physical activity, and behavior therapy, should be continued indefinitely.***

A Cochrane review examined seven long-term and four short-term studies and concluded that ***"currently there is limited high quality data on the effectiveness of obesity prevention programs and as such no generalizable conclusions can be drawn", although "concentration***

on strategies that encourage reduction in sedentary behaviours and increase physical activity may be fruitful"

In a review of seven strong and five moderate quality reviews of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition (EPHPP, 2003), the reviewers concluded that

- "***School-based interventions should include environmental changes*** (cafeterias, physical education classes, and lunch or recess interventions).
- ***School-based interventions should be multi-faceted***, combining a classroom program with environmental changes in the school, home, or community.
- ***Interventions should be behaviourally focused.*** General education programs are effective for knowledge gains only.
- A dose-response effect was evident in that ***effective interventions were longer in duration and had frequent booster sessions.***
- When measured, age, sex, and ethnic subgroups had different outcomes possibly necessitating the need for interventions to be tailored to the different groups."

4.8 Prevention of infections linked to chronic diseases

Not surprisingly, given the growing evidence that infectious agents play a role in some chronic diseases, there is considerable interest in the possibility of immunization or prophylactic treatment as a means of preventing infection with organisms that may cause chronic disease, as well as treatment once infection has occurred. Particular attention has been focused on the development of vaccines against oncogenic viruses. But because tumour-causing viruses contain tumour-promoting genes, it is not safe to administer whole virus vaccines, whether killed or attenuated. Accordingly, work has focused on developing "sub-unit" vaccines, using antigens from the virus that do not include the oncogene. Such sub-unit vaccines may be either purified proteins or peptide fragments or naked DNA. However, once an oncogenic virus is established within the cell, a different form of cancer vaccine is needed, one that can generate cell-mediated immune response against tumour-associated antigens (TAAs) that are present on the cell membrane or intracellular antigens (Khleif and Frederickson, 2001). Such vaccines may thus be both therapeutic as well as preventive.

With respect to the current and immediate future state-of-the-art of vaccines against oncogenic organisms, Khleif and Frederickson (2001) report as follows:

- HPV vaccines are in the early phase of development, with ongoing trials, and early results appear promising (see below for more detail).
- Several clinical trials of EBV vaccine are underway, but "it is still unclear whether any form of these vaccinations will generate neutralizing antibody or prevent or eliminate infection . . . (or) prevent or eliminate resultant tumours".

- ***Hepatitis B virus vaccine is already in wide-spread use. It is effective in reducing the carrier rate, and has been associated with reductions in the incidence of hepatocellular carcinoma.***

- Development of a hepatitis C vaccine has been hampered by genetic and antigenic variability, but active research is underway.

- Work is underway to develop a vaccine against H pylori, with initial tests in humans showing that the vaccine can generate an antibody response and can reduce - but not eradicate – the bacterium in the stomach.

Sherman et al (1998) review the rationale for developing a prophylactic vaccine against the four principal types of human papilloma virus (HPV) and the potential impact this would have on cervical cancer screening. So far, the experimental results suggest that such systemic immunization may be protective; the most likely target population is adolescents prior to initiation of sexual activity, both male and female, since men who have many sexual partners are a risk to their partners. Vaccination of older women is unlikely to be cost-effective, since it is unusual for them to acquire new HPV infection. It will thus take some years, perhaps decades for the impact of HPV vaccination to be seen in terms of a reduction in cancer incidence, with the lifetime risk for developing carcinoma in women who have low-grade squamous intraepithelial lesions falling from 1 in 100 to 1 in 500 or 1 in 1000. Moreover, non-vaccinated women would also be protected to some extent because of the lower rate of infection with HPV in the general population. As a result, screening could be reduced from annual to just a few times in the course of the woman's life. However, since other HPV types would still be prevalent (and would in fact increase in relative frequency), cervical cancer and pre-cancerous lesions would not disappear, so screening would still be required. In addition, it will be necessary to apply an appropriate serologic test following vaccination to ensure that a suitable protective immune response has occurred. In older women, a normal pap smear and negative serology for HPV-DNA may mean that additional screening is no longer necessary.

4.9 Chemoprevention

Chemoprevention refers to the use of pharmacologic or natural agents as a medication or supplement to prevent a disease. There have been two broad areas of interest in the use of chemoprevention for chronic diseases; cancer and cardiovascular disease. Indeed, The U.S. Preventive Services Task Force in 2002 ***strongly recommended that***

> ***"clinicians discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD). Discussions with patients should address both the potential benefits and harms of aspirin therapy"***

while the American Heart Association, in a 1999 Science Advisory noted that ***there is evidence to suggest that anti-oxidants in the diet may play a protective role , and in particular that vitamin E at levels only attainable through supplementation may play a role in preventing some disease end-points in people with pre-existing heart disease.***

However, at that time, the AHA felt it premature to make recommendations for vitamin E supplementation, pending further research (Trimble, 1999).

With respect to cancer, however, while interest is high, at present (2003) the U.S. Preventive Services Task Force concludes that

> **"the evidence is insufficient to recommend for or against the use of supplements of vitamins A, C, or E; multivitamins with folic acid; or antioxidant combinations for the prevention of cancer or cardiovascular disease" and specifically "recommends against the use of beta-carotene supplements, either alone or in combination" for those purposes.**

Nonetheless, the understanding of the process of carcinogenesis discussed earlier does suggest that there is a potential for chemoprevention at least in the area of cancer prevention, as discussed below.

4.9.1 Chemoprevention of cancer

> "The major impetus for cancer control through chemopreventive actions stems from studies on diet and cancer" but "A basic question . . . is whether it is as acceptable to supplement diet using products of the pharmaceutical industry as it is to influence healthy eating habits in the society." (Hakama, 1996)

In discussing the development of supplements, Wattenberg (1997) notes that dietary change can achieve protection against a number of different cancers in the general population, without toxicity, and that this prevention probably results from the combination of chemopreventive compounds occurring in the natural diet. However, Wattenberg also comments that, while on the face of it reliance on dietary change "seems simple and logical", in practice obtaining such changes in the population is complex and difficult. Moreover, uncertainties remain regarding the actual dose of the chemopreventive agents of interest, because of seasonal differences, differences in chemical composition of dietary components, differences in food handling and preparation, portion size and so on. Thus chemopreventive supplements may be an important strategy.

Krishnan, Ruffin and Brenner (1998) define chemoprevention as "the use of non-cytotoxic drugs, diet, or dietary supplements at the earliest stages of carcinogenesis to prevent initiation of cancer and to retard or delay the progression of cancer", while Hong (cited in Zänker, 1999) defines chemoprevention as "the use of pharmacologic or natural agents that inhibit the development of invasive cancer either by blocking the DNA damage that initiates carcinogenesis or by arresting or reversing the progression of pre-neoplastic cells in which such damage has occurred".

Such agents can be thought of in two broad categories: specific chemicals that are administered as a medication (eg., oltipraz, which has been given to humans at high risk of aflatoxin exposure in the Chinese province of Qidong - Kwak et al, cited in Editorial, 2001) or

as a supplement (vitamins, mineral micro-nutrients, etc.), or dietary change that introduces a number of potential chemoprevention agents simultaneously and more naturally.

Hawk and Lippman (2000) note that chemoprevention of cancer seeks to prevent, reverse or delay carcinogenesis by intervening in one or more of four fundamental molecular or cellular level changes by

- protecting genomic integrity
- replacing or repairing damaged genes
- eliminating cells with irreparably damaged genes, or
- slowing clonal evolution by reducing proliferation.

Mukhtar and Ahmad (1999) note that there are more than 600 agents, grouped in 30 different classes, "that have shown marginal to substantial chemopreventive activity". They suggest that since there are many different potential intervention points in the long process of transition from normal to malignant cells "it is a false hope that the distinct opportunities can be met by a single agent". They thus propose the use of a "cocktail" of different agents that act at different points in the process.

With respect to prevention of multiple cancers or even multiple diseases, Hawk and Lippman (2000) suggest that there are several promising agents including cyclo-oxygenase (COX) inhibitors and selective oestrogen receptor modulators (the next evolution of drugs such as tamoxifen). They point to COX inhibitors as an important example, since they have beneficial effects not only with respect to cancer and cardiovascular disease, but also with respect to the pain and inflammation of arthritis, and dementias.

4.9.1.1 Population-wide cancer chemoprevention

Population-wide cancer chemoprevention is an important focus because while "large effects are exciting, even small preventive effects can be important" at the population level (Hawk and Lippman, 2000), although Mettlin (1997) comments that

> ". . . there has not yet been an instance in which the practicality of chemoprevention has been demonstrated in a well-nourished population not already affected by cancer."

Nonetheless, he notes that the potential for benefit is large if any of the chemopreventive approaches currently under evaluation are shown to be effective. At the same time, rigorous evaluation of population-wide chemoprevention is important.

Chemoprevention should be based on "compelling mechanistic data" as well as clinical and epidemiological evidence and well designed trials. **Of 19 large-scale phase III (definitive efficacy) primary prevention trials, only 3 have been positive (2 involving tamoxifen in**

breast cancer prevention and 1 involving retinol in the prevention of skin cancer), 2 have been negative (ß-carotene actually increases the risk of lung cancer in smokers and in people exposed to asbestos) and the remaining 8 were neutral. Other promising but as yet non-definitive chemoprevention trials suggest that wheat bran fibre, dietary modification, aspirin, folic acid and calcium carbonate are able to reduce the incidence or recurrence of precancerous adenomatous lesions in the colon; the NSAID sulindac can reduce polyps in FAP patients; and 13-*cis*-retinoic acid (13cRA) has been successful in treating oral premalignant lesions. Major primary prevention trials in progress include a randomized, double-blind, placebo-controlled study of ß-carotene, aspirin and vitamin E administered to 40,000 women health professionals in the United States, and a similar trial testing both antioxidant vitamins (C, E, ß-carotene) and minerals (selenium, zinc) administered for 8 years in a French trial (Hawk and Lippman, 2000).

However, Hakama (1997) cautions that the cost-effectiveness of chemoprevention may be much less than might be hoped. He cites research by Habbema et al on the cost-effectiveness of a successful chemoprevention program against colon cancer in middle-aged women. Since the preventive treatment would be applied over several decades, but only a small proportion of women would be protected, hundreds of years of chemopreventive treatment would be needed to gain one life-year in the population, resulting in only a few life-weeks gained per woman, on average (see Appendix 3). As Hakama (1997) notes:

> "If the activity of chemo-prevention itself or its harmful effects cause a marginally small decrease in quality of life, there will be a net loss instead of gain in the quality-adjusted length of life."

4.2.2 Promising directions

In looking to the future, Hawk and Lippman (2000) identify a number of promising directions in cancer chemoprevention. These include:

- interventions with improved mechanistic targeting
- genomics and proteomics to better define molecular targets
    - combination screening to identify agents with greater specificity
- broader consideration of agents with preventive potential
    - antibiotics
    - antiviral agents
    - biologics/vaccines
    - gene-directed interventions

- nutraceuticals
- cancer chemotherapeutics - optimized for risk cohorts

- improved agent administration
  - minimal effective dose
  - targeted agent delivery - topical/regional
  - restricted dosing schedules - frequency, duration
  - agent combinations

- improved agent development pathways
  - new in vitro/in vivo models - high throughput and greater biologic relevance
  - better-defined risk cohorts
  - better-validated bio-markers and models
  - cross-sectional, multiplex efficacy evaluations
  - sensitive and specific superficial imaging
  - concomitant prevention and treatment evaluations.

Wattenberg (1997) suggests particularly promising future chemopreventive agents include the polyphenolics found in various foods and, in particular, tea; non-steroidal anti-inflammatory compounds that inhibit the arachadonic cascade; the development of less toxic selenium compounds; and the identification of compounds that can decrease tissue vulnerability to carcinogenesis by promoting cell maturation. This may be a particularly useful strategy because a permanent effect can be achieved through administration of the agent for a relatively brief period of time, provided it is at the right time.

4.10 Clinical prevention

The final level of intervention is clinical prevention, which occurs primarily in physicians offices, and primarily in the primary care setting, although providers other than physicians and settings other than primary care may also undertake clinical prevention. Clinical prevention may involve both primary prevention such as health education and counselling, immunisation, and early detection of risk factors, and preventive treatment (secondary prevention) such as screening and early detection, or treatment of essential hypertension, tobacco addiction or familial hyperlipidemia.

For a number of years, the Canadian Taskforce on Preventive Health Care (formerly the Task Force on the Periodic Health Examination) has been developing and publishing systematic

reviews and recommendations of preventive actions that should be included (or not included) in the periodic health examination.[39] A summary of their recommendations for the primary and early secondary preventive services pertaining to chronic diseases for which there is good evidence (seven "A" recommendations) or for which there is fair evidence (eighteen "B" recommendations) to include the service in the periodic health exam is shown in Table 9. These positive recommendations are outweighed by thirty-four "C" recommendations (where evidence is conflicting - Table 10) and sixteen "D" recommendations, (Table 11) where there is fair evidence to exclude the service from the periodic health exam.

39 Only those conditions which are chronic are considered here; a number of the Task Force's recommendations relate to the prevention of infectious diseases and other conditions that are not considered to be part of the burden of chronic, non-communicable diseases.

Table 9: Effective preventive services for chronic disease, based on Canadian Taskforce on Preventive Health Care

(A= Good Evidence, B = Fair Evidence)

All-cause morbidity and mortality

- Day care or preschool programs for disadvantaged children (A)
- Moderate physical activity for the general population (B)

Primary preventive services

Smoking

- Counselling, smoking cessation or offer nicotine replacement therapy (A)
- Counselling children and adolescents to prevent smoking initiation (B)
- Referral of smokers to validated cessation program (B)

Cardiovascular disease

- Preventive treatment (e.g. anti-hypertensive treatment to prevent stroke) (A)
- Diet/drug treatment for males 30-59 years with elevated cholesterol or LDL-C (B)

Diet

- Counselling on adverse nutritional habits (adult population) and physical activity (general population) (B)
- General dietary advice on fat and cholesterol for males 30-69 years (B)

Cancer

- Counselling on benefits and risks of using tamoxifen to reduce likelihood of breast cancer (High-risk women) (B)

Dental disease

- Community fluoridation, fluoride toothpaste or supplement in general population and fissure sealants in high-risk children to prevent dental caries (A)

Screening and early detection

Cancer

- Mammography (A)

- Multiphase screening with the Hemoccult test in average risk adults > age 50 (A)
- Pap test (B)
- Sigmoidoscopy (Average risk adults > age 50) (B)
- Flexible sigmoidoscopy beginning at puberty, genetic testing (High-risk adults with FAP) (B)
- Colonoscopy (High-risk adults with HNPCC) (B)
- Lung cancer - Dietary advice on green leafy vegetables and fruit in smokers (B)
- Counselling, sun exposure, clothing for general population (B)
- Physical exam of skin for first degree relative of person with melanoma (B)

Cardiovascular disease

- Pharmacologic treatment of hypertension in elderly, specific sub- groups, adults aged 21 – 64 with diastolic BP > 90mmHg (A)
- Blood pressure measurement in the elderly (B)
- Anticoagulation if atrial fibrillation detected after stroke (B)
- Anticoagulation (warfarin) for intracardiac thrombus to prevent systemic emboli (B)

Obesity

Weight-reduction therapy for obese adults with obesity-related disease (B)

Table 10: Preventive services for chronic disease for which there is conflicting evidence (Category "C"), based on Canadian Taskforce on Preventive Health Care

All-cause mortality and morbidity

- counselling for physical activity to prevent obesity in the general population
- measuring BMI and treating obesity in the general population

Cancer

- screening mammography for women aged 40 to 49 years at average risk of breast cancer
- urine dipstick or cytology to detect bladder cancer in high-risk males aged 60 and over
- fecal occult blood and sigmoidoscopy in combination to detect colorectal cancer in average risk adults aged over 50
- colonoscopy to detect colorectal cancer for average risk adults or for high risk adults with a family history of polyps
- digital rectal exam to detect prostate cancer in males over age 50
- pelvic exam, trans vaginal ultrasound, CA 125 or combination to detect ovarian cancer in pre- and post-menopausal women or those with a family history of first-degree relative affected
- physical examination of the oral cavity to screen for oral cancer in asymptomatic patients
- counselling, skin self- examination, physical examination or sun block to detect or prevent skin cancer in the general population
- physical exam or self-examination for testicular cancer in adolescent or adult males

  neck palpitations to detect thyroid cancer in the adult population

Cardiovascular disease

- aspirin prophylaxis in the general population
- anti-platelet therapy to prevent carotid disease/stroke asymptomatic carotid bruit or stenosis
- screening for total plasma homocysteine in the general population of those at high risk for coronary artery disease

- vitamin therapy (folic acid alone or with vitamin B 12) to lower total plasma homocysteine levels in all populations
- diet or drug treatment for individuals with elevated cholesterol or LDL- C (except males aged 30 to 59 years)
- measurement of blood total cholesterol level who (except case-finding for males aged 30 to 59 years)
- general dietary advice on fat and cholesterol (except males aged 30 to 69 years) and an
- pharmacologic treatment for hypertension and in adults under age 21, those with isolated systolic hypertension, and some elderly subgroups will
- trans-thoracic or trans-oesophogeal echocardiogaphy for the detection of intracardiac masses to prevent stroke in patients without clinical disease
- treatment for patent foramen ovale in the general population

Gestational diabetes

- blood glucose level, fasting/random or glucose challenge test in pregnant women, even with a history or with risk factors present

Obesity

- BMI measurement in the general population
- community-based obesity prevention programs for the general population
- weight-reduction therapy for obese adults without obesity-related disease
- exercise and/or nutrition and behavior modification for obese children

height, weight, skin fold thickness, BMI etc. for children

Table11: Preventive services for chronic disease for which there is fair evidence to EXCLUDE from the periodic health exam, based on Canadian Taskforce on Preventive Health Care("D" and "E" recommendations)

Cancer screening

- sputum cytology to detect lung cancer in the general population (E recommendation)
- urine dipstick or cytology to detect bladder cancer in the general population
- tamoxifen to reduce the risk of breast cancer in low-risk women
- teaching breast self-examination to women aged 40 to 59
- human papilloma virus screening for women
- fecal occult blood testing or sigmoidoscopy for those with cancer family syndrome
- chest radioography to detect lung cancer in the general population
- screening the general population by clinical examination to detect oral cancer
- pelvic exam, trans -vaginal ultrasound, CA 125 or combination to detect ovarian cancer in pre-and post-menopausal women
- abdominal palpation, ultrasound or serologic tumor markers to detect pancreatic cancer in the general population
- prostate specific antigen in males over 50
- transrectal ultrasound to detect prostate cancer in males over 50
- tumor markers for testicular cancer in adolescent and adult males

Cardiovascular disease

- neck auscultation or carotid endarterectomy to prevent stroke in the general population

Diabetes

- fasting blood glucose the non -pregnant general population

Obesity

- low-calorie diet in pre-adolescent obese children

Progressive renal disease

- urine dipstick for the general population

In the USA, the US Preventive Services Task Force currently lists 78 reviews (although a few are still in process), which fall into 5 main categories: Screening, immunization, counseling, chemoprevention and chemoprophylaxis. The reviews mainly date from 1996, although a number have been updated since then; a new edition of the Guide is due later in 2003 (http://www.ahcpr.gov/clinic/uspstfix.htm). Thirty reviews - several of which include multiple recommendations - are relevant to chronic disease prevention; they include 12 related to screening for cancer, 11 related to screening for other conditions (mainly cardiovascular disease), 4 related to counseling and 2 related to chemoprevention (see Appendix 4)

Like the Canadian Task Force, on which they are modelled, the US Task Force has "A" recommendations for services they strongly recommend for eligible patients because there is good evidence that health outcomes are improved and the benefit outweighs the harm; "B" recommendations where there is fair evidence, and the benefit outweighs the harm; "C" recommendations, where there is fair evidence of improved outcome, but the balance of the benefits and harms is too close to justify a general recommendation; "D" recommendations that the Task Force recommends against routinely providing to asymptomatic patients because of at least fair evidence that the service is ineffective or that harms outweigh benefits; and "I" recommendations, where the evidence is insufficient to recommend for or against routinely providing the service.

The Task Force "A" and "B" recommendations relevant to chronic disease prevention are shown in Table 12, organised in the following categories: cancer screening, screening for other conditions, counselling, and chemoprevention. Services for which no recommendations are made (due to insufficient [I] or conflicting [C] evidence) are shown in Table 13, organised in the same categories, while Table 14 shows the services that it is recommended not be provided ("D" recommendations).

Table 12: Recommendations on effective preventive services relevant to the prevention of chronic disease (US Preventive Services Task Force)

CANCER SCREENING

Breast Cancer (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommends** screening mammography, with or without clinical breast examination (CBE), every 1-2 years for women aged 40 and older (**"B" Recommendation)**

Cervical Cancer (Update, 2003 Release)

The USPSTF **strongly recommends** screening for cervical cancer in women who have been sexually active and have a cervix **("A" Recommendation)**

Colorectal Cancer (Update, 2002 Release)

The USPSTF **strongly recommends** that clinicians screen men and women 50 years of age or older for colorectal cancer. **("A" Recommendation)**

The USPSTF found fair to good evidence that several screening methods are effective in reducing mortality from colorectal cancer. It found good evidence that periodic fecal occult blood testing (FOBT) reduces mortality from colorectal cancer **("A")** and fair evidence that sigmoidoscopy alone or in combination with FOBT reduces mortality **("B")**.

SCREENING FOR OTHER CONDITIONS

Depression (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommend**s screening adults for depression in clinical practices that have systems in place to assure accurate diagnosis, effective treatment, and followup **("B" Recommendation)**

Diabetes Mellitus, Adult Type II (Update, 2003 Release)

The USPSTF **recommends** screening for type 2 diabetes in adults with hypertension or hyperlipidemia. **("B" Recommendation)**

Hypertension (Update, 2003 Release)

The USPSTF **strongly recommends** that clinicians screen adults aged 18 and older for high blood pressure **("A" Recommendation)**

Lipid Disorders in Adults (Update, 2001 Release)

The U.S. Preventive Services Task Force (USPSTF) **strongly recommends** that clinicians routinely screen men aged 35 years and older and women aged 45 years and older for lipid disorders and treat abnormal lipids in people who are at increased risk of coronary heart disease. **("A" Recommendation)**

The USPSTF **recommends** that clinicians routinely screen younger adults (men aged 20 to 35 and women aged 20 to 45) for lipid disorders if they have other risk factors for coronary heart disease **("B" Recommendation)**

The USPSTF **recommends** that screening for lipid disorders include measurement of total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C) **("B" Recommendation)**

Obesity (1996)

Periodic height and weight measurements are **recommended** for all patients.

Osteoporosis (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommends** that women aged 65 and older be screened routinely for osteoporosis. The USPSTF **recommends** that routine screening begin at age 60 for women at increased risk for osteoporotic fractures. (**"B" Recommendation)**

COUNSELLING

Healthy Diet Counseling (Update, 2003 Release)

The USPSTF **recommends** intensive behavioral dietary counseling for adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease. Intensive counseling can be delivered by primary care clinicians or by referral to other specialists, such as nutritionists or dietitians. **("B" Recommendation)**

CHEMOPREVENTION

Aspirin for the Primary Prevention of Cardiovascular Events (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **strongly recommends** that clinicians discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD). Discussions with patients should address both the potential benefits and harms of aspirin therapy. **"A" Recommendation**

Breast Cancer (Update, 2002 Release)

The USPSTF **recommends** that clinicians discuss chemoprevention with women at high risk for breast cancer and at low risk for adverse effects of chemoprevention. Clinicians should inform patients of the potential benefits and harms of chemoprevention. **("B" Recommendation)**

****

Table 13: Preventive services relevant to the prevention of chronic disease for which there is no recommendation (US Preventive Services Task Force)

CANCER SCREENING

Cervical Cancer (Update, 2003 Release)

The USPSTF concludes that the evidence is insufficient to recommend for or against the routine use of new technologies (such as liquid-based cytology, computerized rescreening, and algorithm based screening) to screen for cervical cancer.

The USPSTF concludes that the evidence is insufficient to recommend for or against the routine use of human papillomavirus (HPV) testing as a primary screening test for cervical cancer.

Colorectal Cancer (Update, 2002 Release)

The USPSTF did not find direct evidence that screening colonoscopy is effective in reducing colorectal cancer mortality; efficacy of colonoscopy is supported by its integral role in trials of FOBT, extrapolation from sigmoidoscopy studies, limited case-control evidence, and the ability of colonoscopy to inspect the proximal colon.

Double-contrast barium enema offers an alternative means of whole-bowel examination, but it is less sensitive than colonoscopy, and there is *no direct evidence* that it is effective in reducing mortality rates.

The USPSTF found insufficient evidence that newer screening technologies (for example, computed tomographic colography) are effective in improving health outcomes

Oral Cancer (1996)

There is insufficient evidence to recommend for or against routine screening of asymptomatic persons for oral cancer by primary care clinicians.

All patients should be counseled to:

- Discontinue the use of all forms of tobacco.
- Limit consumption of alcohol.

Clinicians should remain alert to signs and symptoms of oral cancer and premalignancy in persons who use tobacco or regularly use alcohol.

Ovarian Cancer (1996)

There is insufficient evidence to recommend for or against the screening of asymptomatic women at increased risk of developing ovarian cancer.

Prostate Cancer (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against routine screening for prostate cancer using prostate specific antigen (PSA) testing or digital rectal examination. ("I" Recommendation)

Skin Cancer (Update, 2001 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against routine screening for skin cancer using a total-body skin examination for the early detection of cutaneous melanoma, basal cell cancer, or squamous cell skin cancer. "I" Recommendation

Testicular Cancer (1996)

There is insufficient evidence to recommend for or against routine screening of asymptomatic men in the general population for testicular cancer by physician examination or patient self-examination.

Recommendations to discuss screening options with selected high-risk patients may be made on other grounds.

Thyroid Cancer (1996)

There is insufficient evidence to recommend for or against screening persons with a history of external head and neck irradiation in infancy or childhood, but recommendations for such screening may be made on other grounds.

SCREENING FOR OTHER CONDITIONS

Abdominal Aortic Aneurysm (1996)

There is insufficient evidence to recommend for or against routine screening of asymptomatic adults for abdominal aortic aneurysm with abdominal palpation or ultrasound.

Asymptomatic Carotid Artery Stenosis (1996)

There is insufficient evidence to recommend for or against screening asymptomatic persons for carotid artery stenosis using the physical examination or carotid ultrasound.

For selected high-risk patients, a recommendation to discuss the potential benefits of screening and carotid endarterectomy may be made on other grounds.

All persons should be screened for hypertension, and clinicians should provide counseling about smoking cessation.

Asymptomatic Coronary Artery Disease (1996)

There is insufficient evidence to recommend for or against screening middle-aged and older men and women for asymptomatic coronary artery disease, using resting elecrocardiography (ECG), ambulatory ECG, or exercise ECG.

Depression (Update, 2002 Release)

The USPSTF concludes the evidence is insufficient to recommend for or against routine screening of children or adolescents for depression.

Diabetes Mellitus, Adult Type II (Update, 2003 Release)

The USPSTF concludes that the evidence is insufficient to recommend for or against routinely screening asymptomatic adults for type 2 diabetes, impaired glucose tolerance, or

impaired fasting glucose.

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against routine screening for gestational diabetes (GDM).

The USPSTF found insufficient evidence that screening for GDM substantially reduces important adverse health outcomes for mothers or their infants (for example, cesarean delivery, birth injury, or neonatal morbidity or mortality).

Hypertension (Update, 2003 Release)

The USPSTF concludes that the evidence is insufficient to recommend for or against routine screening for high blood pressure in children and adolescents to reduce the risk of cardiovascular disease ("I" Recommendation)

Lipid Disorders in Adults (Update, 2001 Release)

The USPSTF makes no recommendation for or against routine screening for lipid disorders in younger adults (men aged 20 to 35 or women aged 20 to 45) in the absence of known risk factors for coronary heart disease ("C" Recommendation)

The USPSTF concludes that the evidence is insufficient to recommend for or against triglyceride measurement as a part of routine screening for lipid disorders

Osteoporosis (Update, 2002 Release)

The USPSTF makes no recommendation for or against routine osteoporosis screening in postmenopausal women who are younger than 60 or in women aged 60-64 who are not at increased risk for osteoporotic fractures. "C" Recommendation

COUNSELLING

Gynecologic Cancers (1996)

There is insufficient evidence to recommend for or against routine counseling of women about measures for the primary prevention of gynecologic cancers.

Clinicians counseling women about contraceptive practices should include information on the potential benefits of the following with respect to gynecologic cancers:

- Oral contraceptives.
- Barrier contraceptives.
- Tubal sterilization.
- Clinicians should also promote other practices:
- Maintaining desirable body weight.
- Smoking cessation.

- Safe sex practices.

These measures may reduce the incidence of certain gynecologic cancers and have other proven health benefits.

Healthy Diet Counseling (Update, 2003 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against routine behavioral counseling to promote a healthy diet in unselected patients in primary care settings

Physical Activity (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is insufficient to recommend for or against behavioral counseling in primary care settings to promote physical activity. "I" Recommendation

CHEMOPREVENTION

Vitamin Supplementation to Prevent Cancer and Cardiovascular Disease (New Topic, 2003)

The USPSTF concludes that the evidence is insufficient to recommend for or against the use of supplements of vitamins A, C, or E; multivitamins with folic acid; or antioxidant combinations for the prevention of cancer or cardiovascular disease ("I" Recommendation)

Table 14: Preventive services relevant to the prevention of chronic disease which are not recommended (US Preventive Services Task Force)

CANCER SCREENING

Bladder Cancer (1996)

Routine screening for bladder cancer with urine dipstick, microscopic urinalysis, or urine cytology is not recommended in asymptomatic persons.

Cervical Cancer (Update, 2003 Release)

The USPSTF recommends against routinely screening women older than age 65 for cervical cancer if they have had adequate recent screening with normal Pap smears and are not otherwise at high risk for cervical cancer ("D" Recommendation)

The USPSTF recommends against routine Pap smear screening in women who have had a total hysterectomy for benign disease ("D" Recommendation)

Lung Cancer (1996)

Routine screening with chest radiography or sputum cytology in asymptomatic persons is not recommended.

All patients should be counseled against tobacco use.

Ovarian Cancer (1996)

Routine screening for ovarian cancer by ultrasound, the measurement of serum tumor markers, or pelvic examination is not recommended.

Pancreatic Cancer (1996)

Routine screening for pancreatic cancer in asymptomatic persons, using abdominal palpation, ultrasonography, or serologic markers, is not recommended.

Thyroid Cancer (1996)

Routine screening for thyroid cancer using neck palpation or ultrasonography is not recommended for asymptomatic children or adults.

SCREENING FOR OTHER CONDITIONS

Asymptomatic Coronary Artery Disease (1996)

Routine screening is not recommended as part of the periodic health visit or pre-participation sports examination for children, adolescents, or young adults.

Clinicians should emphasize proven measures for the primary prevention of coronary disease.

Peripheral Arterial Disease (1996)

Routine screening for peripheral arterial disease in asymptomatic persons is not recommended.

Clinicians should be alert to symptoms of peripheral arterial disease in persons at increased risk, and should evaluate patients who have clinical evidence of vascular disease.

CHEMOPREVENTION

Breast Cancer (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) recommends against routine use of tamoxifen or raloxifene for the primary prevention of breast cancer in women at low or average risk for breast cancer. “D” Recommendation

Vitamin Supplementation to Prevent Cancer and Cardiovascular Disease (New Topic, 2003)

The USPSTF recommends against the use of beta-carotene supplements, either alone or in combination, for the prevention of cancer or cardiovascular disease (“D” Recommendation)

4.10.1 Challenges in implementing clinical prevention

The recent report from the Institute of Medicine in the US on fulfilling the potential of cancer prevention and early detection (Curry, Byers and Hewitt, 2003) also addresses the funding and support that is necessary for the benefits of prevention to be fully realized. Key recommendations include:

- "Public and private insurers and providers should consider evidence-based cancer prevention and early detection services to be essential benefits and should provide coverage for them."
    - at a minimum, these services include "implementing the clinical practice guideline on treating tobacco use and dependence, screening for breast cancer among women age 50 and older, screening for cervical cancer among all sexually active women with an intact cervix, and screening for colorectal cancer among adults age 50 and older."
- "Just as preventive services of proven effectiveness should be covered under insurance plans, services for which evidence of benefit is lacking should be excluded from coverage."
- "Evidence suggests . . . that physicians and other practitioners are not providing effective clinical interventions such as counseling and screening tests as often as would be beneficial." These shortcomings can be traced
    - in part to a lack of education and training
    - in part to a lack of support systems such as "supportive management structures; efficient patient-flow procedures; and information systems that support reminder systems, documentation of services, timely follow-up and referrals, and coordinated communication with providers and institutions across the community."
- in addition, opportunities need to be taken "to monitor performance and assist providers in improving their practices".
- " there is convincing evidence that non-physician providers are just as effective as physician providers in delivering certain smoking cessation and screening services . . ." and research is needed on "how to integrate provision of prevention services by such providers into routine primary care."

Clearly, any effective strategy to reduce the burden of chronic diseases must engage primary care practitioners and help them to consistently and fully implement the clinical primary preventive interventions that are known to be effective, or for which their is fair evidence of effectiveness, and to discontinue those practices for which there is no evidence of effectiveness. This will require a combination of education, incentives and support.

The first challenge is the low rate of implementation of effective and recommended preventive interventions in primary care. Lemelin, Hogg and Baskerville (2001) studied 46 HSO

practices in Ontario and found that the proportion of eligible patients who received 8 recommended preventive manoeuvres was 53%, while the proportion of eligible patients who received 5 inappropriate preventive manoeuvres was 21%. This is comparable to the finding that for 38 preventive care quality indicators in the USA, only 55% of patients received the recommended care – exactly the same proportion as those that received recommended care overall, including acute and chronic care (McGlynn et al, 2003).

Hutchinson et al (1998) studied 62 physicians in southern Ontario who were visited by unannounced standardized patients posing as new patients. They noted the proportion of "A", "B", "C" , "D" and "E" recommendations of the Canadian Task Force on Preventive Health Care were performed, offered or advised. They found that "study physicians performed or offered 65.6% of applicable grade A manoeuvres, 31.0% of grade B manoeuvres, 22.4% of grade C manoeuvres, 21.8% of grade D manoeuvres and 4.9% of grade E manoeuvres".

Coffield et al (2001) undertook a systematic assessment of the value of clinical preventive services recommended for average-risk patients by the U.S. Preventive Services Task Force. Based on a combination of the burden of disease prevented by each service and the cost-effectiveness of the intervention, they identified the following priority interventions relevant to chronic disease prevention- those ranked highest in priority (seven or more out of 10) and yet having the lowest delivery rates (less than 50 percent in the U.S.) are:

- tobacco cessation counselling for adults
- screening older adults for undetected vision impairment
- offering adolescents an anti-tobacco message or advice to quit
- counselling adolescents on alcohol and drug abstinence
- screening adults for colorectal cancer
- screening adults for problem drinking

Other priority interventions for chronic disease prevention that are delivered at a rate greater than 50% in the US, are:

- screening for cervical cancer among sexually active women aged 18 and over
- screening for hypertension among all persons
- screening for high blood cholesterol among men aged 35 to 65 years and women aged 45 to 65 years.

One reason for this low level of implementation is pin-pointed by Yarnall et al (2003), who raised the interesting question as to whether there is enough time for prevention in a primary care practice - and concluded that there isn't. They took the list of recommended preventive services (both A and B recommendations) from the U.S. Preventive Services Task Force's

"Guide to Clinical Preventive Services", estimated times to provide those services from the literature, and applied this to a representative practice population of 2500 people distributed according to the age and sex distribution of the U.S. population. They concluded that it would take 1773 hours of a physician's time annually (or 7. 4 hours per working day) to provide all these services to children, adults and pregnant women. Clearly this would leave no time to practice other aspects of primary care such as diagnosis and treatment! If only the category A recommendations were followed, it would still require 525 hours a year (2. 2 hours per working day), while just doing the top priority preventive services identified by Coffield at al (7 or above on a scale a 10) would require one hour per day. However, they note that "providing only these services excludes a large number of other services that have also been recommended and shown to be efficacious". They conclude that we have to find a better ways to both fund and pay for effective preventive services, either through group visits, patient education, or - "the most promising model currently available" - by using non-physicians, especially nurse practitioners and physician assistants, to provide preventive and wellness services.

The study by Lemelin, Hogg and Baskerville (2001) used a fairly resource-intensive intervention (nurse prevention facilitators) over an 18-month period and demonstrated a modest one-fifth increase in appropriate interventions in the study group (from 52.3% to 62.3%) and a small decrease in inappropriate interventions compared to the control group. In a process evaluation of that same project Baskerville, Hogg and Lemelin (2001) found that the key interventions were audit and feedback on prevention performance, developing consensus on the practice's prevention plan, and developing reminder systems.

"Put Prevention Into Practice", is a program of the (US) Agency for Healthcare Research and Quality that is intended to increase the appropriate use of clinical preventive services, such as screening tests, immunizations, and counseling, based on U.S. Preventive Services Task Force recommendations. This program has identified ***five key elements of a formal system for delivering preventive services which increases their delivery in the clinical setting*** (Put Prevention Into Practice, http://www.ahcpr.gov/ppip/manual/guideint.htm) ***They are:***

- ***Establish preventive care protocols***
- ***Define staff roles for delivering and monitoring preventive care***
- ***Determine patient and material flow***
- ***Audit the delivery of preventive care continually***
- ***Readjust and refine your delivery system and standards***

There are lessons to be learned from the implementation of the 'Put Prevention Into Practice ' (PPIP) program in the United States. ***McVea et al (1996) examined eight Mid-western family practices that had purchased the PPIP kit and found that the materials were not being used.*** They concluded that technical support was needed, and that a "one size fits all" approach would not meet the needs of diverse providers , which suggests the need for a more tailored approach. ***Medder et al (1997) found that after two years of active promotion through the American Academy of Family Physicians, only 27% of a AAFP members had***

heard about PPIP. They concluded that simple availability of the kit is inadequate, and that additional strategies might be needed such as the provision of external consultation services to practices, the incorporation of preventive services into HMO organizations, and residency training.

Melnikow, Kohatsu and Chan (2000) evaluated the extent to which PPIP materials affected the delivery of eight clinical preventive services in a family medicine practice serving a diverse, low-income population. They found that the delivery rates were higher for seven of these preventive services at six months, but that by 30 months this increase had flattened or decreased. They concluded that while the use of these materials could have a modest impact, "sustained improvement will require substantial system changes and ongoing support". ***Goodwin et al (2001) tested a practice-tailored approach in 77 community family practices in northeast Ohio, with particular emphasis on health habit counselling. The intervention consisted of a nurse facilitator who, after a one-day practice assessment, met with the physicians and their staff and helped them choose and implement individualized prevention tools and approaches.*** They found that this approach increased delivery of the U.S. Preventive Services Task Force interventions from 31% to 42% over a one-year period***. Yeazel et al (2002) looked at the implementation of PPIP in two family practice residency sites compared to two control sites., following a careful planning process to initiate PPIP.*** They found "only inconsistent or sporadic differences" and concluded that "PPIP had little effect on the delivery of clinical preventive services".

Goodson, Gottlieb and Smith (1999) examined the initiation of PPIP in nine Texas public health clinics. **Factors that seemed to predict the successful initiation of PPIP included "a medium patient load, the ability to serve low-resource populations, prior attempts to implement categorical programs, existence of the philosophy of prevention, and pre-implementation planning"*****. Gottlieb et al (2001) examined the impact of PPIP in five primary-care clinics in Texas over a three-year period.*** They found that there were modest increases in a number of screening, health and immunisation interventions***. Goodson et al (2001) looked at the organizational determinants of the institutionalisation of PPIP in these five clinics.*** The organizational factors they identified were "the site's institutional strength, the integration of PPIP within extant programs and services, visibility of the program within and outside the site, planning for the termination of grant funding, and presence of a program champion with mid- to upper-level managerial authority".

From these studies, one must conclude that programs such as PPIP can have some impact on the delivery of preventive services, but this requires providing external resources such as a nurse facilitator, tailoring the interventions to the needs and capacities of individual practitioners and practice environments, finding a champion, and finding ways to institutionalize the process.

4.10.2 Genetic screening and family history

As noted earlier, the extent to which we can intervene effectively with respect to genetic factors so as to prevent chronic diseases may be limited, at least for the foreseeable future. Thus Goldgar (2002) notes with respect to cancer that

> " The challenge for the future will be to identify the genetic polymorphisms which confer increased cancer risk, but may do so only in combinations with each other, and/or only in the context of specific environmental exposures. Even if such ' risk profiles' can be determined, it is far from clear how useful they will be at the population level in terms of cancer prevention".

This is illustrated by an example used by Caporaso and Goldstein (1997). For a known susceptibility factor (the GST-M1 gene, which increases susceptibility to lung cancer), if the prevalence of the exposure (cigarette smoking) is 35% and the relative risk of the exposure is 10, while the population attributable risk of this susceptibility gene is relatively high, the positive predictive value of a positive identification of the gene in an individual is only modestly elevated: "This suggests that this gene will have no role in screening or clinical testing and that clinical relevance to the individual is limited."

Tonstad (1998) makes two important points that apply to the role of genetic factors in the etiology of chronic diseases in general:

- it can be useful for "individuals who share genetic markers with diseased family members" to know about their susceptibility so that preventive measures can be taken. (However, what Tonstad does not note is that a good family history could accomplish much the same objective, as discussed below.)

- ". . . interventions to decrease risk associated with need not be genetic . Moreover , genetic risks are not resistant to treatment" and "both genetically susceptible individuals within a population and entire "sick" populations can benefit from environmental changes."

In short, what we can do at present is:

- take a good family history and identify individuals who seem to have a higher risk of chronic diseases, especially of early onset

- investigate these individuals for 'single gene' and other familial genetic factors

- encourage and support those at higher risk due to genetic factors to make appropriate changes in their way of life so as to reduce their risk

- encourage and support the general population to make such changes, since the susceptibility genes are so widespread in the population, and have such a significant population health impact.

Yoon et al (2002) point out that "DNA-based testing is limited for the most part to analysis of highly penetrant single gene disorders that account for approximately 5 percent of the total disease burden in the population" and that therefore we should not look to such tests contributing much for some years to our ability to predict the onset of common diseases and treat them appropriately. Instead, they suggest that family history can be used with some

degree of reliability to detect people at high risk, making them a natural focus for disease prevention, screening and early intervention (see Table 15).

Table 15: The relative risk (RR*) or odds ratio (OR) due to family history of some common chronic diseases (Source: Yoon et al, 2002)**

- Cardiovascular disease
  - 2.0** (one first-degree relative)
  - 5.4** (two or more first-degree relatives)
- Breast cancer
  - 2.1* (one first-degree relative)
  - 3.9* (three or more first-degree relatives)
- Colorectal cancer
  - 1.7** (one first-degree relative)
  - 4.9** (two first-degree relatives)
- Prostate cancer
  - 3.2* (one first-degree relative)
  - 11.0* (three or more first-degree relatives)
- Melanoma
  - 2.7** (of one or more first-degree relatives)
  - 4.3** (one first-degree relative)
- Type 2 diabetes
  - 2.4* (mother)
  - 4.0* (maternal and paternal relatives)
- Osteoporosis
  - 2.0** for osteoporotic fracture in women (female relative)
  - 2.4* for wrist fracture in men (father)
- Asthma
  - 3.0** (mother)
  - 7.0* (mother and father)

They suggest that based on family history the following individuals are at high risk for chronic conditions such as these: those with

- premature disease in a first-degree relative
- premature disease in a second degree relative (coronary artery disease only)
- two affected first-degree relatives
- one first-degree relative with late or unknown disease onset and an affected second degree relative with premature disease from the same lineage
- two second degree maternal or paternal relatives with at least one having premature onset of disease
- 3 or more affected maternal or paternal relatives
- presence of a "moderate risk" family history on both sides of the pedigree.

And they propose the development and testing of "simple tools for collecting family health history that can be used in public health settings", with such tools meeting the same criteria as have been recommended for genetic testing (analytical validity, clinical validity, clinical utility, and ethical, legal and social issues).

4.10.3 Preventive treatment early in the disease process

While all treatment is a form of secondary prevention, some forms of treatment are really primary prevention for other conditions. In chronic disease prevention, two forms of treatment are of particular importance:

- the treatment of tobacco dependence, which prevents a wide range of chronic diseases, and
- the prevention of hypertension, which prevents cardiovascular and renal disease.

4.10.3.1 Treating tobacco use and dependence

Reviewers for the EPHPP (2003) undertook a meta-analysis of 20 Cochrane reviews of smoking cessation intervention, using only reviews that used RCT studies and had a follow-up of at least 6 months. Their findings are shown in Table 16. Of particular note are the following:

- Many people who smoke may make multiple attempts to quit and will benefit from the variety of interventions available to assist them.
- ***Since all forms of nicotine replacement are effective and all of the nicotine replacement trials include at least brief advice, this combination is the minimum intervention that should be offered to people who are trying to quit smoking.***

Table 16: **The Effectiveness of Smoking Cessation Interventions: A meta-analysis of Cochrane systematic reviews (Source: EPHPP, 2003)**

Clinical Advice from Doctors and Nurses

- ***Advice from doctors has proven to be effective*** in 31 RCTs (OR 1.69, 95%CI 1.45-1.98)
- ***Individual smoking cessation counselling by nurses was also found to be effective***.

Counselling Interventions

- ***Individual and group counseling are effective interventions***.
- ***Individual counselling was found to be more effective than brief advice*** in 9 studies (OR 1.55 95%CI 1.27-1.90).
- ***Group therapy is more effective than self-help materials***, but not better than other interventions involving contact with professionals.
- Aversion therapy, studied in 24 trials, was found to have little effect upon smoking cessation.
- 6 trials found a positive effect for counsellor phone calls to follow-up mailing of written materials.

Self-directed Interventions

- Self-help behavioural interventions such as pamphlets, videotapes and computer games are no more effective than brief personal advice.
- ***When self-help materials were compared to no intervention in 12 trials a small effect was demonstrated*** (OR 1.23, 95%CI 1.02-1.49).
- ***Personalized self help materials, matched upon demographic data and readiness to change, were found to be more effective than general materials*** in 8 studies (OR 1.41, 95% CI 1.14-1.75)
- Materials tailored only to group characteristics i.e., gender, age or race were no more effective than standard materials.
- There is little evidence for the use of mediated resources (i.e. as found on the Internet).
- ***Proactive and reactive telephone contact, added to self-help materials, increased benefit.***

- There is insufficient evidence to show if information available on the internet improves success.

Nicotine replacement therapy

- ***90 trials found that all interventions that include nicotine replacement therapy are effective to help people stop smoking*** (i.e., chewing gum, transdermal patch, nasal spray, inhaler, sublingual tablets, lozenges)
- ***Nicotine replacement therapies were found to increase the chance of quitting by 1.5 to 2 times*** (OR 1.71 95%CI 1.60-1.83).
- All of these trials include some form of brief advice.
- There is little evidence that one form of replacement is better than another.
- These results may not be applicable to smokers without nicotine dependence (i.e. social smokers)

Pharmacological interventions

- ***Anxiolytics and the drug Lobeline are not effective in helping people to stop smoking***.
- ***The antidepressant buproprion has demonstrated efficacy in 2 large trials*** (OR 2.73 95%CI 1.90-3.94).
- ***2 trials attest to the efficacy of nortriptyline*** (OR 2.83, 1.59-5.03) in smoking cessation.
- The usefulness of clonidine, an antihypertensive medication has been reported in 6 clinical trials (OR 1.89, 95% CI 1.30-2.74). However, side effects limit the drug's clinical usefulness.

Other therapies

- The use of acupuncture (20 trials) or hypnotherapy (9 trials) interventions for smoking cessation show no benefit.
- The effect of exercise in smoking cessation is not clear.

The US Public Health Service has released a Clinical Guideline on the treatment of tobacco use and dependence (CDC, 2000) (http://www.surgeongeneral.gov/tobacco/smokesum.htm). The Guideline is based on a review of 3,000 articles in the peer-reviewed literature between 1975 and 1994 and a further 3,000 article published between 1995 and 1999. Some of the key points from the Guideline are summarized here; a longer extract can be found in Appendix 5.

- ***Brief tobacco dependence treatment is effective***, and every patient who uses tobacco should be offered at least brief treatment.
- ***There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness***.
- ***Treatments involving person-to-person contact (via individual, group, or proactive telephone counseling) are consistently effective, and their effectiveness increases with treatment intensity (e.g., minutes of contact***).
- ***Three types of counseling and behavioral therapies were found to be especially effective and should be used with all patients attempting tobacco cessation:***
    - Provision of practical counseling (problemsolving/skills training).
    - Provision of social support as part of treatment (intra-treatment social support).
    - Help in securing social support outside of treatment (extra-treatment social support).
- ***Numerous effective pharmacotherapies for smoking cessation now exist. Except in the presence of contraindications, these should be used with all patients attempting to quit smoking.***
- ***Five first-line pharmacotherapies were identified that reliably increase long-term smoking abstinence rates:***
    - Bupropion SR
    - Nicotine gum
    - Nicotine inhaler
    - Nicotine nasal spray
    - Nicotine patch.
- Two *second-line* pharmacotherapies were identified as efficacious and may be considered by clinicians if first-line pharmacotherapies are not effective:

- Clonidine
- Nortriptyline

- ***Over-the-counter nicotine patches are effective relative to placebo, and their use should be encouraged***.

Perhaps the most important finding is that

> ***"tobacco dependence treatments are both clinically effective and cost-effective relative to other medical and disease prevention interventions"***

and this leads to ***the key recommendation that health insurance programs, whether public or private, should cover effective tobacco cessation therapies and that clinicians be "reimbursed for providing tobacco dependence treatment just as they are reimbursed for treating other chronic conditions".***

Smoking cessation in pregnancy is of particular concern, given the well-established relationship between maternal smoking and low birth weight and other impacts on the health of the fetus and infant. A systematic review of studies of smoking cessation during pregnancy (EPHPP, 2003) found that

- ***"Smoking cessation programs are effective, even though the effects are not large.*** (Pooled data from 30 trials demonstrated an absolute reduction of 6.6% in the proportion of pregnant women who smoke.)"
- ***"Comprehensive prenatal programs need to include smoking cessation activities***", although attendance at group cessation activities is poor, and other strategies need to be considered.

4.10.3.2 Treatment of hypertension

Hypertension is the most common reason in Canada for visits by adults to doctors; the successful treatment of hypertension has been shown to reduce mortality, cardiovascular events, stroke and stroke recurrence, myocardial infarction, Alzheimer's dementia, renal complications and renal failure, and incidence of diabetes . Yet only 50% of Canadians with hypertension are aware of their diagnosis, and only 16% of Canadians with hypertension have adequate blood pressure control (B.C. Ministry of Health Services and BCMA, 2003). This recently released two-part BC guideline on the detection, diagnosis and treatment of hypertension in non-pregnant adults aged 19 years and older notes that if during a clinical encounter the blood pressure is found to be great to than 140/90, based on a least two readings during the visit, a series of five further monthly visits should be scheduled, a search for target organ damage, risk factors and modifiable causes should be initiated, and lifestyle reminders should be provided. [40]

[40] If BP > 200/130 or there are other indicators of urgency, treatment should be initiated immediately; if BP > 180/110, the second visit should be no more than one week later.

If at the end of the four visits, during which lifestyle advice is reinforced, BP is found to be > 140/90, treatment is initiated (or sooner if target organ damage is found or BP > 180/105). Treatment includes the identification of appropriate treatment targets (taking into account the presence or absence of target organ damage), continued suggestions for lifestyle changes, support for self management, and suitable pharmacologic treatment based on an individualized assessment of benefits and potential harms and costs.

A Cochrane review of reduced sodium intake as a means of reducing blood pressure found that the magnitude of the effect in Caucasians with normal blood pressure does not warrant a general recommendation to reduce sodium intake. Reduced sodium intake in Caucasians with elevated blood pressure has a useful effect to reduce blood pressure in the short-term.[41]

A Cochrane review of the benefits of reduced dietary salt to reduce cardiovascular disease examined three trials in normotensives (n=2326), five in untreated hypertensives (n=387) and three in treated hypertensives (n=801), with follow up from six months to seven years. The most informative studies used intensive behavioural interventions. The review found that intensive interventions, unsuited to primary care or population prevention programmes, provide only minimal reductions in blood pressure during long-term trials. However, evidence from a large and small trial showed that a low sodium diet helps in maintenance of lower blood pressure following withdrawal of antihypertensives. If this is confirmed, with no increase in cardiovascular events, then targeting of comprehensive dietary and behavioural programmes in patients with elevated blood pressure requiring drug treatment would be justified. (Feb 2003)

4.11 Evidence of effectiveness for specific diseases

Although BC has chosen – along with many others – to address the prevention of chronic disease in a comprehensive, holistic, risk –focused way rather than by focusing on diseases one at a time, it is important to note that the disease-focused approach remains a common one. Thus a summary of recent disease-specific prevention work is presented here, with respect to the four categories of disease that are the focus of this report.

The Centers for Disease Control in the USA have recently released a report on best practices for chronic disease prevention (CDCP, 2003), with particular reference to best practices at the state (provincial) level. The report is organized around both a set of common chronic diseases and a set of behavioural risk factors. Evidence from this report and other recent disease-specific reports not discused elsewhere is summarised here.

4.11.1 Heart disease and stroke prevention

The Centers for Disease Control and Prevention consider that primary prevention of cardiovascular disease requires addressing the risk factors of high blood pressure, high cholesterol, tobacco use, poor nutrition, physical inactivity, overweight and obesity, and diabetes. But because of the complexity of this problem, ***CDCP also recommends a socio-ecological approach with the following key components***:

[41] The results suggest that the effect of low versus high sodium intake on blood pressure was greater in Black and Asian patients than in Caucasians. However, the number of studies in black (8) and Asian patients (1) was insufficient for different recommendations.

- promotion of cardiovascular health to prevent the development of risk factors
- primary prevention of heart disease and stroke and
- secondary prevention (prevention of recurrent events by ensuring compliance with guidelines on the use of aspirin, beta-blockers, ACE inhibitors, anti-coagulants etc)
- elimination of health disparities
- a major emphasis on heart-healthy policies and supportive environmental changes at multiple levels of society
- programs in multiple settings: health care, worksites, schools and communities.

The CDCP report places particular emphasis on the importance of policy and the development of societal conditions that support healthy behaviors. The report suggests that the primary roles of state-level cardiovascular disease prevention programs are to:

- provide public and professional education and training
- facilitate policy and environmental change
- conduct surveillance and
- develop/establish interventions.

The report emphasizes that state-level programs "should focus their efforts at the highest level possible", working with business coalitions or state medical associations rather than individual work sites and individual health care settings.

The American Heart Association has recently released a Guide for improving cardiovascular health at the community level (Pearson et al, 2003). The release of the guide is timely, since the authors note that recent community-based studies suggest that the rates of new cases of and heart attack and stroke in the USA have not fallen since 1990; that there has been little increase in either screening or awareness of cholesterol levels in the past decade; that physical activity in schools has declined, and that access to preventive services, healthy food, and safe and attractive places to be physically active remains limited for many people.

The guide "emphasizes the social and environmental origins of the CVD epidemic" and notes that the evidence provides "a compelling rationale for attacking the cardiovascular epidemic at community level". They cite the work of Goldman and Cook, who attributed 39.5% of the decline in CVD mortality in the United States between 1968 and 1978 to medical interventions, while attributing 54% of to reductions in smoking and serum cholesterol levels, resulting largely from public education campaigns.

The goal of the Guide is to "promote lifestyle and behavior change at the individual and community levels and policy change at community level", employing research-based and well-

evaluated methods and materials. The guide lays out a set of goals for improving cardiovascular health at the community level in the areas of community assessment, general health education, school and youth education, work site education, health care facility education, community organization and partnering, assuring personal health services, environmental change, and policy change (see Appendix 6 for the full list of goals).

4.11.2 Cancer prevention

Cancer as a disease is a process rather than a state, and thus "the most rational target of anticancer intervention" is the long latency period between initiation of carcinogenesis and the onset of clinical disease (Hrelia and Tanneberger, 1997). Effective prevention of cancer thus requires a clear understanding of the process of carcinogenesis, in order to understand where interventions can best be targeted. Hawk and Lippman (2000) suggest that while at present primary prevention refers to the prevention of the incidence of cancer as defined in terms of histopathologic changes and in resulting morbidity and mortality, our changing concept of cancer will change the endpoint for primary prevention. As we have come to understand cancer as a "long disease process driven by progressive alterations in gene structure and function", we have come to recognize that "carcinogenesis, not clinically evident cancer alone, is the disease of interest". Accordingly, primary prevention will increasingly come to be understood as prevention of the initiation and progression of the process of carcinogenesis at the molecular level.

This also means that the relevant endpoint for primary prevention of cancer will be a reduction in the incidence of key molecular alterations. However, this assumes that such molecular changes can be validated as markers of risk. This is an important point because we know that histologic evidence of pre-invasive neoplastic lesions (eg., dysplasia in cervical mucosa) will often regress spontaneously, if left alone. If this is true of histologic changes, how much more true would it be of molecular changes even earlier in the process?

With a good understanding of carcinogenesis, it becomes possible to consider a variety of preventive interventions. These can be broadly categorized as follows:

- prevent exposure
- strengthen resistance to the process of carcinogenesis, and
- detect cancer as early in the process as possible.

4.11.2.1 Prevent exposure

The first strategy should be to prevent or minimise exposure to exogenous genotoxic carcinogens through environmental protection, tobacco control, dietary and other lifestyle changes, infection control, prevention of iatrogenesis and similar strategies. This argues strongly in favour of reducing exposure as much as possible and for a rigorous application of the precautionary principle in the face of uncertainty, as well as a much better understanding

of the potential interaction of agents, the range of biological sensitivity of individuals, and the need for more attention to protecting infants and young children.

4.11.2.2 Strengthen resistance to initiation, promotion and progression

There are many opportunities for intervention in the process of carcinogenesis, which might be said to include preventing the production of endogenous carcinogens as well as preventing promoting and progression at the cellular and sub-cellular levels. Some key intervention points were shown in Figure 5; some potential key interventions are:.

- decrease inflammation and the associated production of reactive oxygen species (ROS) (Hursting and Kari, 1999)
- improve direct scavenging of DNA-reactive electrophiles/ROS (Hursting and Kari, 1999).
- inhibit enzymes responsible for carcinogen activation (Hursting and Kari, 1999)
- inhibit genotoxic effects by increasing the intake of anti-mutagens (eg., N-acetyl cysteine, curcumin, genistein, oltipraz, certain anthraquinone pigments such as purpurin or cochineal extract, vitamins C and E, the mineral selenium, the flavouring spice cinnamomium cassia - Editorial, 2001) - or anti-oxidants (vitamins A, C, D, and E, anti-oxidant polyphenols and other anti-oxidants found in vegetables, fruits, soy products, red wine and tea (Weisburger, 2001)
- maintain DNA stability/improve DNA repair, for which vitamins and mineral micro-nutrients are essential. Vitamin B12 and folic acid in particular "are required at higher levels than normally recommended, in order to maintain genomic stability" (Editorial, 2001)
- interfere with signal transduction: "Growth control elements are transferred from the normal cell to the neoplastic cell through gap junctions" (Weisburger, 2001). The pathway involved can be inhibited or blocked by a number of chemical tumour promoters such as DDT and unsaturated fatty acids, while antioxidants such as retinoids, carotenoids and green tea components counteract this effect (Editorial, 2001).
- inhibit cell proliferation/induce apoptosis: uncontrolled cell proliferation is one of the hallmarks of cancer, and in part represents a failure of apoptosis, the elimination of damaged genomes through programmed cell death. Substances that interfere with enhanced cell division include curcumin, quercetin and auraptene (Editorial, 2001).
- stimulate phase I I detoxifying enzymes: phenolic antioxidants and other compounds can induce or enhance detoxifying enzymes and thus protect cells against exogenous or endogenous carcinogenic intermediates (Editorial, 2001).

- enhance immune response: the polyphenol curcumin and similar molecules have effects on immune response (Editorial, 2001) while vaccines may have either a general or specific effect on enhancing immune response. Psychological and psycho-social factors, acting through the psycho-neuro-immune system, may also play a role here, as may exercise.

Key strategies for these interventions include dietary change, chemoprevention with supplements or medications, physical activity, and immunoprevention; a combination of all these measures may be called for.

4.11.2.3 Detect cancer early

The final strategy is to detect and treat cancer as early as possible, although strictly speaking this is not prevention. However, Miller (1999) is cautious about the value and impact of screening, in part because we often lack knowledge about "the natural history of the detectable precancerous phase", as well as the problems of ensuring that screening is used appropriately and reaches the groups most at risk. He suggests that in the case of breast cancer "the major benefit from screening derives from the earlier detection of relatively advanced, not early disease"; that in the case of cervical cancer screening, conservative management of low-grade lesions is warranted, since "the majority of women with mild or moderate dysplasia showed regression to normal within 5 years", as will the large majority of young women with HPV effects; in the case of colorectal cancer, the case for initiating wide-spread screening, particularly with flexible sigmoidoscopy, is questionable at a time when the incidence and mortality from colorectal cancer is already declining.

4.11.2.4 Cancer prevention strategies

A recent report on the prevention of cancer from the National Cancer Policy Board of the Institute of Medicine in the U.S. (Curry, Byers and Hewitt, 2003) suggests that

> "A 19% decline in the rate at which new cancer cases occur and a 29% decline in the rate of cancer deaths could potentially be achieved by 2015 if efforts to help people change their behaviors to put them at risk were stepped up and if behavioral change were sustained."

The report reviews the evidence on the effectiveness of cancer prevention and early detection and approaches that can enhance the potential benefits of proven interventions, and makes a number of recommendations based on the evidence. As with other reports this report focuses on the prevention and cessation of smoking, maintaining a healthy weight and diet, and regular physical activity; it also addresses the need to keep alcohol consumption at low or moderate levels and the importance of screening for breast, cervical and colon cancer. Among the key recommendations with respect to the behavioural and societal factors that are important in the aetiology of cancer are the following:

- "Taxation is the single most effective method of reducing the demand for tobacco."

- states should have sales-to-minor rates no greater than 20%
- tobacco licensing should be required for merchants selling tobacco products
- the promotion, sale and distribution of tobacco products over the internet to individuals under the age of 18 should be prohibited
- "Efforts to maintain a healthy weight that start early in childhood and continue throughout adulthood are likely to be more successful than efforts to achieve and maintain weight loss once obesity is established."
- "Worksite fitness programs have resulted in increased levels of physical activity among employees."
- " . . . it is recognized that environmental policies related to zoning, land use, safety, and transportation greatly affect opportunities for exercise."
- " . . . school policies regarding healthy school lunches, physical education requirements, and the availability of after-school recreational programs improve nutrition and affect rates of participation in exercise."

As with prevention of cardiovascular disease, the CDCP (2003) report suggests the importance of social and environmental conditions as well as addressing individuals; specific reference is made to the importance of regulatory controls in the workplace. There are common risk factors for a number of the most important forms of cancer, including smoking, physical inactivity, low intake of food and vegetables, and high- fat and/or low-fiber diets. At the clinical level, a variety of specific evidence-based interventions are available for preventing sun exposure and for increasing screening for breast, cervical and colorectal cancer:

- breast cancer - because "opportunities for the primary prevention of breast cancer are limited", ***regular mammogram screening is recommended, with strong evidence indicating that this can lower the risk of dying of breast cancer for women aged 50 to 69 by 30 percent, and by about 17% for women in their forties.***
- cervical cancer - ***in addition to promoting safe behaviors such as limiting the number of sex partners, delaying sexual intercourse, using condoms, and avoiding tobacco products, regular cervical cancer screening (the Pap test) is recommended, especially among those women who have not had a Pap test in at least five years***, since 60 percent of women diagnosed with cervical cancer are in this group.
- colorectal cancer - ***screening for colorectal cancer is particularly important for those who have a personal or family history, or who have colon polyps or inflammatory bowel disease.***

- prostate cancer - the report notes the still unresolved dispute about the efficacy of PSA screening and a digital rectal exam, with some recommending this be offered annually in men age 50 and over, and others yet to be convinced that finding and treating early-stage prostate cancer is beneficial. Consequently, this decision is left to the individual man and his physician.

- skin cancer - given the high five-year survival rate of patients with localized melanoma (96%) , ***limiting or avoiding sun exposure, covering up when outdoors and using sunscreen, especially during the midday hours and especially for children, is an effective prevention strategy***.

CDCP (2003) suggests that ***the building blocks for a comprehensive state-level cancer control program include***:

- enhancing the infrastructure (they suggest a statewide program requires at least a full-time coordinator and preferably several staff positions)

- mobilizing support

- utilizing data and research

- building partnerships

- assessing and addressing the cancer burden and

- conducting evaluations.

- they estimate that putting these building blocks in place may take up to two years.

Cancer Care Ontario (2003) recently undertook to develop a broad provincial plan for cancer prevention. This involves reviewing the evidence on causation and prevention, examining likely future developments in cancer prevention (particularly chemoprevention and new genetic and biochemical screening technologies) and establishing priorities for action and ambitious prevention targets for the year 2020. The report notes that and about half of all cancer deaths are related to the three risk factors of tobacco use, unhealthy eating and physical inactivity; that three types of cancer account for at least 50% of new cancer cases in each sex (lung and colorectal cancers in both men and women, breast cancer in women and prostate cancer in men); and that while there has been little change in the risk of developing cancer for the average individual over the past 50 years, roughly half of the cancers that will be diagnosed over the next 20 years could be either prevented or detected early in their course. In Ontario, this could result in savings of more than $375 million between now and 2020 in direct costs alone, with indirect costs being approximately five times this amount.

The report identifies a set of ambitious but feasible prevention targets and screening targets to be achieved by 2020, and two emerging issues that need to be monitored. These targets are shown Table 17, with the most recent estimate in brackets.

Table 17: Cancer Care Ontario targets for 2020

Cancer prevention targets

- tobacco use - teen current smokers reduced to 2% (19%), adult current smokers reduced to 5% (26%), 90 % of daily smokers attempt to quit smoking at least once per year (48%), less than 1% of Ontarians exposed to secondhand smoke (25% of adults, 18% of children), and 100 percent of public places (including bars, restaurants and gaming facilities) smoke-free (50%);

- diet - 90 percent of Ontarians consume five or more servings of vegetables and fruits daily (32% ofadults, 44% of children over age 12);

- physical activity - 90 percent of Ontarians participate in moderate to vigorous activity on most days of the week (34%);

- obesity - 10% of Ontarians are obese, with a BMI over 30 (over 15%);

- alcohol consumption - 98% of Ontarians follow the low-risk drinking guidelines (94%);

- occupational carcinogens - enhanced surveillance of exposure (initial priorities include diesel exhaust and its components, pesticides and asbestos), updated threshold limit values for designated substances, all workplaces to be free of tobacco smoke and other workplace contaminants, and an increased percentage of outdoor workers demonstrating sun-protective safety behaviors;

- environmental carcinogens - improved surveillance and public reporting on key air, drinking water, soil and ground water carcinogens , and reduced exposure levels for these (particularly THMs and other possible chlorinated disinfection by-products in drinking water , and fine particulates in air) such that no Ontarians will be exposed to ambient levels of these environmental carcinogens above the minimum of risk level of one in a million excess cancer risk ;

- ultraviolet exposure - reduce time in the sun , use of tanning and percent of Ontarians reporting a sunburn once in the summer by 75%.

Screening targets

- breast screening - 90 percent of women aged 50 to 69 participate in organized breast screening (62%);

- cervical screening - 95 percent of women who have ever been sexually active participate in organized cervical screening (82% in the last three years);

- HPV vaccination - 95% of young women are vaccinated for HPV before sexual activity begins (vaccine not yet available);

- colorectal screening - 90 percent of Ontarians participate in an organized colorectal screening program (10% of those aged 50 to 74 report FOBT in past two years).

Emerging issues

- chemoprevention - monitor research on the use of medication and supplements to determine their future clinical application;

- new screening techniques - establish a panel to review and assess effectiveness of new screening methods and approaches.

The report also identified immediate priorities and longer-term priorities. Immediate priorities are focused on existing cancer prevention and screening strategies and programs that need further funding. These are:

- the comprehensive tobacco control strategy
- colorectal screening pilot program
- Ontario breast and cervical screening programs
- Aboriginal cancer strategy .

Longer-term priorities are focused on new strategies and programs that need to be developed. These are:

- nutrition and healthy body weight strategy
- active living strategy
- alcohol strategy
- occupational carcinogens surveillance strategy
- environmental carcinogens reduction strategy
- sun safety strategy
- provincial screening strategy.

Finally, if these cancer prevention and screening targets are to be achieved, the report identifies the need to integrate these targets into the public health mandatory core programs, to invest in prevention research, to enhance risk factor surveillance activities, to establish a screening panel to review and assess new screening methods and approaches, and to establish mechanisms to coordinate and plan regional cancer prevention and screening activities.

4.11.3 Chronic respiratory disease prevention

A report on respiratory disease in Canada (Canadian Institute for Health Information et al, 2001) confirms that "Tobacco is the most important preventable risk factor for chronic respiratory diseases" while also making the point that "the quality of indoor and outdoor air contributes significantly to the exacerbation of symptoms of respiratory diseases". A recent review of the epidemiology of chronic obstructive pulmonary disease (Anto et al, 2001), while confirming that active smoking is a "beyond any reasonable doubt the most important causal factor", identifies a number of other important factors including maternal smoking and environmental tobacco smoke, air pollution, occupation, socio-economic status, and genetics.

A recent report on a national asthma prevention and control strategy (Centre for Disease

Prevention and Control, 2002) notes that 11 percent of children and 8% of adults report that they have been diagnosed with asthma by a physician at some time in their lives, while 9 percent of children and 6 percent of adults report they currently have asthma. The rate of asthma in Canada has been increasing not only among children but among adults, particularly among women. In the four-year period from 1994/5 to 1998/9, the reported rate of asthma among 45 to 64 year old women increased from 5.3% to 8.4%. While the exact cause of asthma is not known, it is known at that there are

- predisposing factors (particularly atopy, in which individuals have a greater tendency to have an allergic reaction to foreign substances),
- causal factors that sensitize the airway (pet dander, dust mites, cockroaches, molds, pollens, workplace contaminants),
- contributing factors such as environmental tobacco smoke, viral respiratory infections, indoor and outdoor air pollution and low income, and
- exacerbating factors that can trigger an attack, which in order of frequency in Canada are colds and chest infections, exercise, tobacco smoke, pollen, flowers and grass, dust, cold air, dampness and humidity, animals, air pollution, stress, and molds and mildew.

In addition, there is some evidence that changes in exposure to various factors in early childhood may influence the development of the immune system.

Clearly, the prevention of asthma is a complex proposition that requires multiple intervention strategies in multiple settings. ***The National Asthma Control Task Force (2000) has recommended a range of prevention measures that include creating dust-free homes to reduce indoor allergens; reducing the exposure of both the fetus and infants to tobacco smoke; reducing the level of motor vehicle emissions and reducing airborne commercial and industrial pollutants; preventing worker exposure to harmful agents and preventing sensitisation by occupational hygiene; preventing respiratory infections among young children, including promoting good nutrition, and avoiding overcrowding and instituting infection control in daycares; and encouraging and supporting breast feeding for at least six months.***

4.11.4 Diabetes prevention

The Centers for Disease Control (2003) report that with respect to the prevention of diabetes

> "The most compelling evidence for the effectiveness of primary prevention is for interventions targeting people with impaired glucose tolerance",

and ***the interventions that have been shown to be most effective here are "lifestyle changes related to losing weight and increasing physical activity".***

Key components of a state health department program should include:

- partnering with other programs that assume responsibility for reducing risk factors in the population at large (e.g. participating in coalitions that seek broad environmental changes to support walking , working with urban planning groups or restaurant associations)

- a leadership role in primary prevention interventions focused on ensuring that people at highest risk for diabetes have access to interventions that will delay or avert the development of the disease (e.g. lifestyle change interventions, in particular exercise and health and nutrition)

- working to identify more people with impaired glucose tolerance by increasing screening among populations at high risk, including obese people, people over age 45, and members of certain racial or ethnic groups

- improving preventive health care practices both by providers and people with diabetes to prevent complications (e.g. maintaining near normal glucose, blood pressure and cholesterol levels and routine preventive care practices such as foot exams, eye exams, and frequent hemoglobin A1C testing)

5 The potential for prevention

The potential for prevention can be understood in part by examining the health and economic costs of chronic diseases to BC, the evidence that prevention has already worked in BC, and the remaining gap between our rates of chronic disease mortality and morbidity, health determinants and behaviours, and the best rates that have been attained by comparable countries such as those in the OECD. Closing this prevention gap is the principal challenge we face.

5.1 The cost of chronic diseases in British Columbia

As noted at the outset, the total economic cost of the four chronic disease categories of concern here amounts to some $5 billion annually. One way to understand the potentially avoidable costs is by understanding the relative contribution of smoking, physical inactivity and obesity to mortality and to both direct and indirect costs (data on the cost to BC of poor nutrition is not yet available). The direct and indirect costs of smoking, obesity and physical inactivity in British Columbia are shown in Table 18, although the costs are not simply additive; some of the benefits of increased physical inactivity, for example, are due to the accompanying reduction in overweight and obesity. While it is unlikely that smoking would be completely eliminated, or that all British Columbians would achieve and maintain an ideal body weight and level of physical activity, even small reductions in some of these risk factors may have significant impacts on mortality and on both direct and indirect costs, as discussed below and as shown in Figures 13, 15 and 16.

It is not possible to completely avoid all these costs, both because not all these diseases can be completely prevented and because, even if they were, we would develop other diseases and die of other causes in their place that would have their own costs. Nonetheless, a proportion of these diseases are preventable and a (probably somewhat smaller) proportion of the costs should be avoidable, or at least postponable.

Table 18: Contribution of smoking, obesity and physical inactivity to premature deaths, direct and indirect costs in BC

Sources: Tobacco use –Tobacco control Program, MOHP, 2000; physical inactivity – Colman and Walker, 2003; obesity – Colman, 2001

Risk behaviour	Premature deaths	Direct costs	Indirect costs
Tobacco use	5,600	$381 m	$1,720 m
Physical inactivity	1,727	$185.7 m	$236 m
Obesity	2,000 (approx)	$380 m	$350 – 450 m

5.2 Prevention works in BC

There is considerable evidence that prevention can and indeed already does work in BC, and that the potential of further benefits from prevention is considerable. The effectiveness of prevention can be seen in evidence from B.C. with respect to smoking, lung cancer and cardiovascular disease, as shown in the accompanying figures. [42] These figures also show the projected benefits of continued reduction in smoking, and in hoped-for improvements in diet, physical activity and obesity, for lung cancer, cardiovascular disease and diabetes.

- Figure 9 shows that smoking rates among men in B.C. have declined from more than 50 percent in the 1960's to less than 30% in the late 1990's, while the rates for women have declined from more than 30% to less than 20% in that same period.

- The impact of this decline in smoking rates on lung cancer cases and deaths is shown in Figure 10 which also demonstrates the lag time between a change in smoking patterns and the change in lung cancer mortality. New cases of lung cancer in B.C. continued to increase among men until the late 1980's, since when both deaths and new cases have declined. Among women, both in new cases and deaths continue to increase reflecting the fact that the decline in smoking among women did not really begin until the late 1970's.

- Figure 11shows projected annual tobacco-related health care costs for several different scenarios of smoking prevalence in B.C. Even if smoking rates were to decline from 20% in 2000 to 10% in 2010, costs would continue to increase until around 2030, and then would slowly decline. Only if we succeed in reducing smoking to zero by 2020 do we see a dramatic downturn in costs, and this occurs only after 2030, due to the long lag time between onset of smoking and onset of lung cancer and other smoking -related diseases.

- Figure 12 shows a dramatic and continuing decline in cardiovascular disease death rates in B.C, which have fallen by more than 50 percent for both men and women between 1950 and 1997. While some of this decline can be attributed to improved treatment after the onset of cardiovascular disease, much of the decline has been attributed to improved prevention, including reduced smoking, changes in diet, improved management of hypertension and other preventive interventions.

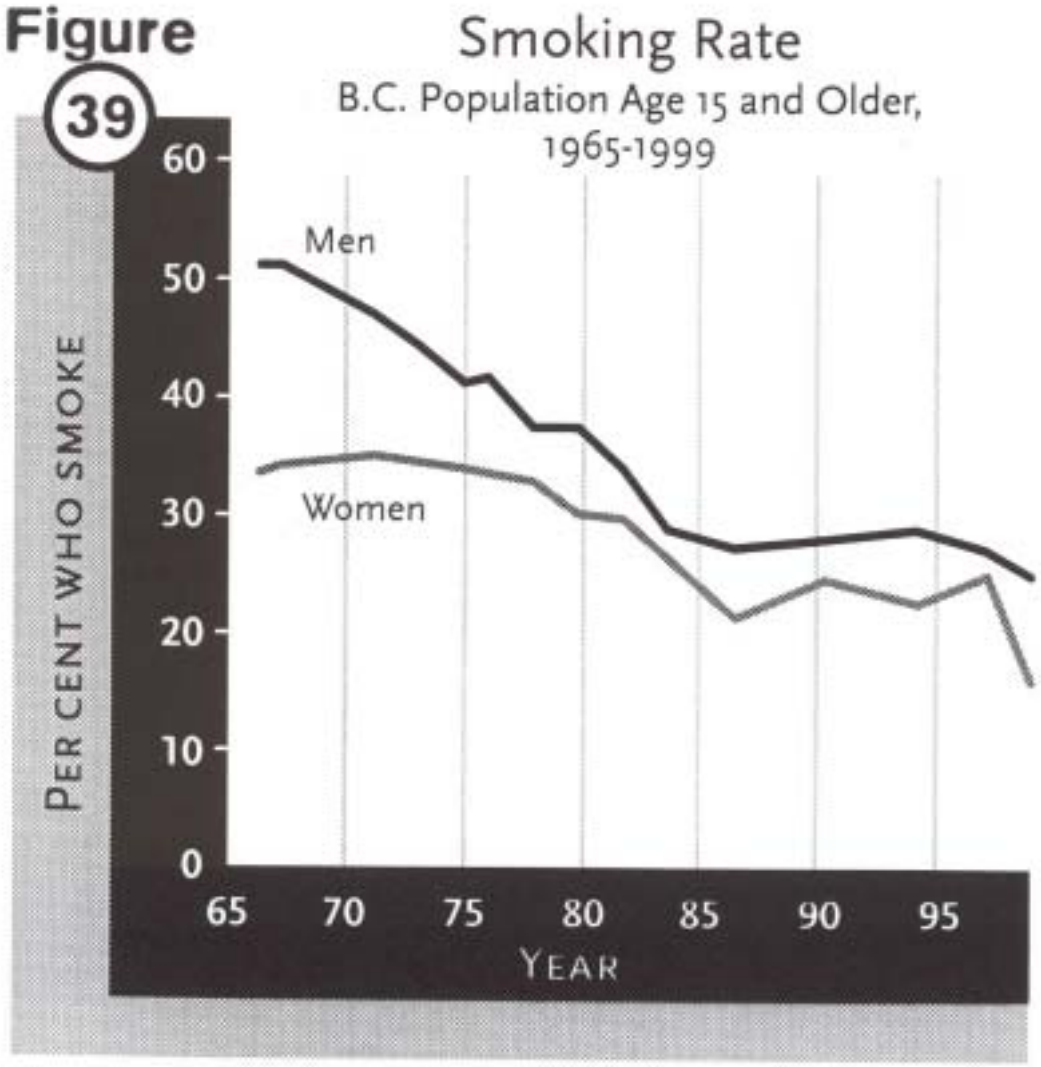
- Figure 13, which pertains to coronary events among women in Canada, shows the potential benefits of positive changes in diet, smoking and exercise, reduced obesity, and a moderate consumption of alcohol. Together, this combination of preventive interventions could reduce the number of expected coronary events by more than 50 percent by 2016.

- Finally, Figure 14 presents actual and predicted changes in health service costs for people in B.C. with diabetes between 1993/4 and 2011/12 under different assumptions of population

[42] The figures are taken from "Creating a Focused Prevention Strategy for Chronic Disease and Injury in B.C.", a presentation byDr. Perry Kendall, Provincial Health Officer, 2002.

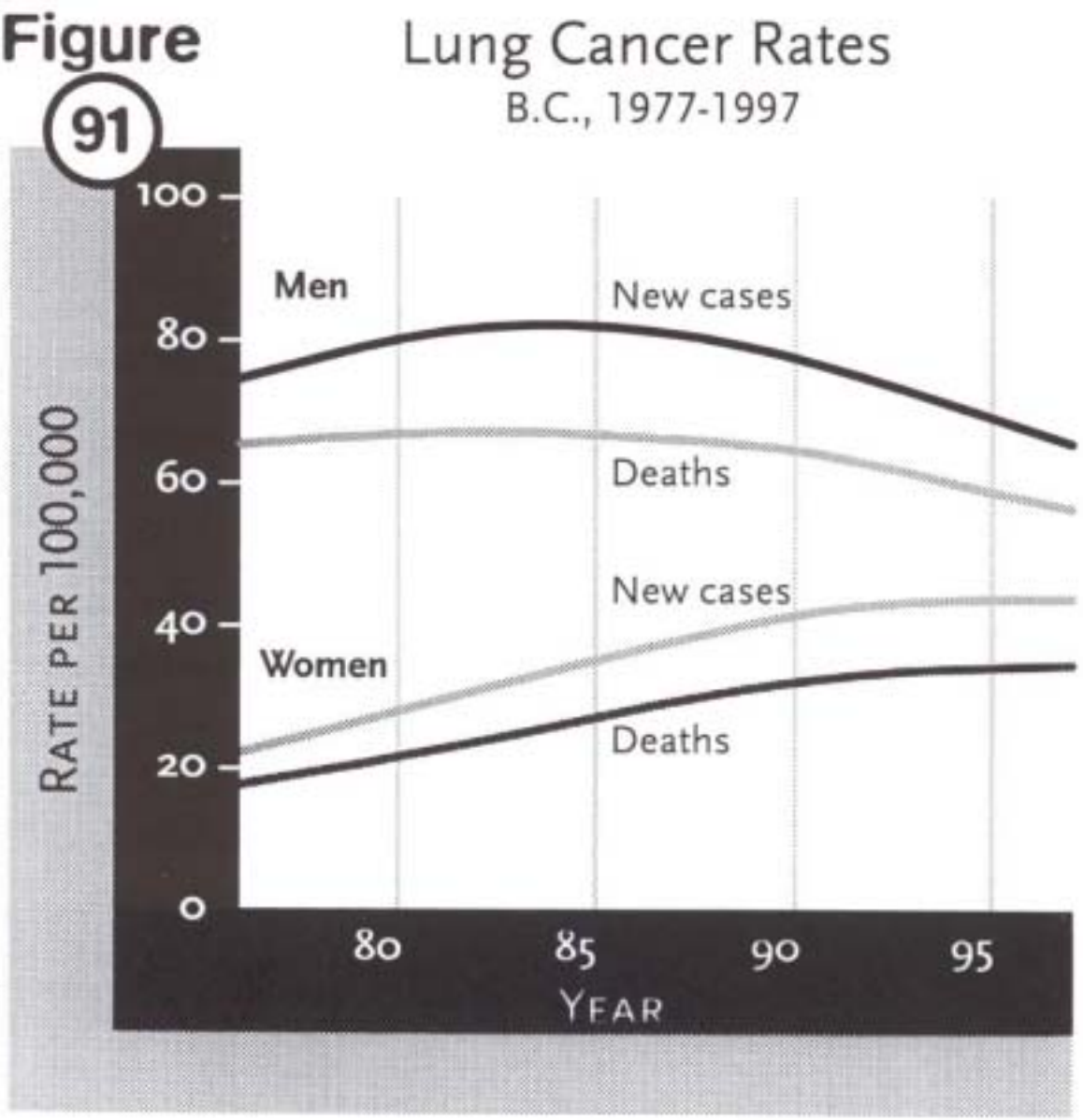
control of overweight. If the prevalence of overweight remains where it is today at 46 percent (in 1996, 15 percent of BC adults were obese and 30 percent were overweight), costs will increase from more than $600 million in 2001/2 to almost $1.1 billion in 2011/12, while if the prevalence of overweight were to decline to 15%, costs will increase much less.

Figure 9



Proportion of the population who were current smokers (1990-1999) or daily smokers (1965-1989).Data on current smoking, a term that includes daily as well as non-daily smoking, are not available for British Columbia prior to 1990. Data for 1965-1986: Stephens, T. (1988, April). A critical review of Canadian survey data on tobacco use, attitudes, and knowledge. Prepared for Tobacco Programs Unit, Health Promotion Directorate, Health and Welfare Canada. Data for 1990: Canada's Health Promotion Survey 1990. Data for 1994: Health Canada. Survey on Smoking in Canada, Cycle 1. Data for 1996-97: Statistics Canada. National Population Health Survey. Data for 1999: Health Canada. Canadian Tobacco Use Monitoring Survey (CTUMS), Wave 1. http://www.hc-sc.gc.ca/hpb/lcdc/bc/ctums

Figure 10



Rates per 100,000 (smoothed, age-standardized to the Canadian 1991 population).
Source: B.C. Cancer Registry. Unpublished tables, December 1999.

Figure 11

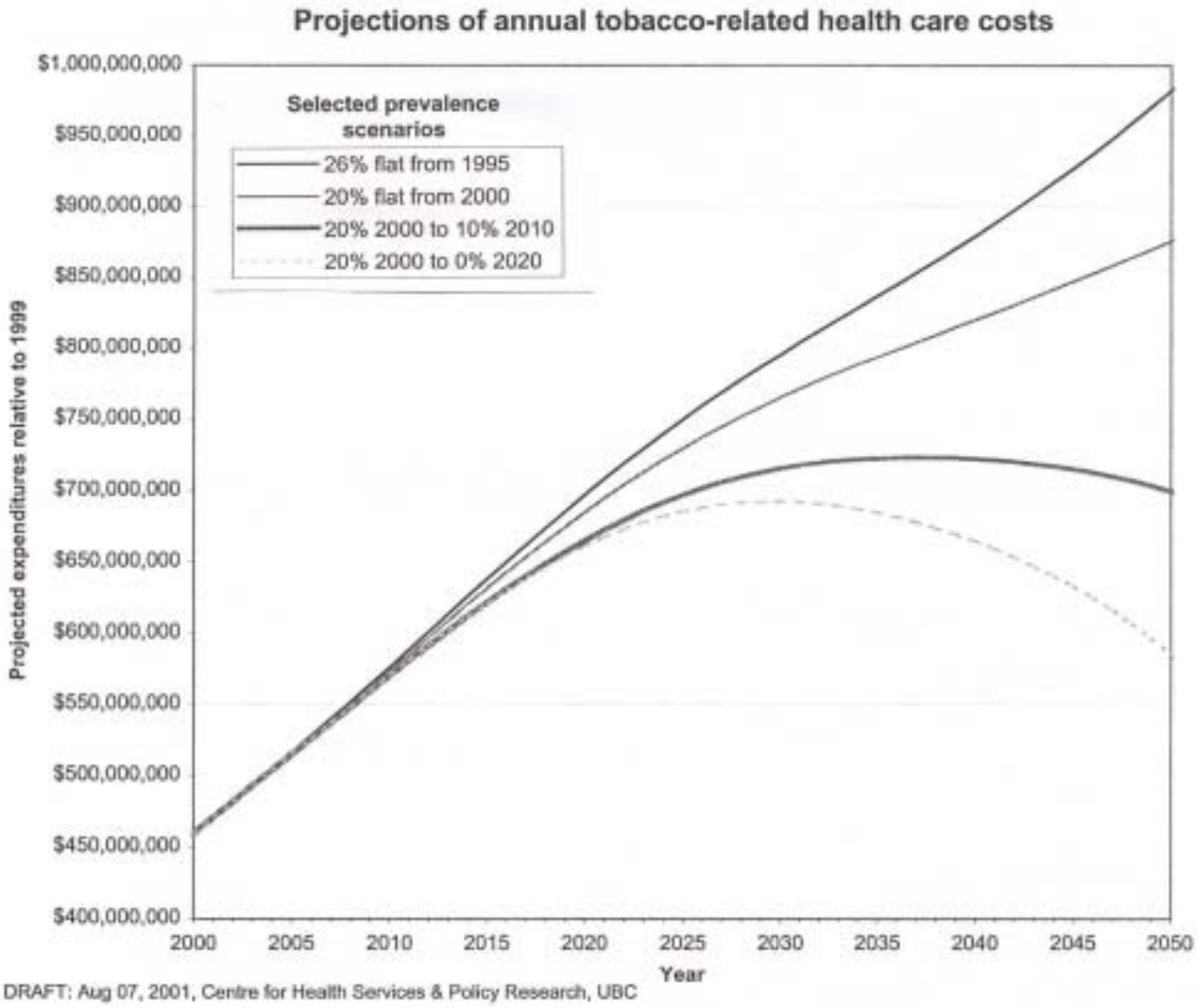
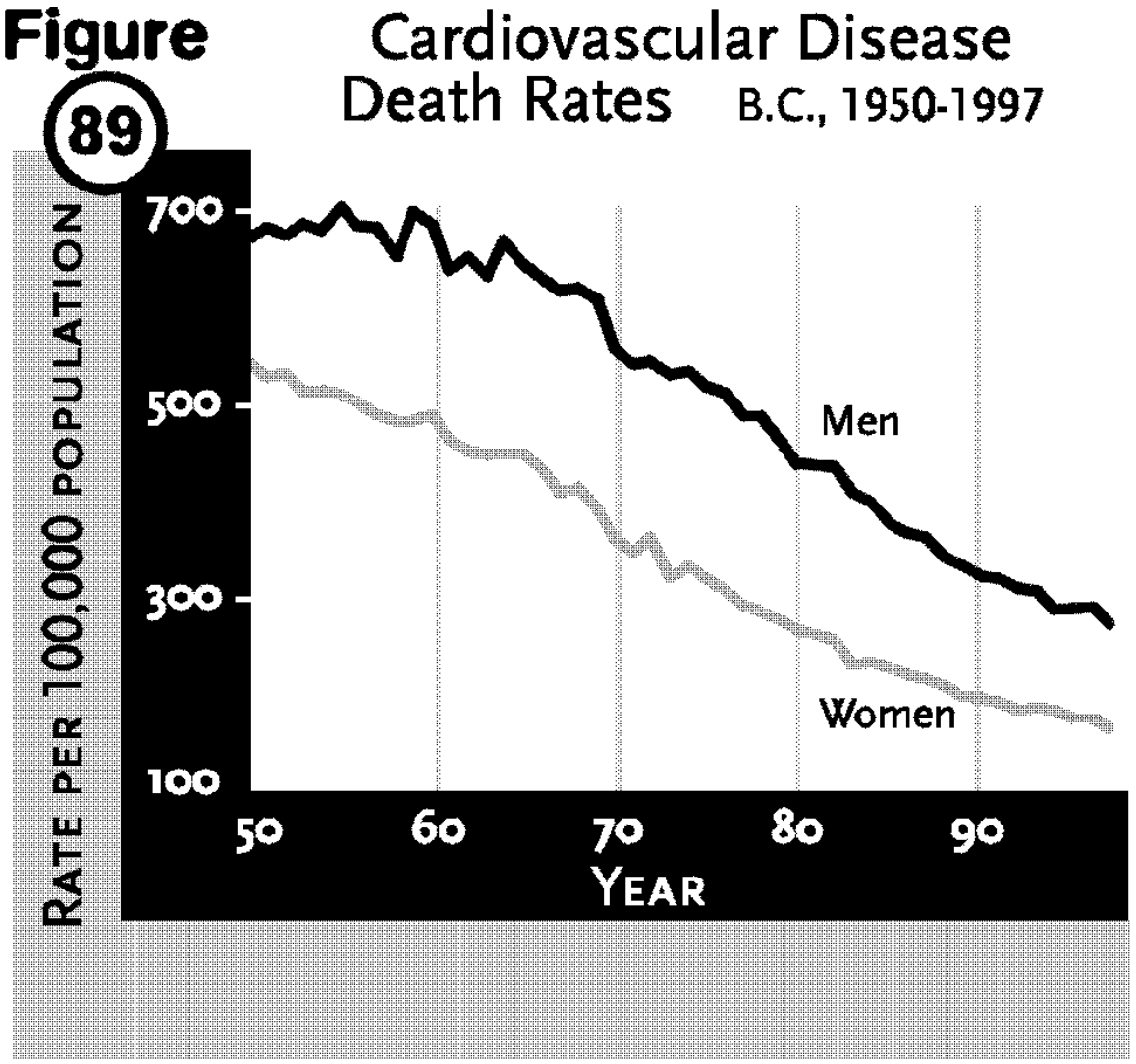

Projections of annual tobacco-related health care costs
Selected prevalence scenarios
26% flat from 1995
20% flat from 2000
20% 2000 to 10% 2010
20% 2000 to 0% 2020
Projected expenditures relative to 1999
$1,000,000,000
$950,000,000
$900,000,000
$850,000,000
$800,000,000
$750,000,000
$700,000,000
$650,000,000
$600,000,000
$550,000,000
$500,000,000
$450,000,000
$400,000,000
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year
DRAFT: Aug 07, 2001, Centre for Health Services & Policy Research, UBC

Figure 12



Age standardized mortality rate, all cardiovascular diseases.
Source: Disease Surveillance On-Line. Laboratory Centre for Disease Control, Health Canada. http://www.hc-sc.gc.ca/hpb/lcdc/webmap/index.html.

Figure 13

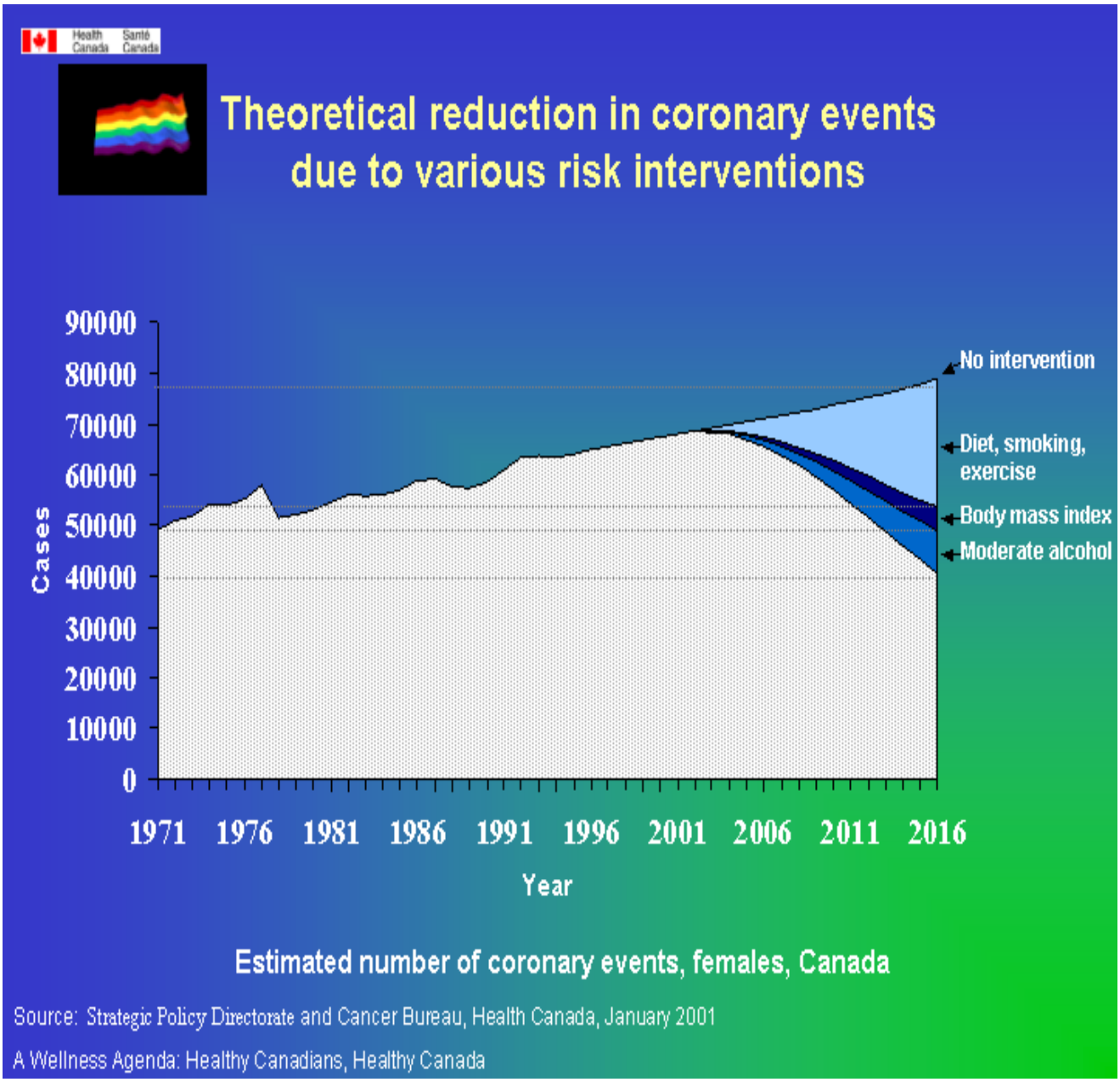
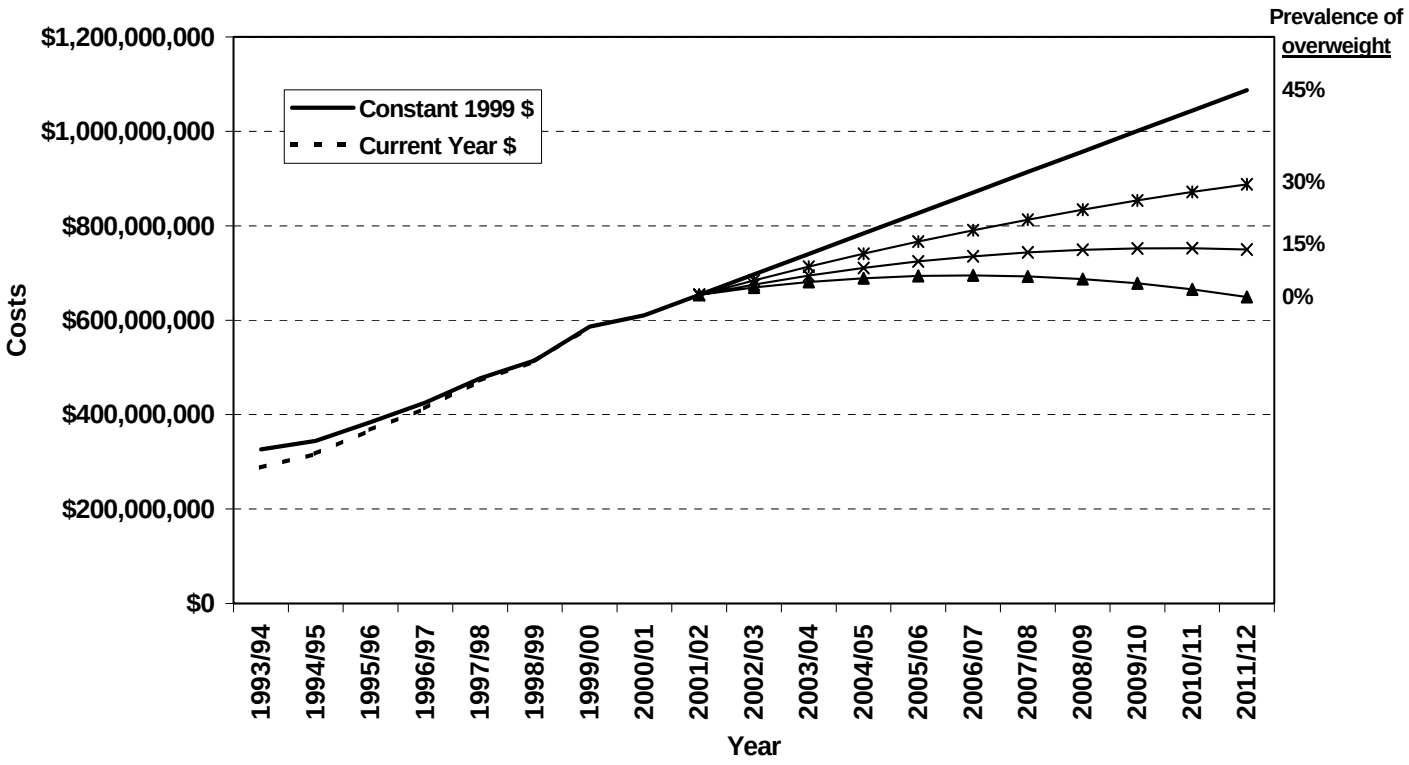

Health Canada Santé Canada
Theoretical reduction in coronary events due to various risk interventions
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Cases
1971 1976 1981 1986 1991 1996 2001 2006 2011 2016
Year
No intervention
Diet, smoking, exercise
Body mass index
Moderate alcohol
Estimated number of coronary events, females, Canada
Source: Strategic Policy Directorate and Cancer Bureau, Health Canada, January 2001
A Wellness Agenda: Healthy Canadians, Healthy Canada

Figure 14

Estimated Actual and Projected Health Service Costs for Persons with Diabetes, Under Varying Assumptions as Population Control of Overweight in 10 Years, B.C., 1993/94 to 2011/12



5.3 The prevention gap

While there has been considerable progress in preventing some chronic diseases, the projections shown above suggest there is much more to be done; we are far from realising the full potential of prevention. One way to understand what might be termed the "prevention gap" is illustrated in a 1998 report from the Queensland (Australia) Ministry of Health which compared age - standardized death rates for Queensland and Australia with the rates for the the OECD countries. While recognizing that there are cultural, genetic and other factors that may explain those differences, the report suggested that Queensland should aim to have mortality rates for the major causes of death equivalent to the lowest European rates. For Queensland, with a population of 3.4 million people (similar in size to BC), this would result in over 10,000 years of life gained with respect to cardiovascular disease, nearly 5500 life years gained with respect to cancer, more than 1700 life years gained with respect to chronic obstructive pulmonary disease, and over 1100 life years gained with respect to diabetes.

A recent report prepared for the Ministry of Health Planning (Bearing Point and Conference Board of Canada, 2003) noted that "compared with citizens of leading OECD countries British Columbians have the second highest life expectancy in the world" with Icelandic males and Japanese females being the only ones to surpass life expectancy for BC males and females respectively. However, for the 12 OECD countries for which data on disability-free life expectancy (DFLE) was available, BC's DFLE was exceeded by Japan, Austria, Germany and Switzerland for both males and females.

A study of age-standardized mortality rates for the main chronic diseases that are the focus of this report, comparing BC and 18 countries in the OECD [43] (but excluding the U.K., France, Italy, and Canada as a whole, for whom data was not available) generally reveals a positive picture of health in B.C., while at the same time indicating the "prevention gap" that might be closed (Table 19). [44]

The study found that, compared to those OECD countries for whom data was available, B.C. has:

- the lowest rate of cerebrovascular disease mortality
- the second lowest rate of deaths from
    - all causes

[43] Surveillance and Epidemiology Unit, Population Health and Wellness, Ministry of Health Planning (unpublished report, 2003)

[44] However, in considering international comparisons, even for standard data from WHO sources, it is important to recognize not only the cultural differences between countries, but also possible differences in diagnostic and reporting standards. Moreover, mortality may reflect not only differences in prevention, but differences in treatment and/or access to care. The very low rate of COPD in Japan, and the low rate in Estonia, both countries where smoking rates are higher than in Canada and in BC (at almost 35% in Japan in 1999, for example, more than twice the rate in BC) may be examples of these issues.

    - all cardiovascular disease
    - colon cancer
- the third lowest rate of deaths from
    - all forms of cancer
    - breast cancer

Table 19 also shows that the age-standardized mortality ratio for BC is lower - sometimes dramatically lower - than in the USA for all causes except prostate cancer. However, Table 19 also indicates that B.C. lags behind

- Japan, for all causes, especially cardiovascular diseases, as well as breast and prostate cancer
- Finland, for deaths from all causes of cancer, especially colon cancer and also breast cancer
- Iceland, for deaths from diabetes
- Spain, for deaths from ischaemic heart disease
- Sweden, for deaths from lung cancer.

When it comes to some key lifestyle determinants of chronic disease the evidence is mixed (Bearing Point and Conference Board of Canada, 2003):

- Japan, Norway, Switzerland, Sweden, the Netherlands, Denmark, France, Ireland, Belgium, Finland, and Germany all have lower rates of obesity;
- on the other hand, with a rate of 16%, BC has the lowest rate of smokers age 15 and older among all OECD countries, including Canada; in the USA, only Utah, at 13.9%, has a lower smoking rate then BC;

(Unfortunately, OECD data were not available for physical activity.)

Table 19: Age-standardized Mortality Ratios, BC v Selected OECD Countries,* 1997 – 2001 ** (ICD-10 coding)

NB: ASMR > 1 means BC mortality rate is worse (higher)
ASMR <1 means BC mortality rate is better (lower)

Cause of death	BC v Best	BC v Best "European"	BC v USA
ALL CAUSES	1.04 (Japan)	0.94 (Australia)	0.78
All Cardiovascular disease	1.58 (Japan)	0.86 (Spain)	0.62
- Ischaemic heart disease	2.46 (Japan)	1.31 (Spain)	0.62
- Cerebrovascular disease	1.0 (BC)	0.90 (USA)	0.90
All Cancer	1.08 (Finland)	1.08 (Finland)	0.92
- Lung cancer	1.75 (Sweden)	1.75 (Sweden)	0.84
- Breast cancer	2.5 (Japan)	1.07 (Australia, Finland, Poland, Spain, Sweden)	0.94
- Colon cancer	1.27 (Finland)	1.27 (Finland)	0.78
- Prostate cancer	2.6 (Japan)	1.3 (Poland)	1.08
Chronic obstructive pulmonary disease	27 (Japan)	2.7 (Estonia)	0.73
Diabetes	2.71 (Iceland)	2.71 (Iceland)	0.73

* Data for some countries did not appear in the WHOSIS database from which the data used to calculate this Table was taken.
** Year 2001 for BC and Hungary, all the rest are 1999 or 2000, except Iceland (1997) and Denmark (1998).

Conclusion

Admittedly, there are gaps in the evidence with respect to the effectiveness of preventive interventions for chronic diseases, in part because the necessary reasearch has not been done, which is due in part to the chronic underfunding of public health research compaered to biiomedical research. Nonetheless, there is a great deal of evidence as to what does work, and there there are some things we can say with great certainty:

- Chronic diseases exact a very high toll in pain and suffering, as well as high direct and indirect economic costs
- Our health status is not as high and our burden of chronic disease is not as low as it could be, in comparison with some other countries
- Our levels of both proximate risk factors and societal risk conditions that contribute to the burden of disease is not as low as it could be, in comparison with some other countries
- The burden of chronic disease, and the occurrence of both proximate risk factors and societal risk conditions, is inequitably distributed across different population groups and communities
- We know quite a lot about the major risk factors and conditions that contribute to the burden of chronic disease
- We know quite a lot about how to reduce many of those risk factors and conditions and thus how to reduce the burden of chronic disease
- It is as improper to withhold an effective preventive intervention as it would be to withhold an effective therapeutic intervention (Dudley, 2003).

Given the potential for prevention, surely it would be a worthwhile investment to take 1% (or 2%, or 3%, or 5 percent?) of the potential avoided cost in 2010 and invest that money annually in prevention – now. We need to act in the face of uncertainty, applying what evidence we have, with due regard for both the strength of the association and the weight of the evidence.

Reducing the burden of chronic diseases and promoting the health of the people of BC is one of the most important tasks that we face as a society today, not only because of the economic and social benefits, but because it is the right thing to do. Indeed, we should undertake prevention even if it were to cost money - as indeed it might, under some forms of economic analysis - for the same reasons that we treat disease; not for economic gain, but because it is the hallmark of a civilised, humane, caring and compassionate society.

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Appendix 1: Cochrane Collaborative reviews and protocols of relevance to the prevention of chronic disease

CARDIOVASCULAR HEALTH - REVIEWS

Multiple risk factor interventions for primary prevention of coronary heart disease (Feb 1999)

A total of 18 trials were found of which 10 reported clinical event data. Net changes in systolic and diastolic blood pressure, smoking prevalence, and blood cholesterol were -3.9mmHg (95% CI -4.2,-3.6 mmHg), -2.9 mmHg (95% CI -3.1,-2.7 mmHg), -4.2% (95% CI -4.8, -3.6%), and -0.08mMol/l (95% CI -0.1.-0.06 mMol/l) respectively. In the ten trials with clinical event end-points, the pooled odds ratios for total and coronary heart disease mortality were 0.97 (95% confidence intervals (CI) 0.92-1.02) and 0.97 (95% CI 0.88-1.04) respectively.

Reviewers' conclusions: The pooled effects (of 10 studies) suggest multiple risk factor intervention has no effect on mortality. However, a small, but potentially important, benefit of treatment (about a 10% reduction in CHD mortality) may have been missed. Risk factor changes were relatively modest, were related to the amount of pharmacological treatment used, and in some cases may have been over-estimated because of regression to the mean effects, lack of intention to treat analyses,habituation to blood pressure measurement, and use of self-reports of smoking. Interventions using personal or family counseling and education with or without pharmacological treatments appear to be more effective at achieving risk factor reduction and consequent reductions in mortality in high risk hypertensive populations. The evidence suggests that such interventions have limited utility in the general population.

Reduced or modified dietary fat for preventing cardiovascular disease (May 2001)

Twenty seven studies were included (40 intervention arms, 30,901 person-years). There was no significant effect on total mortality (rate ratio 0.98, 95% CI 0.86 to 1.12), a trend towards protection from cardiovascular mortality (rate ratio 0.91, 95% CI 0.77 to 1.07), and significant protection from cardiovascular events (rate ratio 0.84, 95% CI 0.72 to 0.99). The latter became non-significant on sensitivity analysis.

Reviewers' conclusions: The findings are suggestive of a small but potentially important reduction in cardiovascular risk in trials longer than two years. Lifestyle advice to all those at high risk of cardiovascular disease (especially where statins are unavailable or rationed), and to lower risk population groups, should continue to include permanent reduction of dietary saturated fat and partial replacement by unsaturates.

Reduced dietary salt for prevention of cardiovascular disease (Feb 2003)

Three trials in normotensives (n=2326), five in untreated hypertensives (n=387) and three in treated hypertensives (n=801) were included, with follow up from six months to seven years. The large, high quality (and therefore most informative) studies used intensive behavioural interventions.

Reviewers' conclusions: Intensive interventions, unsuited to primary care or population prevention programmes, provide only minimal reductions in blood pressure during long-term trials. Further

evaluations to assess effects on morbidity and mortality outcomes are needed for populations as a whole and for patients with elevated blood pressure.

Evidence from a large and small trial showed that a low sodium diet helps in maintenance of lower blood pressure following withdrawal of antihypertensives. If this is confirmed, with no increase in cardiovascular events, then targeting of comprehensive dietary and behavioural programmes in patients with elevated blood pressure requiring drug treatment would be justified.

Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterols, and triglyceride (Updated Nov 2002)

Reviewers' conclusions: The magnitude of the effect in Caucasians with normal blood pressure does not warrant a general recommendation to reduce sodium intake. Reduced sodium intake in Caucasians with elevated blood pressure has a useful effect to reduce blood pressure in the short-term. The results suggest that the effect of low versus high sodium intake on blood pressure was greater in Black and Asian patients than in Caucasians. However, the number of studies in black (8) and Asian patients (1) was insufficient for different recommendations. Additional long-term trials of the effect of reduced dietary sodium intake on blood pressure, metabolic variables, morbidity and mortality are required to establish whether this is a useful prophylactic or treatment strategy.

CARDIOVASCULAR HEALTH - PROTOCOLS (reviews in progress)

- Home versus center based physical activity programs for older adults
- Fruit and vegetables for cardiovascular disease
- Anti-oxidant foods or supplements for preventing cardiovascular disease
- Dietary interventions for reducing cardiovascular risk
- Smoking cessation for the secondary prevention of coronary heart disease
- Weight reduction for reducing mortality in obesity and overweight
- Interventions for promotion of physical activity

DIABETES - PROTOCOLS

- Lifestyle interventions for preventingType II diabetes

NUTRITION, OVERWEIGHT AND OBESITY - REVIEWS

Interventions for preventing childhood obesity (Jan 2002)

Ten studies were included; seven were long-term (children observed for at least one year), three were shorter term (at least 3 months). Eight were school/nursery-based interventions,

Reviewers' conclusions: There is limited high quality data on the effectiveness of obesity prevention programs and no generalisable conclusions can be drawn. However, concentration on strategies that encourage reduction in sedentary behaviours and increase in physical activity may be fruitful. The

need for well-designed studies that examine a range of interventions remains a priority, although a number of important studies are underway.

Advice on low-fat diets for obesity (Feb 2002)

Calorie restriction can achieve short-term weight loss but the weight loss has not been shown to be sustainable in the long-term. An alternative approach to calorie restriction is to lower the fat content of the diet. However, the long-term effects of fat-restricted diets on weight loss have not been established.

Main results: Four studies were included at the six month follow-up, five studies at the 12 month follow-up and three studies at the 18 month follow-up. There was no significant difference in weight loss between the two groups at six months (WMD 1.7 kg, 95% CI -1.4 to 4.8 kg).

Apart from one study which showed a slight but statistically significant difference in total cholesterol in the low fat group at one year follow-up, there were no significant differences between the dietary groups for other outcome measures such as serum lipids, blood pressure and fasting plasma glucose. Studies measuring other factors such as perceived wellness and quality of life reported conflicting results.

Reviewers' conclusions: The review suggests that fat-restricted diets are no better than calorie restricted diets in achieving long term weight loss in overweight or obese people. Overall, participants lost slightly more weight on the control diets but this was not significantly different from the weight loss achieved through dietary fat restriction and was so small as to be clinically insignificant.

Reduced or modified dietary fat for preventing overweight and obesity (January 2002)

Three of the four long-term studies that combined dietary education and physical activity interventions resulted in no difference in overweight, whereas one study reported an improvement in favour of the intervention group. In two studies of dietary education alone, a multimedia action strategy appeared to be effective but other strategies did not. The one long term study that only focussed on physical activity resulted in a slightly greater reduction in overweight in favour of the intervention group, as did two short term studies of physical activity.

Reviewers' conclusions: There is limited high quality data on the effectiveness of obesity prevention programs and no generalisable conclusions can be drawn. However, concentration on strategies that encourage reduction in sedentary behaviours and increase in physical activity may be fruitful. The need for well-designed studies that examine a range of interventions remains a priority, although a number of important studies are underway.

Dietary fibre for the prevention of colorectal adenomas and carcinomas (Nov 2001)

The population included all subjects that had adenomatous polyps but no previous history of colorectal cancer (CRC), a documented "clean colon" at baseline and repeated visualization of the colon/rectum after at least two years of follow-up. Dietary fibre was the intervention.

Five studies with 4349 subjects met the inclusion criteria. The interventions were wheat bran fibre, ispaghula husk, or a comprehensive dietary intervention with high fibre whole food sources alone or in

combination. When the data were combined there was no difference between the intervention and control groups for the number of subjects with at least one adenoma [RR 1.04 (95% CI 0.95,1.13); RD 0.01 (95% CI 0.02,0.04)].

Reviewers' conclusions: There is currently no evidence from RCTs to suggest that increased dietary fibre intake will reduce the incidence or recurrence of adenomatous polyps within a two to four year period.

PROTOCOLS

- Exercise for obesity

- Dietary calcium for the prevention of colorectal caner and adenomatous polyps

- Anti-oxidant foods or supplements for preventing cardiovascular disease

POPULATION SCREENING – CANCER - REVIEWS

Personalised risk communication for informed decision making about entering screening programs (Nov 2002)

Most of the included studies addressed mammography programmes. These studies showed slightly smaller effects than the overall dataset,

Reviewers' conclusions: Personalised risk communication (as currently implemented in the included studies) is associated with increased uptake of screening programmes, but this may not be interpretable as evidence of informed decision making by consumers.

Interventions targeted at women to encourage the uptake of cervical screening (March 1999)

Thirty-five studies were included (27 RCTs and eight quasi-RCTs)

Reviewers' conclusions: There was some evidence to support the use of invitation letters to increase the uptake of cervical screening. There was limited evidence to support educational interventions but it was unclear what format was most effective. The majority of the studies were from developed countries and so the relevance to developing countries is unclear.

Screening for breast cancer with mammography (August 2001)

Seven completed and eligible trials involving half a million women were identified. The two best trials provided medium-quality data

Reviewers' conclusions: The currently available reliable evidence does not show a survival benefit of mass screening for breast cancer (and the evidence is inconclusive for breast cancer mortality). Women, clinicians and policy makers should consider these findings carefully when they decide whether or not to attend or support screening programs.

Strategies for increasing women's participation in community breast cancer screening (Oct 2000)

Main results: The evidence favoured five active strategies for inviting women into community breast cancer screening services: letter of invitation (OR 1.66, 95% CI 1.43 to 1.92), mailed educational material (Odds Ratio(OR) 2.81, 95% Confidence Interval (CI) 1.96 to 4.02), letter of invitation plus phone call (OR 2.53, 95% CI 2.02 to 3.18), phone call (OR 1.94, 95% CI 1.70 to 2.23), and training activities plus direct reminders for the women (OR 2.46, 95% CI 1.72 to 3.50). Home visits did not prove to be effective (OR 1.06, 95 % CI 0.80 to 1.40) and letters of invitation to multiple examinations plus educational material favoured the control group (OR 0.62, 95 % CI 0.32 to 1.20).

Reviewers' conclusions: Most active recruitment strategies for breast cancer screening programs examined in this review were more effective than no intervention. Combinations of effective interventions can have an important effect. Some costly strategies, as a home visit and a letter of invitation to multiple screening examinations plus educational material, were not effective. Further reviews comparing the effective interventions and studies that include cost-effectiveness, women's satisfaction and equity issues are needed.

Screening for colorectal cancer using the faecal occult blood test, Hemoccult (Feb 1998)

Main results: Meta-analysis of mortality results from the randomised controlled trials shows that those allocated to screening had a reduction in colorectal cancer mortality of 16% (RR 0.84, CI: 0.77-0.93).

When adjusted for screening attendance in the individual studies, the mortality reduction is 23% (RR 0.77, CI: 0.57-0.89).

Overall, if 10 000 people were offered a biennial Hemoccult screening program and two-thirds attended for at least one Hemoccult test, there would be 8.5 deaths (CI: 3.6-13.5) from colorectal cancer prevented over 10 years.

However, the screening program would also result in 2 800 participants having at least one colonoscopy, if screening harms from the Minnesota trial are considered, and there would be 3.4 colonoscopy complications (perforation or haemorrhage). If screening harms from the Gothenburg trial are considered, approximately 600 participants would need at least one sigmoidoscopy and double contrast barium enema, resulting in 1.8 perforations or haemorrhages.

Reviewers' conclusions: Screening benefits include reduction in colorectal cancer mortality, possible reduction in cancer incidence through detection and removal of colorectal adenomas and potentially, treatment of early colorectal cancers may involve less invasive surgery.

Harmful effects of screening include the physical complications of colonoscopy, disruption to lifestyle, stress and discomfort of testing and investigations, and the anxiety caused by falsely positive screening tests.

Although screening benefits are likely to outweigh harms for populations at increased risk of colorectal cancer, we need more information about the harmful effects of screening, the community's responses to screening and screening costs for different health care systems

Screening for lung cancer (Sept 1999)

Seven trials were included (6 randomised controlled studies and 1 non-randomised controlled trial) with a total of 245,610 subjects. There were no studies with an unscreened control group.

Reviewers' conclusions: The current evidence does not support screening for lung cancer with chest radiography or sputum cytology. Frequent chest x-ray screening might be harmful. Further,methodologically rigorous trials are required before widespread screening can be recommended.

POPULATION SCREENING – CANCER - PROTOCOLS

- Screening for prostate cancer

POPULATION SCREENING – OTHER - REVIEWS

Newborn screening for cystic fibrosis (April 2001)

Reviewers' conclusions: There are few randomised controlled trials assessing the effectiveness of neonatal screening in cystic fibrosis. From the data available at this time, there is little evidence suggesting benefit from screening for cystic fibrosis in the neonatal period, although there is similarly little evidence of harm.

POPULATION SCREENING – OTHER - PROTOCOLS

- Personalized risk communication in health screening programs

- Influencing people's experience of screening

RESPIRATORY DISEASE - REVIEWS

- Feather versus non-feather bedding for asthma

- Limited (information only) patient education programs for adults with asthma

- House dust mite control measures for asthma

RESPIRATORY DISEASE - PROTOCOLS

- Antenatal screening for cystic fibrosis

- Cat allergen control measures for allergic asthma

- Educational interventions for adults who attend the emergency room for acute asthma

- Educational interventions for asthma in children

- Educational interventions for asthma in adults

TOBACCO CONTROL - REVIEWS

- Workplace interventions for smoking cessation **(new)**

- School based programs for preventing smoking

- Community interventions for reducing smoking among adults

- Community interventions for preventing smoking in young people

- Exercise interventions for smoking cessation

- Interventions for smoking cessation in hospitalised patients

- Interventions for preoperative smoking cessation

- Interventions for preventing tobacco sales to minors

- Interventions for preventing tobacco smoking in public places

- Interventions for promoting smoking cessation during pregnancy

- Mass media interventions for preventing smoking in young people

- Telephone counselling for smoking cessation

TOBACCO CONTROL - PROTOCOLS

- Relapse prevention interventions for smoking cessation

- Impact of advertising on adolescent smoking behaviours

- Tobacco cessation interventions for young people

- Interventions for pre-operative smoking cessation

- Partner support for smoking cessation

- Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke

- Smoking cessation for the secondary prevention of coronary heart disease

PRIMARY CARE-RELATED REVIEWS ON SMOKING - REVIEWS

- Tobacco cessation interventions for young people

- Physician advice for smoking cessation

- Training health professionals in smoking cessation

- Self help interventions for smoking cessation

- Nursing interventions for smoking cessation

- Nicotine replacement therapy for smoking cessation

- Individual behavioural counselling for smoking cessation

- Hypnotherapy for smoking cessation

- Group behaviour therapy programmes for smoking cessation

- Acupuncture for smoking cessation

- Aversive smoking for smoking cessation

- Antidepressants for smoking cessation

- Anxiolytics for smoking cessation

PRIMARY CARE-RELATED REVIEWS ON SMOKING - PROTOCOLS

- Community pharmacy personnel interventions for smoking cessation

Appendix 2: - Effective interventions for reducing coronary heart disease in the areas of tobacco use, diet and nutrition, physical activity, and overweight/obesity
Source: Health Development Agency, 2001

Table 1.6 Suggested activities to support local action

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Smoking cessation	Effectiveness and cost effectiveness are well established (Fiore *et al.* 1996; Raw *et al.* 1998). Updated guidelines (Dec 2000).	Depends on the particular intervention under consideration (see below).	Health professionals, LAs, specialist smoking cessation coordinators, voluntary sector, HAZs, local smoking alliance.	Smoking cessation skills, carbon monoxide monitor, leaflets. Although training schemes are available nationally, accredited courses should be established. Demonstrate cultural sensitivity.	Major component of government strategy to reduce smoking in England. HSC (1999) has set out guidelines on monitoring for the new services. The availability and accessibility of services should take account of cultural differences.	HSC (1998, 1999), DH (1998a), Acheson (1998). Cochrane Library website: http://www.update-software.com/clibhome/clib.htm Evaluation of year one of national cessation strategy (Adams *et al.* 2000). ASH (2000a).
Nicotine replacement therapy	Doubles chance of success of smokers wishing to stop (Fiore *et al.* 1996; Raw *et al.* 1998).	Can double the effectiveness of an intervention, be it brief advice from a GP or intensive support through a specialist clinic or will-power alone.	PHC, pharmacists, health promotion specialists.	Smoking cessation skills, access to NRT products.	Currently, some are available on prescription as well as being available over the counter (OTC). Nasal spray is OTC and 2 mg gum is also available on the general sales list (GSL).	See above.
Bupropion (Zyban)	Just launched in the UK. An effective pharmacotherapy (Hurt *et al.* 1997; Jorenby *et al.* 1999), it will be available on prescription.		GPs and those approved for prescribing through the Patient Group Directive, PHC, pharmacists, health promotion specialists.	Smoking cessation skills.	Prescription only.	

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Brief advice in NHS and primary care	Fiore *et al.* 1996; Raw *et al.* 1998; updated guidelines (December 2000).	Very brief advice (three minutes) can result in a 2% increase in number of smokers abstinent for six months or longer compared with no advice. Brief advice (10 minutes) can result in a 3% increase. Adding NRT to brief advice can result in a 6% increase.	PHC team, link with other support services if appropriate [eg healthy living centres (HLCs), hospital staff, doctors, nurses, midwives].	Smoking cessation skills.		As above.
Intensive support (eg smokers' clinics)	Fiore *et al.* 1996; Raw *et al.* 1998; updated guidelines (Dec 2000).	Compared with no intervention intensive support can result in an 8% increase in the number of smokers abstinent for six months or longer.	See above.	Smoking cessation skills.	Reach lower than that for brief advice, but associated with a higher success rate; resource intensive; ease of access (eg convenience, safe location, timing) and cost (if any) are important considerations.	As above. The Maudsley smokers' clinic is an example of good practice highlighted in the tobacco white paper (DH 1998a).
Cessation advice and support for hospital patients	Fiore *et al.* 1996; Raw *et al.* 1998; updated guidelines (Dec 2000).	Result in a 5% increase in the number of smokers abstinent for six months or longer.		Smoking cessation skills.		
Cessation advice and support for pregnant smokers	Raw *et al.* 1998; Fiore *et al.* 1996; updated guidelines (Dec 2000).	Result in a 7% increase in the number of smokers abstinent for six months or longer.		Smoking cessation skills.		
Telephone helplines	Evidence base for effectiveness is growing and Thorax guidelines indicate that they may provide an effective service (Raw *et al.* 1998). A meta-analysis reports a significant effect (Fiore *et al.* 1996).	Quit rate of 15.6% (adjusted) reported in England with mass media campaign (Owen 2000).	Providers of (national and local) helplines, workplace, public places, NHS, community groups, cessation services.	Smoking cessation skills, trained staff required.	Mass reach, easy and convenient for smoker. Guidelines are available for those wanting to set up local helplines. Alternatively, activities and literature could be undertaken to raise public awareness of and use of existing helplines. Can be used to promote other cessation support services in locality.	Lichtenstein *et al.* (1996), NHS Direct Helpline 0800 169 0169, Quit (Charity) 020 7388 5775, Quitline 0800 002200.

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Other treatments	Insufficient evidence of effectiveness for hypnotherapy and acupuncture, etc. (Abbot *et al.* 2000; White *et al.* 2000).	Likely impact uncertain.	Private sector, links with other smoking cessation providers. In view of lack of evidence base, consider contacting recognised professional associations for trained individuals.		Smokers should be given information about other treatments to enable them to make an informed choice without discouraging attempts to stop. Level of training likely to vary from none to sufficient to justify membership of a professional body (Raw *et al.* 1998).	British Hypnotherapy Association (BHA), 1 Wythburn Place, London W1H 5WL Tel: 0207 723 4443, email: firebird@agonet.co.uk British Society of Hypnotherapists (BSH), 37 Orbain Road, London SW6 7JZ Tel: 020 7385 1166 Association of General Practitioners of Natural Medicine (AGPNM), 38 Nigel House, Portpool Lane, London EC1N 7UR Tel: 020 7405 2781. Institute of Complementary Medicine (ICM), PO Box 194, London SE16 1QZ Tel: 020 7237 5165.
Reduce smoking in public and work places	Associated with reduced consumption, possible reductions in prevalence in the longer term (Brenner and Mielck 1992; Buck and Godfrey 1994; Reid 1996).	A US study of employees reported a reduction of 5% in smoking prevalence and 10% in consumption after the introduction of workplace bans. Other benefits include recognition of non-smoking as norm, protection of non-smokers, increased public awareness and acceptance of health risks. May encourage adolescents not to start.	British Hospitality Association, The Restaurant Association, British Institute of Innkeeping, Brewers and Licensed Retailers Association, Association of Licensed Multiple Retailers, employers and employees, NHS.		Charter agreed between government and licensed hospitality trade. The HSE is producing a new ACoP on smoking in the workplace, which will provide practical advice on how to comply with the law.	DH (1998a), HEA (1999c,d). The National HSE (NHSE) is developing a toolkit to help with the implementation of its policies.
Mass media campaigns	Can enhance natural quit rate and may reduce relapse (Reid 1996; McVey and Stapleton in press); may also reduce uptake of smoking in young people (Sowden and Arblaster 2000a).	Quit range 0–5% for adult interventions (Reid 1996), direct influence on climate of public opinion.	National and local media, community settings and activities, workplaces and public places.	Costly; requires minimal level of exposure and development of new messages to avoid consumer burn-out.	High reach; works well with other interventions such as tax increases; can support local cessation services; focus should be on adults.	DH smoking policy team, DH communications team, review of use of mass media campaigns in England available from HDA (Grey *et al.* 2000). Cochrane Library website http://www.update-software.com/clibhome/clib

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Media advocacy and No Smoking Day	Effectiveness lower than more intensive interventions but highly cost-effective because the reach is much greater (Reid *et al.*, 1992; Buck and Godfrey 1994).	One year net quit rates estimated 0.3–0.5% (Reid *et al.*, 1992; Buck and Godfrey 1994); influence on public opinion; provides basis for other initiatives; may contribute to impact of mass media campaign; extends debate about smoking.	NHS, local government, commercial interests, voluntary agencies.	Cheaper than paid advertising but substantial resources required for generating stories; good contacts with local media and the leisure and hospitality trade. Training in media advocacy needed.	Relies on good links with other agencies (eg voluntary sector, local government, hospitality trade) to create local activities.	http://www.no-smoking-day.org.uk/campaign.htm Example of good practice: Roy Castle Good Air Awards
Advertising ban	Possible effect on adult consumption and teenage prevalence (Reid *et al*. 1992; Sowden and Arblaster, 2000a).	Impact of monitoring local infringement of voluntary agreement not known, but does offer opportunities for media advocacy.	Government, health promotion specialists, tobacco advocates and others can monitor existing voluntary agreements.		Local activity could include monitoring infringements to voluntary agreements (eg advertising on billboards near schools, promotions in magazines aimed at young people).	DH (1992). Issued with DH circular EL (92) 71.
Reduce illegal sales	Local activity can reduce sales. This may have a small delaying effect on children's uptake of smoking.	Local activity can reduce sales; useful for media advocacy; may have a small delaying effect on children's uptake.	Magistrates, retailers, local trading standards officers, schools, parents, local government association, LAs, National Association of Cigarette Machine Operators.	Requires substantial resources.	Existing law states that it is illegal to sell tobacco products to under 16s, but enforcement is problematic. Possibly adds to perception that smoking is a forbidden fruit (Kay Scott Associates 2000).	National Association of Cigarette Machine Operators has produced a code for members. Local Government Association (LGA) and Local Authorities Coordinating Body on Food and Trading have produced an LA enforcement protocol.
Smoking policies in schools	Impact on uptake of smoking uncertain.	Implementation varies so that outcome is unclear; reinforces non-smoking as the norm; other potential benefits include reduced absenteeism, reduced costs and elimination of passive smoking.	School teachers, governors, heads, parents, pupils, local community (for policies that involve non-smoking in school premises for community activities).		Supports health messages in the national curriculum.	HEA (1993, 1999e).

Improving Diet and Nutrition

Table 2.6 Suggested activities to support local action

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Nutritional standards for school lunches From April 2001, new legislation will require school lunches to meet minimum nutritional standards.	Roe *et al.* (1997) identified two good quality studies relevant to school meals. Ellison *et al.* (1989, 1990) showed that passive manipulation of fat content reduced saturated fat intake by 2% with a similar increase in polyunsaturated fat intake. Whitaker *et al.* (1994) showed a 3% increase in low fat choices when promoted.	Compliance with legal requirement; gives a sound basis to a whole school approach; will contribute to achieving the National Healthy Schools Standard (NHSS); clear guidance and framework for monitoring will be provided; will ensure good nutritional standards for free meals.	Local education authority (LEA), direct service organisation; contract caterers and in-house dietitians; Local Authority Caterers' Association (LACA): http://www.laca.co.uk Schools Nutrition Action Group (SNAG) initiative can help schools in developing a school food policy. Local healthy schools programme. Child Poverty Action Group: http://www.cpag.org.uk	Support for caterers from community dietitian or public health nutritionist in training in healthier catering practices and in monitoring compliance with the standards.	Pricing of healthier choices – and caterers' perceptions of the higher production costs; introducing a school food policy to support adoption of the standards; opportunity to review snack provisions at same time, as well as breakfast clubs and vending machines. Meeting and monitoring standards will be a legal requirement.	Department for Education and the Environment (DfEE) http://www.nutritional.standards@dfee.gov.uk *National Standards for School Lunches, England. Regulations 2000.* Statutory Instrument number 1777. The Stationery Office. £1.50. *Eating well at school: dietary guidance for school meal providers* (1997). DfEE Publications, PO Box 5050, Annesley, Nottingham, NG15 0DJ. Tel: 0845 602260. Free of charge. School Meals Assessment Pack (SMAP; computer package assessing the nutritional quality of secondary school meals) produced by the NHF. SMAP, PO Box 7, London W5 2GQ. £45.00, cheques payable to BSS. *School food policy guide* produced by SNAG. Contact Joe Harvey, Health Education Trust (tel/fax: 01789 773915). *Nutrition guidelines for school meals* (1992) available from The Caroline Walker Trust, 22 Kindersley Way, Abbots Langley, Herts, WD5 0DQ. Cost £10 including postage and packing (p&p). *What are today's children eating?* The Gardner Merchant School Meals Survey 2000. Gardner Merchant (tel: 01793 512112).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
						Future of food in schools report (1998). Available free of charge from Penny Rolfe, Chartwells, Icknield House, 40 West Street, Dunstable, Beds LU6 1TA. McMahon, W. and Marsh, T., 1999. *Filling the gap*. Child Poverty Action Group. Cost £5.00, http://www.cpag.org.uk or 94 White Lion Street, London W1 9PF. Tel: 020 7837 7979. Their website also contains briefing papers on school meals and healthy eating and school meals in Scotland.
National healthy school standard (NHSS) Criteria for healthy eating, to inform implementation of whole school approach.	Evaluation of pilot sites (Rivers *et al.* 2000) found conflict between healthy eating criteria and school meals contracts. New legal minimum standards for school lunches should overcome this. Not yet evaluated nationally.	Addresses a range of risk factors for CHD as part of whole school approach. Has a formalised support network. Could be used to formalise and secure funding for any school based initiatives. Allows a flexible approach to meeting standard criteria. NHSS support materials will facilitate strategic connections and help identify local partners as well as provide case study examples of good practice.	Local healthy schools programme coordinators based in LEAs or HAs.	Local programme coordinators will welcome the involvement of community dietitians, public health nutritionists, health promotion specialists, in meeting the standard.	Schools agree priorities with coordinators of local healthy school programmes. Healthy eating may not be the first priority. This is an opportunity to become involved in the strategic planning to meet the healthy eating standard. Legal requirements for school lunches will increase the priority for healthy eating. All LEAs have now signed up to achieve the NHSS.	*National Healthy School Standard guidance*. DfEE (1999). Available free from DfEE Publications, PO Box 5060, Annesley, Nottingham NG15 0DJ. The 'Your healthy school' section of http://www.wiredforhealth.gov.uk *Food - a fact of life*: range of teaching resource material for primary and secondary schools (British Nutrition Foundation). Contact 020 7404 6504 or http://www.nutrition.org.uk

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Breakfast and after school clubs Government has recently funded 230 school breakfast clubs as part of its drive to tackle inequalities in health.	34 breakfast clubs; breakfast club evaluations currently under way.	Offer broader benefits (eg pre- and after-school care). Opportunity to encourage the intake of fruit on cereal, as juice or after school as snacks. May also help to address low intakes of iron and other micronutrients (Gregory *et al*. 2000). HEA Young People and Health Survey (1999) revealed that almost one in five (18%) young people aged 11–16 years never (or hardly ever) had breakfast before school (males 13%, females 23%).	LEA Direct Service Organisations; school caterers; head teachers, school governors and PTAs; regional and local coordinators of the healthy schools programmes; schools nutrition action groups (SNAGs); Kellogg's http://www.breakfast-clubs.co.uk/ Local healthy schools programme.	Paid staff to prepare food and supervise children; venue, facilities and equipment for the safe and hygienic preparation and storage of food; activities/ resources to occupy the children; research support to evaluate success of programme.	Could form part of a whole school approach to improving diet. Breakfasts and snacks offered need to reflect *The balance of good health* (HEA, DH and MAFF 1994) (eg wholegrain cereals with semi-skimmed milk and fruit). Free EU intervention stocks of fruit could be useful. Fruit is available to schools but this must be in addition to normal supplies and not used as part of school canteen meals. Currently, government is funding breakfast clubs in areas of deprivation, including HAZs, education action zones (EAZs) and Sure Start areas, to help tackle health inequalities.	Breakfast Clubs. *A how to... guide*. Kellogg's New Policy Institute and Kellogg's. Available from http://www.breakfast-club.co.uk Street, C. and Kenway, P., 1998. *Fit for school - how breakfast clubs meet health education and childcare needs*. New Policy Institute. Cost £12.50. Donovan, N. and Street, C., 1999. *Food for thought - breakfast clubs and their challenges*. New Policy Institute. Cost £7.50. Reports available from: New Policy Institute, 109 Coopergate House, 16 Brune Street, London E1 7NJ (tel: 020 7721 8421). Scottish Community Diet Project, c/o Scottish Consumer Council, Royal Exchange House, 100 Queen Street, Glasgow G1 3DN (tel 0141 226 5261). Email scdp@scotconsumer.org.uk Website: http://www.dietproject.co.uk Information on EU intervention stocks of fruit from the Intervention Board's fruit and vegetable withdrawal section (tel: 0118 953 1694). An information sheet for schools is available (form HOR 18). *School food policy guide* produced by SNAG. Contact Joe Harvey, Health Education Trust (tel/fax: 01789 773915).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Cooking skills clubs Cooking and food preparation skills compulsory within National Curriculum Food Technology (Key Stage 1 and 2, optional at Key Stage 3 and 4). National initiatives on cooking skills include Cooking for Kids (DfEE) for Years 6 and 7 and Focus on Food cooking skills bus, Retail Services Association (RSA) and Waitrose.	Lang *et al.* 1999 showed a general dearth of cooking skills in the population and that schools are a key setting for learning such skills. Focus on Food is being evaluated by the University of Reading, results due 2001. *Cooking for Kids* reported a range of benefits at end of first year, social as well as educational (Waldon 1999, unpublished report).	Clubs can stimulate interest and confidence to develop cooking skills out of the school setting; Cooking for Kids reports opportunities to reinforce nutrition and food hygiene lesson taught in class, a head start in Year 7 food technology; getting to know new school/teacher in advance; opportunity to build interest and enthusiasm for cooking skills.	DfEE's Cooking for Kids; RSA and Waitrose Focus on Food; LEAs; head teachers, parents and school governors, school caterers, teachers of food technology; local chefs restaurateurs and shops who may be willing to help/donate ingredients. Local healthy schools programme.	Access to school kitchens or community kitchens equipped for the safe and hygienic preparation and storage of food; teaching staff/school meals staff willing to participate out of hours; parents or volunteers to assist with supervision; ingredients and equipment; funding sources (eg Education Extra; The Foundation for After School Clubs).	Clubs take place out of school hours or in holidays and for most children this is a one day experience. Not a replacement for regular teaching of cooking skills; can be a useful part of a whole school approach; for some children this may be one of very few opportunities to cook.	http://www.wiredforhealth.gov.uk *Cooking for Kids project manual*. Available free from Joe Monks at the Department of Health tel 020 7972 2000. Focus on Foods campaign: http://www.waitrose.com/focusonfood/ Tel: 01422 383191.
Healthy tuck shops, break times and vending Food and drinks available at break times are an important part of a whole school approach to healthy eating and are an ideal opportunity to increase children's fruit and vegetable intakes.	Food Standards Agency has funded three studies promoting fruit and vegetables in schools (Anderson *et al.*, University of Dundee; Barker *et al.*, University of Sheffield; Moore *et al.*, University of Bristol).	Part of a 'whole school' approach to healthy eating; reinforces the taught curriculum on healthy eating and oral health; complements the new nutritional standards for school lunches; provides ideal opportunity to increase fruit and vegetable intakes and promote snacks safe for teeth.	Local growers, markets, greengrocers, food cooperatives and supermarkets; LEAs; school caterers, local and regional NHSS programme coordinators; head teachers and school governors; SNAGs; community development workers.	A dedicated person to manage ordering and preparation of fruit/vegetables; facilities for the safe and hygienic storage, washing and preparation of fruit and vegetables; for tuck shops/vending machines, someone to manage the money; a pricing policy where fruit is purchased; stock rotation and temperature in vending machines.	New National Plan for the NHS has announced a National School Fruit Scheme where every child in nursery and aged four to six years in infant schools will be entitled to a free piece of fruit every school day (see Breakfast and after school clubs). National Diet and Nutrition Survey of young people (Gregory *et al.* 2000) showed low intakes of fruit and vegetables and high intakes of confectionery and soft drinks. Fruit and vegetable intakes are lowest in households on low income and receiving benefits.	British Dietetic Association *Give Me 5 Pack* http://www.bda.uk.com/ Tel: 0121 633 9555. Information on EU intervention stocks of fruit (see Breakfast and after school clubs). *School food policy guide* produced by SNAG. Contact Joe Harvey, Health Education Trust (tel/fax: 01789 773915).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Cook and eat Sessions Mainly local initiatives, some based originally on the former *Get cooking!* programme.	Caraher *et al.* (1999) suggested that redesigned cooking and food classes changed diets of young people and their families. A general lack of cooking skills in the population was found and confidence to cook varied with age and gender (Lang *et al.* 1999). Increased self confidence and esteem found in *Get Cooking in Wales* (Caraher and Lang 1995). Saffron Food and Health Project (Dobson *et al.* 2000) suggests that the aim of community food projects must be to get people interested and improve confidence and basic cooking skills.	Sustain (2000) reported that such projects could increase nutritional knowledge and improve skills as long as the approach was relevant to participants' cultural and socio-economic circumstances. Evaluations also report wider health benefits such as reducing social isolation, and building self confidence. May provide a forum in which to discuss other health issues.	Sessions could be run in groups such as women's groups, youth clubs; church, temples or religious settings; local catering colleges, and home economics teachers; LACA; local retailers or gardening and allotment schemes for produce and ingredients; health visitors.	Venue, facilities and equipment for the safe and hygienic preparation and storage of food; funding; ingredients; a project leader with practical food preparation skills, food hygiene and nutritional knowledge; link workers/ peer educators, particularly for work with minority ethnic groups or young people; budget management skills.	Could be used to encourage intakes of fruit and vegetables by providing opportunity to taste new varieties. May provide a way in to working with certain audiences (eg South Asian women) as a socially acceptable activity.	Food and low income (FLI) database (http://www.hea.org.uk), our healthier nation in practice (OHNiP), HAZnet. South Asian cooking club in Luton HAZ is a Beacon Site and can be visited at: *http://www.ntsbeacons.org.uk/* Saffron Food and Health Project: *http://www.crsp.ac.uk* *Get cooking and get shopping* pack from Sustain, £14 (tel: 020 7837 1228). *OK! Let's cook*, Healthy Norfolk 2000, £2 (tel: 01603 487 990). *No dosh good nosh* from Nightsafe, Blackburn, £1 (tel: 0125 4587687).
Community cafes Run on a local and 'not for profit' basis, often part of a wider community centre offering other services; aim to provide affordable (not necessarily healthy) meals in a sociable atmosphere, to reduce social isolation.	Not well documented; an evaluation of a community café in southeast England (Kaduskar *et al.* 1999) could not determine whether the cafe was successful in its aim of providing cheap, good quality food.	Can help people access affordable meals; may reduce social isolation; empowerment of project workers and development of their skills base; may provide point of access to other health and social services.	LA, EHO and trading standards; funding could be available from regeneration related initiatives (eg New Deal for Communities and Single Regeneration Budget); links with local supermarkets, retailers, community owned retailing (food cooperatives) and growing schemes; local catering colleges, LACA (investigate peer education of local volunteers); job centres for caterers seeking work.	Venue, facilities and equipment for the safe and hygienic preparation of foods; a project leader with food preparation and book keeping skills; training in food preparation and food hygiene for volunteers and paid staff.	Cafes reliant on external funding, and so sustainability may be an issue; involving the community in development seems to lead to greater sustainability; should be run as a proper business, complying with environmental health (EH) and trading standards; local circumstances important: particularly good for people who are homeless, lack cooking facilities or are elderly/single on low income.	FLI database; OHNiP; HAZnet. *Just for starters* from the Health Education Board for Scotland (tel: 0131 536 5500) 'starting up' advice and recipes. Community Catering Initiatives conference report and 'how to' information, from Community Health UK, £7.50 + £1.75 (p&p) (tel: 01225 462 680). Heartbeat Award caterers' guide (see 'Catering awards').

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Community owned retailing (food cooperatives) Locally organised initiatives that can improve accessibility to foods such as fruit and vegetables in areas that lack local affordable supplies. In some areas it is difficult to access affordable good quality fruit and vegetables (PAT 13 1999).	Evaluations in Bolton and in Tower Hamlets and Stepney (Price and Sephton 1995; Ostasiewicz 1997) showed increased availability of fruit and vegetables. It allowed people to try new foods at affordable prices; increased the confidence, self esteem and developed new skills in those running the cooperative.	Likely to be broader than increasing the availability of fruit and vegetables alone (eg providing a social meeting place in the local community); empowerment of local community and skills development in those running it; Bolton Food cooperative developed spin-offs, supplying fruit tuckshops in schools and delivery to the elderly. The Tower Hamlets cooperative has subsequently developed a local farmers' market. Increase buying power by linking with other local food cooperatives.	LA EHO and trading standards; funding could be available from regeneration-related initiatives (eg New Deal for Communities and Single Regeneration Budget); suppliers such as local wholesalers, farmers' markets or community allotment and growing schemes.	Venue, including hygienic storage space and transport; equipment such as till, scales, float; start up costs and fuel costs; staff, including drivers and a bookkeeper.	Food cooperatives are legal entities and have to run on a membership basis. Fees for membership can help with start up costs. Commitment of the staff is essential to ensure survival. Payment for their time may help. There is a need to comply with trading standards and EH regulations, and to supply culturally appropriate foods. Food cooperatives are not viewed as a long-term solution but can be used alongside other regeneration initiatives to improve access. The *NHS Plan* states that the government will work with industry to increase provision of fruit and vegetables and where necessary to establish local food cooperatives.	*Start your own food co-op* video Bolton co-op, £15 (tel: 01204 360094/360095). *Food for thought* report and video. Wolverhampton Food Co-ops Umbrella Group Ltd, £1 (tel: 01902 304 851). *The co-op start up pack* CWS. Available free (tel: 0161 827 5349). CWS small grants Community Dividend Scheme (tel: 0161 827 5950). FLI database, OHNiP, HAZnet. Sandwell Beacon site http://www.nhsbeacons.org.uk/
Community growing schemes May vary from city farms to allotments or schemes set up on wasteland; can increase supplies of affordable vegetables and fruit locally; can be linked to food cooperatives; sometimes set up with an environmental rather than health agenda.	Bradford 'Gardening for Health' project, run with Bangladeshi women. Participants reported eating more fruit and vegetables, being more active, losing weight and feeling more confident to go out alone (Hussain and Robinson 2000).	May increase physical activity, reduce social isolation, and build confidence. Participants in the Bradford Project initially grew familiar Asian vegetables but then grew and started to eat British vegetable varieties which are cheaper; also developed marketable gardening skills.	Local Agenda 21 (LA 21) coordinators; LA leisure or environmental services; local horticultural colleges. Funding could be available from regeneration related initiatives (eg New Deal for Communities and Single Regeneration Budget). National Society of Allotment and Leisure Gardeners Ltd (tel: 01536 266576).	Start up costs; land, equipment, storage, water supply, seeds; project leaders with experience in gardening/ horticulture who will need to be paid; a bookkeeper; if working with black and minority ethnic groups may need a link worker.	Getting access to land and setting up an agreement for its use over a suitable period of time; possible contamination of land in some areas; sharing out produce between participants and/ or selling it on to food cooperatives, farmers' markets, community cafes; may be useful in areas of regeneration where access to affordable fruit and vegetables are poor. May help meet priorities of LA 21.	FLI database. Sustain publications: *Growing food in cities* (£10); *City harvest* (£30 full report, summary £5); tel: 020 7837 1228. Federation of City Farms and Community Gardens, *Starter pack* (tel 0117 923 1800).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Farmers' markets Markets that allow farmers and growers to sell directly to consumers, thereby reducing the price. They are often set up as environmental initiatives and require produce to be grown within a certain radius of the market. Some focus on organic produce.	Farmers' markets offer good value for money; provide an opportunity to buy fresh, local produce; give local people a sense of well being and belonging; provide a social meeting place; and also play a role in revitalising the local rural economy (Bur *et al*. 1999; Bullock 2000).	Improved access to affordable fruit and vegetables; retail outlet for community growing schemes; environmental benefits in that produce is not transported great distances; increased social capital.	LA and trading standards; any local growers' associations; LA 21 coordinator; National Association of Farmers' Markets (tel: 01225 787914); Soil Association local food links department (tel: 0117 914 2426).	Staff (paid or voluntary) to liaise with local council, growers and consumers; suitable venue in proximity to area of need; access to growers willing to participate within the locality.	Needs help and support from LA; need to encourage growers to participate; needs publicity; an accessible venue not requiring costly public transport; ensure *bona fide* growers only participate; may improve access to retail services and increase supply of affordable fruit and vegetables; may affect trade in local small shops. Meets priorities of LA 21.	The National Association of Farmers' Markets has a list of farmers' markets (tel: 01225 787914) http://www.farmersmarkets.net 'Eco-logic' publications on farmers' markets (tel: 01225 484472). The Soil Association provides training on setting up and running a farmers' market: (tel: 0117 914 2426).
Community shops and similar schemes Set up in response to closure of local shops on housing estates or in rural areas; may be run on a 'not for profit' basis, usually by volunteers.	Community shops are a recent innovation, which have not yet been evaluated.	Improved access to foods such as fruit and vegetables; useful in rural areas where public transport is poor; shop staff can develop marketable skills and gain work experience; can be part of neighbourhood renewal initiatives.	LA, EH department and trading standards; Village Retail Services Association (VIRSA; tel: 01305 259 383); funding could be available from regeneration-related initiatives (eg New Deal for Communities and Single Regeneration Budget). Community Owned Retailing: training and support in setting up neighbourhood shops (tel: 01435 883005) http://www.communit retailing.co.uk	Project leaders with retail experience and/or book keeping skills; driver and transport to travel to wholesalers; funding from grants or subsidies; suitable premises with storage facilities and equipment in the locality, which complies with EH and health and safety regulations.	'Not for profit', therefore dependent on grants or subsidies; membership fees can help start up costs; must comply with trading standards, EH regulations; in some areas more appropriate to take people to shops rather than shops to people (PAT 13 1999); could help improve access to fruit and vegetables; may contribute to neighbourhood renewal strategies.	*How to make your community shop succeed.* Community Enterprise Ltd (tel: 0131 475 2345). *Village shops and post offices: a guide to deployment of village investment to rescue, sustain and revive.* VIRSA, £15 (tel: 01305 259 383). *If the village shop closes .. a handbook on community shops*. Oxford Rural Community Council, £3.50 (tel: 01865 883488).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Transport to shops schemes Can be run on a local basis or by linking with supermarket chains or local retailers.	**Case study** Hackney Community transport developed to increase access to local activities for disabled and elderly people. 'Plusbuses' now run every 30 minutes on a fixed route which links up the local hospital, day centres, schools, shops and other transport interchanges.	Access to mainstream shops and services (PAT 13 1999). Overcome difficulties experienced by people in carrying heavy fruit and vegetables from shops.	Local supermarkets and local chamber of commerce or trade.	Drivers, vehicles and funding to support running costs; insurance and compliance with safety regulations.	Areas that need to be linked, frequency of services; linking with local retailers bus schemes. Schemes may be very useful in increasing access to affordable supplies of fruit and vegetables.	Community Transport Association (tel: 0161 367 8780). *Ferguslie Park Access to Shopping project report* (tel: 0141 887 9650).
Supermarket tours Usually led by a dietitian or nutritionist with small groups of consumers. May focus on interpreting food labels and health claims and on selecting foods and discussing healthier preparation methods. Sometimes used with groups with a particular area of interest (eg diabetes).	Increase in self reported 'healthy' purchases and behaviour compared with controls, one month after two-hour tour, but study was of poor quality (Silzer *et al.* 1994).	May be useful as part of a wider programme of healthy eating supermarket initiatives, but most need to be coordinated nationally rather than locally. Roe *et al.* (1997) found four good quality supermarket studies: three point of purchase labelling, one video feedback which showed increases in sales of promoted products while the study was running.	Supermarkets, nutritionists based in head office; local press; groups with particular interest (eg diabetics, mothers of young children).	Dietitian/public health nutritionist; good relationship with local supermarket and ability to identify and use PR opportunities.	Useful with groups with a particular focus (eg diabetics); useful to base the tour on *The balance of good health* (HEA, DH and MAFF 1994); opportunity to make links with local retailers.	Retailers' own materials based on *The balance of good health* (HEA, DH and MAFF 1994) could be used as a resource.
Catering awards For example, Heartbeat Award is a nationally recognised but locally run award made to caterers who adopt healthier practices, have good standards of food hygiene and offer nonsmoking seating. Usually run by LA EHOs in partnership with dietitians and health promotion specialists.	One of six schemes evaluated by HEA in 1998 showed significantly greater use of healthier catering practices in award holding premises (Paterson *et al.*, in preparation). A quarter of Heartbeat Award premises reported increases in sales of some healthier items but sales of less healthy choices tended to remain the same (Holdsworth *et al.* 1999). Greater provision of some healthier foods, healthier options and greater commitment to healthy eating (Warm *et al.* 1997).	Better relationships between caterers and EH department; good public relations (PR) for caterers, a commitment to customer care and to food hygiene training; difficult to demonstrate the effect of the scheme on the overall diet of consumers.	Caterers, catering trainers, employers, occupational health nurses; health promotion specialists with an interest in evaluation.	EH, dietetics and health promotion expertise on smoking policies; partnership working skills; evaluation skills; time for processing annual renewals in addition to new applications; funding to support scheme; PR support.	To maximise impact may be best concentrated in venues where the same people eat every day (eg workplaces, prisons); needs to have both dietetic and EHO input, requires a good working relationship between the two departments; could help to support HImPs as requires joint working between LA and HA trusts. Evaluation is vital, as funders may seek evidence of benefits before committing resources to continue the scheme. This will also help to build evidence base nationally.	*Heartbeat Award Starter pack: A caterer's guide to the Heartbeat Award* (packs 5); *Heartbeat Award flyers* (packs 50). Heartbeat award certificates and window stickers (packs 10 each). *A guide to evaluating the Heartbeat Award.* (HEA 1998). *The Heartbeat Award: Making the most of the media* (HEA 1996). All HEA publications available from Marston Book Services (tel: 01235 465565).

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Adoption of healthier catering practices in workplace catering and highlighting 'healthier' choices	Positive effect on food choices for the duration of interventions modifying recipes or highlighted healthier choices in variety of settings; no good quality studies in a workplace setting (Roe *et al.* 1997); increase in sales of low fat meals in the workplace when highlighted with symbols on menus and posters (Levin 1996). Making small changes to best selling dishes can be effective in promoting healthier choices, and presentation is important. Promoting menu items is successful where parallel choices are on offer (HEA 1998b).	Around an eighth of energy, fat, and saturated fat in the diet is from the food eaten away from home. Workplace caterers may prepare a significant proportion of meals for regular customers and so have an important influence on the overall diet.	Caterers, service staff, catering managers, chef trainers; workplace management, human resources, occupational health; contract caterers dietitians/in house chef trainers; community dietitians, Public Health Nutritionists, workplace health promotion specialists.	Some training of caterers and service staff; basic research skills to carry out needs assessment among customers.	Workplace offers a major opportunity to gain access to, and communicate with, a large proportion of the adult population; acknowledged by government as a useful setting for general health promotion. Covert changes to the menu overall have potential to benefit all customers, promoting healthier options only benefits customers that choose them. Should extend to vending and snack provision and to hospitality catering. May help caterer qualify for an HBA.	*Tipping the balance* video and workshop notes, HEA; *A caterer's guide to the Heartbeat Award*, HEA; *Dine out eat well*, leaflet, DH; *The national catering initiative: promoting healthier choices*, HEA; *Framework for action. Health at work in the NHS*, HEA. These publications are available free from Marston Book Services (tel: 01235 465565).
Promoting healthy eating in pre-schools, such as family centres run by social services or private day nurseries	Pre-school and day care centres were likely to be appropriate settings for interventions (Tedstone *et al.* 1998b).	Increase child carers, children and parents' nutritional knowledge; improve main meal provision and between meal snacks and drinks.	Health promotion specialists; LA early years adviser; voluntary sector (eg Pre-School Learning Alliance, National Childminding Association); local Sure Start programmes working in partnership with parents.	Community dental staff and community dietitians can provide specialist knowledge and local data (eg on oral health of under fives).	A comprehensive healthy eating policy should include all meals, should consider children with special requirements and should foster good eating skills and table manners. A more limited policy may not cover between meal snacks.	Website: http://www.surestart.gov.uk/home.cfm on Sure Start includes a comprehensive contact list for under 5s agencies and web links. Caroline Walker Trust (1998). *Eating well for under-5s in child care. Practical and nutritional guidelines.* 22 Kindersley Way, Abbots Langley, Hertfordshire, WD5 0DQ. Cost £12.95 (including p&p). Watt, R., ed., 1999. *Oral health promotion: a guide to effective working in pre-school settings.* London: HEA. Available free from Marston Book Services (tel: 01235 465565).

Table 3.7 Suggested activities to support local action

Primary care

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Individual patient risk assessment and advice	Some evidence for short-term effectiveness but no evidence of sustainability (Bull and Jamrozik 1998; Marcus *et al*. 1998; Eakin *et al*. 2000).	Identification of levels of activity, interventions based on predicted risk.	PHC staff.	Assessment protocols, tailored advice, responsive to client's needs, knowledge of health impact of physical activity on health.	NSF CHD requirement to 'identify all people at significant risk of cardiovascular disease … and offer them appropriate advice and treatment to reduce their risks' (Standard 4); knowledge of local facilities useful; knowledge of messages about physical activity may be low among PHC staff; focus on active living likely to be appropriate for many people.	Coats *et al*. (1995).
Counselling for behaviour change	Frequent professional contact is associated with adherence (Hillsdon *et al*. 1999). Long-term effects are more likely with continuing interventions and behavioural approaches (Simons-Morton *et al*. 1998).	Sustained behaviour change in target group, possible reduction in risk factors (eg hypertension) in target group.	PHC staff, physiotherapists, leisure professionals.	Motivational interviewing, good knowledge about physical activity and local facilities.	Availability and time of PHC staff; most effective in those actively contemplating increasing levels of physical activity.	Harland *et al*. (1999); Hillsdon *et al*. (1999).
Physical activity referral	Small but possibly meaningful improvements achieved (Riddoch *et al*. 1998); no evidence of long-term impact.	Effective partnership between health and leisure services, identification and referral of appropriate patients, sustained behaviour changes.	GP, PHC staff, leisure service personnel, HLC staff.	Collaboration with leisure services trained staff, community networks to support post-referral; costly, resource intensive.	Effectiveness improved when: staff are trained in behaviour change strategies, and quality supervision is achieved by adequate patient/practitioner ratios; opportunities for targeting groups with clinical conditions putting them at risk.	Riddoch *et al*. (1998).

Transport						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
Promotion of active transport This includes walking to school (eg Walking buses) and walking/cycling to work.	Walking is a key intervention to promote active lifestyles (Morris and Hardman 1997). Environmental changes are important to facilitate its uptake. Areas that promote the needs of cyclists and pedestrians have above average use of these modes (eg York transport policy: House of Commons 1996).	Reduced danger to pedestrians/cyclists by encouraging greater active transport; modal shift towards these transport choices.	LAs, education services; business; nongovernmental organisations (NGOs); local road safety officers; police; LA 21.	Cross sectional financing through HImPs possible; skills – joint working, target setting and planning.	Production of a local transport plan (LTP) is a requirement for LAs; promotion of cycling and walking is encouraged, as is joint working with HAs, HImP coordinators and others. Schemes addressing danger from vehicles (eg 20 mph zones) have shown dramatic accident reduction outcomes (61% drop in pedestrian casualties and a 67% drop in child pedestrian and cyclists casualties; Webster and Mackie 1996).	HEA (1998c, 1999b,c); DETR (1999, 2000). Free copies of the latter (*School travel strategies and plans. A best practice guide for local authorities*) are available, tel: 0870 1226236 (quoting: 99ASCS 0240A). WHO (1998); website: www.who.dk/environment/pamphlets

Schools						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
NHSS, 'whole school' approach	Positive outcomes have been reported following implementation of physical activity programmes in schools.	Suggests all pupils experience two hours of physical activity a week; encourages staff, pupils, parents/carers and other adults to become involved in promoting physical activity.	Staff, pupils, local education authority (LEA), healthy schools network, leisure services, transport department, NGOs (eg Sustrans).	In-service training of teachers.	Physical activity participation may enhance academic performance and encourage lifelong physical activity; provides positive environmental impact (eg reduced car travel); helps fulfil National Curriculum requirements for science and physical education as well as contributes to the national framework for personal, social and health education (PSHE).	The NHSS identifies criteria on physical activity to inform good practice and the implementation of a 'whole school' approach (NHSS 2000). NHSS support material on physical activity for primary and secondary schools; *NHSS physical activity*, DH and DfEE (2000). London: HDA. British Heart Foundation (BHF) (2000). http://www.wiredforhealth.gov.uk/
School travel plans [including Safer Routes to School (SRTS)]	Case studies have shown increases in cycling, walking and bus use (eg 'Walking buses') (DETR 2000a).	Improved environment for cycling and walking; changes in use of motorised travel to school; reduced road danger.	Staff, pupils, parents, local transport planners, NGOs (Sustrans), school governors.	May involve physical changes to road layout or school environment; provision of safe cycle parks.	School travel plans are supported by Integrated Transport White Paper (DETR 1998); can be incorporated into a local transport plan; links to local environmental concerns (Community Strategy, LA21).	The STAG report is available at: http://www.local-transport.detr.gov.uk/schooltravel/index.htm#1998-1999report DETR School Travel Plan Best Practice Guide: http://www.local-transport.detr.gov.uk/schooltravel/bpgla/index.htm School Travel Strategies and Plans Case Studies Report can be accessed at: http://www.local-transport.detr.gov.uk/schooltravel/bpgla/casestudies/index.htm In this guide, details are provided for urban and rural schools. Sustrans SRTS can be accessed at: http://www.sustrans.org.uk/f_srs.htm

Workplace interventions						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
'Green' transport plans (GTPs)	Schemes to promote walking to work can be effective (*Walk in to work out*, Mutrie *et al*. 1999); changes in travel modes when GTPs have been implemented.	Percentage of employers with developed transport plans; changes in workplace travel.	Staff, unions, local transport planners, local public transport providers.	Provide safe parking for bicycles and showers.	NSF CHD milestone: 'By April 2002 every local health community will ... have developed "green" transport plans' (milestone 3). Promotion of GTPs need not be confined to health service sites. Workplace cycling promotion in particular requires environmental changes (in the workplace and on the road).	Transport 2000 (1998). DETR advice for government departments: 'green transport guide' http://www.environment.detr.gov.uk/greening/fleet/gcont.htm DETR (1999, 2000b). Free copies of the latter (*School travel strategies and plans. A best practice guide for local authorities*) are available, tel: 0870 1226236 (quoting: 99ASCS 0240A). WHO (1998); website: www.who.dk/environment/pamphlets
Stair use promotion	Promotion of stair use was effective in Glasgow, using posters (Blamey *et al*. 1995).	Stair use to become the norm; increased prominence of stairs in building design compared to lifts/escalators; increased use of stairs.	Staff, unions, employers, architects.		Cheap intervention; objectives allied with environmental concerns (reduction in use of electricity).	

Leisure activities						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
Promoting use of facilities These include leisure and sports centres, community centres, and local community interventions for minority groups.	Access and cost are important determinants for many groups. Involving 'hard to reach' groups is likely to increase uptake and appropriateness of projects.	Identification of groups not participating in local provision; increased participation by 'hard to reach' groups; involvement in design and running of projects by representatives from specific local groups, such as older people, black and minority ethnic groups, young people, people with disabilities.	Leisure services, professionals/ community leaders involved with 'hard to reach' groups, PHC, community groups, HLCs.	Audit and evaluation skills, translation, knowledge of local facilities; community development skills; separate changing areas; provision of appropriate facilities.	Cultural and language issues may be important. 'Sporty' connotations of leisure and exercise centres can be off putting. HLC funding is available. Projects need to be additional to statutory provision and involve communities in development and management.	HEA (1997a,b, 1998b, 1999a). The Confederation of Indian Organisations runs an exercise project to increase levels of walking in the Asian community in Leicester (contact Sandeep Rohit, tel: 0116 225 9299, for details).

Community strategies/LA 21/neighbourhood renewal						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
Health walks and other non-facility based physical activity	Uncertainty about who participates and impacts on other physically active behaviours; 11% of the Sonning Common population; three times more women than men (Bartlett 1998); some evidence of a shift from car journeys to walking/cycling.	Local health walks, partnerships with transport/environment services; raised profile of physical activity; addresses some safety issues.	PHC staff, environment, planning and transport professionals, leisure services, LA 21.	Maps and/or marked routes, trained leaders.	Participants tend to be older and from higher socio-economic groups. Consider community gardening schemes or gardening on prescription.	Bartlett, H., 1998. *Walking the way to health.* BHF/ Consumers Association (CA). Sonning Common Health Walk programme an example (Bartlett 1998).
Integration of local plans	Environment important for informal physical activity (eg walking, active play) but frequently not formally evaluated.	Development of effective intersectoral partnerships; provision of safe, appropriately built design for active, high quality lifestyles.	Communities, local planners, architects, developers, business, Regional Development Agencies (RDAs), government offices, police.	Skills in developing partnerships across sectors.	LAs will have requirement to produce community strategies and many have LA21 plans. Neighbourhood renewal consultation was published recently. Supports several sustainable development aims. Personal safety is frequently an important concern restricting use of open space and needs to be addressed. Lottery funding (£125m) is available for 'Green and sustainable communities'.	New Opportunities Fund (NOF) website: http://www.nof.org.uk/env/temp.cfm?content=envi_1 Community strategy consultation website: http://www.local-regions.detr.gov.uk/consult/lgbill99/pcsdraft/index.htm DETR (1999, 2000b). Free copies of the latter (*School travel strategies and plans. A best practice guide for local authorities*) are available, tel: 0870 1226236 (quoting: 99ASCS 0240A). WHO (1998); website: http://www.who.dk/environment/pamphlets

Table 4.6 Suggested activities to support local action

Community

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Individual weight management integrated with population interventions	Individual strategies may be most effective alongside wider environmental interventions (Jeffery 1995; Nestle and Jacobson 2000).	Increase in accessible and safe settings for the promotion of physical activity; greater access to affordable and healthy food options.	HAs, education sector, local environment planners.	Awareness of the complexities in the aetiology of obesity and an understanding of the multifactorial approach to reducing obesity.	Mass media has limited short-term impact on physical activity participation but may have an impact in encouraging a climate of change (Cavill 1998).	
Small but steady change in diet and activity	Weight loss about 1–2 lb/week for a period of six months. In the longer term, weight loss can be maintained. Women who did some form of moderate exercise on a regular basis gained weight more slowly than those who were less active (Sherwood *et al*. 2000).	Weight reduction by about 10% of baseline weight; prevention of relapse to previous weight level.	Primary care team, dietitians, behavioural therapists.	Skill in encouraging patients who may become disillusioned with slow loss.	There is cumulative benefit in frequent, but short spells of physical activity.	
Combine diet, physical activity and behavioural therapy	A combination of interventions is most effective (Clinical Evidence 2000). Evidence suggests that effects are short term.	Improved links between leisure facilities, caterers, LAs and HAs.	Nutrition and physical activity experts.	Regular meetings between different sectors will be required. Identify lead person or organisation.	Frequent ongoing contact is suggested to help maintain the benefits.	

Schools						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
Secondary prevention in schools Use 'whole school' approach (Goran *et al*. 1999; Story 1999).	About a 10% mean reduction in overweight was reported (Story 1999). Younger (pre-adolescent) interventions were more successful. This result was based on a short-term follow up (mostly less than six months).	Prevent increases in weight in already overweight children.	School nurses, teachers, counsellors, local healthy schools programme.	Access to gyms and playing fields. Children can eat up to two meals per day in schools; families are not to incur the cost (Goran *et al*. 1999).	Need longer-term data to see whether weight loss can be sustained. Potential harmful effects (stigmatisation, eating disorders, labelling) may result. Potential framework for PSHE.	More information on young people's attitudes to diet, health and exercise can be found at: http://www.ex.ac.uk/~dregis/Pubs/yp98.html A summary of the side effects of treatment in children can be found in (Epstein *et al*. 1998).
Primary prevention in schools Use 'whole school' approach.	Approach shown to be effective (Story 1999).	Prevent becoming overweight or obese.	LAs, food sector, leisure facilities managers, teachers, school based counsellors, youth workers/youth clubs, parents, local healthy schools programme.		Provide a culturally appropriate intervention; include classroom health education classes; potential framework for PSHE.	A systematic review on health promotion in schools is available (Lister-Sharp *et al*. 1999). It can also be accessed on the Web: http://hta.nhsweb.nhs.uk
Supportive and respectful approach	Qualitative interviews of US children (Story 1999); increased adherence if approached in a sensitive manner.	Build self-confidence and self esteem.	Teachers, school based counsellors, parents, local healthy schools programme.	Will require trained youth counsellors/dietitians.	Be aware of adverse psychological impact.	

Children						
Intervention	**Evidence**	**Outcome**	**Who could be involved?**	**Skills and resources**	**Points to consider**	**Further information**
The 'Stoplight Diet' for treatment of pre-adolescent children It has 'red' foods for best avoided, 'amber' for foods that can be eaten in moderation and 'green' for plentiful.	Younger children achieved better weight loss, and maintenance of loss (Epstein *et al*. 1998).	Weight loss; modification of eating and exercise behaviours.	School based health carers (dietitians and school nurses), PE teachers, family.	Leaflets on diets.	Ensure the child has adequate nutrition for growth. Monitor psychological impact on children.	Epstein, L.H. and Squires, S.S., 1998. *The Stoplight Diet for children*. Boston, MA: Little, Brown and Co.
Regular daily activity in children; combine diet and exercise	Integrating regular activity into daily life is more effective than structured aerobic exercise. The effect was maintained at a two year follow up (Epstein *et al*. 1998).	Regular physical activity in daily life becomes the norm.	School, physical education (PE) teachers, exercise specialists, family, local parks and recreation areas; local healthy schools programme.	Education for parents and children will be required.	Safety issues with local urban planners and recreational division to ensure safe play areas.	BHF leaflets for parents: *Get kids on the go*: https://www.bhf.org.uk/publications/uploaded_pdfs/activechildren.pdf
Encourage less sedentary leisure time	Trial of reducing TV watching resulted in decreased adiposity (Robinson 1999). Trial of a reward system for decreasing sedentary behaviour showed a reduction in percentage overweight (Epstein *et al*. 1995).	Increased activity and less 'snacking' time.	Parents, teachers, youth workers, local healthy schools programme.	Teachers to explain how to be selective in choice of TV watching; leaflets to parents about recording child's activities; TV monitoring boxes could be considered.	Long-term outcome not yet known.	
Family group sessions with dietary advice, and regular visits to GP	Prevented progression to severe obesity in adolescence in 10- and 11-year-olds (Flodmark *et al*. 1993), but no difference at one-year follow up. A trial with a 10-year follow up showed that involvement of parent and child was most effective (Epstein *et al*. 1998). Inclusion of mastery element (taking control of own behaviours) and use of rewards were found to be more effective in reducing weight in children.	Encourage changes in habitual lifestyle by all family members.	Counselling services, dietitians, PCGs, school nurses.		One study shows that if the child and parent are counselled separately, better weight loss is achieved. Both are involved in the process, but are seen apart. Self-monitoring and goal setting praise are suggested. Gradual behavioural therapy over a longer period of time had a better long-term effect than intense sessions (Epstein *et al*. 1998).	

Primary care level

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Individualised advice and risk assessment Provide regular follow up contact.	Group sessions appeared more effective (Hughes and Martin 1999). Sustained weight loss in primary care settings is uncommon (Hughes and Martin 1999).	Appropriately tailored interventions for particular groups lead to better compliance and effective outcomes; can be used for higher risk groups such as ethnic minority or disabled groups.	Primary care teams, GPs, community dietitians, community (ethnic group) link workers, health visitors.	Link with local community groups working with ethnic minorities; language skills, recognition of cultural and religious requirements; see Improving diet and nutrition (Chapter 2) for interventions.	Assessing readiness to change is important when recommending a weight reduction programme (Dietz 1999). Identify barriers (access to affordable, nutritious food, child care arrangements, opening hours of facilities).	A framework has been developed that runs through the stages of promoting exercise for weight management from assessing readiness to change to the process of change and interventions (Biddle and Fox 1998).
Exercise as integral part of intervention Encourage friends and family to accompany participant (maybe a buddy scheme where participants can link up with another member of the group).	Moderate (short-term) effects of primary care based counselling and interventions tailored to particular needs with written materials had a stronger effect (Eakin *et al.* 2000).	Increased activity as part of everyday living; better balance of energy intake and expenditure.	PCGs, practice nurses, leisure facility personnel; some health visitors have this role.	Training for primary care teams about the role of physical activity; see Increasing physical activity (Chapter 3).	A motivated coordinator and supportive team may improve outcomes. Patients should be given choice of activity (including home based) (Hillsdon 1998). Exercise referral schemes can identify suitable candidates and establish the responsibilities within a programme between the parties (Hughes and Martin 1999), but recruitment and adherence may be fairly low and not reach those with most to gain (Hillsdon 1998)	
Energy-restricted diet (1,000-2,000 kcal/day) rather than fat restricted diet (22-26 g/day)	Randomised controlled trial (RCT) showed greater weight loss in the energy restricted diet, at 18 month follow up (Clinical Evidence 2000).		Dietitians, practice nurses.	Training for health professionals (see Improving diet and nutrition, Chapter 2).		See Improving diet and nutrition (Chapter 2).
Specialist weight loss clinic within a GP practice	A weekly clinic (with a health visitor) achieved weight loss even at a one-year follow up; 33% achieved a 10% weight reduction and 6% maintained this loss at one year (Sleath 1999).	Maintenance of weight loss through regular follow up.	PCG, health visitor, community dietitian.	Room in the practice; training for a health visitor (which could be shared between practices in the area).		

Maintenance of weight loss

Intervention	Evidence	Outcome	Who could be involved?	Skills and resources	Points to consider	Further information
Frequent contact over long term	Systematic review showed that any type of frequent contact led to less weight gain (Clinical Evidence 2000). Interventions should last for least six months and incorporate continuing contact to prevent weight regain (National Heart, Lung and Blood Institute 1998). Face to face contact (house visits) were shown to be effective in reducing weight regain in one RCT (more so than phone or letter contact) (Clinical Evidence 2000).	Reduce weight gain.	GP, practice nurse or weight specialist.	Resources to follow up over longer time period required (staff/phone calls/letter); frequent or long-term follow up may require extra practice resources.	Self-help peer groups, self-management techniques and family or spousal involvement may all be of some help (Clinical Evidence 2000).	
Provision of home exercise equipment Also supervised exercise sessions with simple behavioural therapy (SBT) at one year compared with SBT and simple exercise (Clinical Evidence 2000).	Improved weight loss achieved with provision of exercise equipment for the home combined with advice on continuous exercise (versus intermittent) (Clinical Evidence 2000). Supervised exercise sessions (three times a week for 12 weeks) plus SBT was more effective in weight loss at one year, but another found that supervised walks or a personal trainer resulted in less weight loss than SBT alone (Clinical Evidence 2000).	Cumulative daily activity can be of benefit in a weight control programme and can improve adherence (Jakicic *et al.* 1995).	Physical activity advisor, counselling services.	Supervised sessions require extra resources. Liaison with leisure facilities or local suppliers may make it easier to provide home based equipment (consider a renting scheme?).	Approach can encourage sedentary people to become more active. Smaller bouts of activity may appear more attainable. Aim to accumulate about 30 minutes of activity per day (National Heart, Lung and Blood Institute 1998).	
Commercial weight loss programmes	Evidence that better weight loss is achieved in group settings (Davis *et al.* 2000).	Improve psychological well-being. Make the process of losing weight more enjoyable.		Motivated class leader may be important.	Evaluation tools for commercial weight loss programmes are needed (Conley 1998).	

Appendix 3: Nine components of comprehensive tobacco control programs (CDC, 1999a)

Community Programs to Reduce Tobacco Use (Base funding of $850,000–$1.2 million per year for State personnel and resources; $0.70–$2.00 per capita per year for local governments and organizations).

Local community programs cover a wide range of prevention activities including engaging youth in developing and implementing tobacco control interventions; developing partnerships with local organizations; conducting educational programs for young people, parents, enforcement officials, community and business leaders, health care providers, school personnel, and others; and promoting governmental and voluntary policies to promote clean indoor air, restrict access to tobacco products, provide coverage for treatment, and achieve other policy objectives. In California and Massachusetts, local coalitions and programs have been instrumental in achieving policy and program objectives. Program funding levels range from approximately $1.00 per capita in California to over $2.50 per capita in Massachusetts.

Chronic Disease Programs to Reduce the Burden of Tobacco-Related Diseases ($2.8 million–$4.1 million per year).

Even if current tobacco use stopped, the residual burden of disease among past users would cause disease for decades to come. As part of a comprehensive tobacco control program, communities can focus attention directly on tobacco-related diseases both to prevent them and to detect them early. The following are examples of such disease programs and recommended funding levels:

- Cardiovascular disease prevention ($500,000 for core capacity and $1–$1.5 million for a comprehensive program).

- Asthma prevention (base funding of $200,000–$300,000 and $600,000–$800,000 to support initiatives at the local level).

- Oral health programs ($400,000–$700,000).

- Cancer registries ($75,000–$300,000).

School Programs ($500,000–$750,000 per year for personnel and resources to support individual school districts; $4–$6 per student in grades K–12 for annual awards to school districts).

School program activities include implementing CDC's *Guidelines for School Health Programs to Prevent Tobacco Use and Addiction*, which call for tobacco-free policies, evidence-based curricula, teacher training, parental involvement, and cessation services; implementing evidence-based curricula identified through CDC's Research to Classroom Project; and linking school-based efforts with local community coalitions and statewide media and educational campaigns. Oregon has developed a new funding model for school programs based upon CDC's guidelines and experience in California and Massachusetts. At an annual funding level of approximately $1.60 per student, Oregon was able to provide grants to approximately 30% of

their school districts. Assuming 100% coverage of school districts using a funding model similar to the Oregon model, $4–$6 per student in grades K–12 should be budgeted.

Enforcement ($150,000–$300,000 per year for interagency coordination; $0.43–$0.80 per capita per year for enforcement programs).

Enforcement of tobacco control policies enhances their efficacy by deterring violators and by sending a message to the public that community leaders believe that these policies are important. The two primary policy areas that require enforcement activity are restrictions on minors' access to tobacco and on smoking in public places. State efforts should be coordinated with Food and Drug Administration (FDA) and Substance Abuse and Mental Health Services Administration (SAMHSA) Federal programs. California and Massachusetts have addressed enforcement issues as part of community program grants. Florida has taken a more centralized approach by using State Alcoholic Beverage Control Officers to conduct compliance checks with locally recruited youth in all regions of the State.

Statewide Programs (Approximately $0.40–$1 per capita per year).

Statewide projects can increase the capacity of local programs by providing technical assistance on evaluating programs, promoting media advocacy, implementing smokefree policies, and reducing minors' access to tobacco. Supporting organizations that have statewide access to racial, ethnic, and diverse communities can help eliminate the disparities in tobacco use among the State's various population groups. Statewide and regional grants to organizations representing cities, business and professional groups, law enforcement, and youth groups inform their membership about tobacco control issues and encourage their participation in local efforts. Both California and Massachusetts have awarded grants to statewide organizations, businesses, and other partners that total about $0.40 to $1.00 per capita per year.

Counter-Marketing ($1–$3 per capita per year).

Counter-marketing attempts to counter pro-tobacco influences and increase pro-health messages and influences throughout a State, region, or local community. Counter-marketing consists of a wide range of efforts, including paid television, radio, billboard, and print counter-advertising at the State and local level; media advocacy and other public relations techniques using such tactics as press releases, local events, and health promotion activities; and efforts to reduce or replace tobacco industry sponsorship and promotions. Counter-marketing activities can promote smoking cessation and decrease the likelihood of initiation. They also can have a powerful influence on public support for tobacco control interventions and set a supportive climate for school and community efforts. Counter-marketing campaigns are a primary activity in all States with comprehensive tobacco control programs. With funding levels ranging from less than $1.00 per capita up to almost $3.00 per capita, the campaigns in California, Massachusetts, Arizona, and Florida have been trendsetters in content and production quality.

Cessation Programs ($1 per adult to identify and advise smokers about tobacco use; $2 per smoker to provide brief counseling; and the cost of a full range of cessation services including pharmaceutical aids, behavioral counseling, and follow up visits ($137.50 per served smoker covered by private insurance; $275 per served smoker covered by publicly financed insurance).

Strategies to help people quit smoking can yield significant health and economic benefits. Effective cessation strategies include brief advice by medical providers, counseling, and pharmacotherapy. In addition, system changes (e.g., tobacco-use screening systems, clinician training, and insurance coverage for proven treatments) are critical to the success of cessation interventions. State action should include establishing population-based treatment programs such as telephone cessation helplines; covering treatment of tobacco use under both public and private insurance; and eliminating cost barriers to treatment for underserved populations, particularly the uninsured. No State currently is fully implementing the Agency for Health Care Policy and Research smoking cessation guidelines. Massachusetts and California are implementing the basic recommended elements. The complete recommended program is being implemented in several large health maintenance organizations around the country.

Surveillance and Evaluation (10% of total annual program costs).

A surveillance and evaluation system monitors program accountability for State policymakers and others responsible for fiscal oversight. Surveillance is the monitoring of tobacco-related behaviors, attitudes, and health outcomes at regular intervals of time. Program evaluation efforts build upon surveillance systems by linking statewide and local program efforts to progress in achieving intermediate and primary outcome objectives. Experience in California, Massachusetts, and other States has demonstrated that the standard public health practice guideline of devoting 10% of program resources to surveillance and evaluation is a sound recommendation. State surveillance efforts should be coordinated with Federal tobacco surveillance programs such as SAMHSA's National Household Survey on Drug Abuse.

Administration and Management (5% of total annual program costs).

An effective tobacco control program requires a strong management structure to facilitate coordination of program components, involvement of multiple State agencies (e.g., health, education, and law enforcement) and levels of local government, and partnership with statewide voluntary health organizations and community groups. In addition, administration and management systems are required to prepare and implement contracts and provide fiscal and program monitoring. Experience in California and Massachusetts has demonstrated that at least 5% of program resources is needed for adequate staffing and management structures.

Appendix 4: U.S. Preventive Services Task Force Recommendations Relevant to Chronic Disease Prevention

Standard Recommendation Language

A—The USPSTF strongly recommends that clinicians routinely provide [the service] to eligible patients. (The USPSTF found good evidence that [the service] improves important health outcomes and concludes that benefits substantially outweigh harms.)

B—The USPSTF recommends that clinicians routinely provide [the service] to eligible patients. (The USPSTF found at least fair evidence that [the service] improves important health outcomes and concludes that benefits outweigh harms.)

C—The USPSTF makes no recommendation for or against routine provision of [the service]. (The USPSTF found at least fair evidence that [the service] can improve health outcomes but concludes that the balance of the benefits and harms is too close to justify a general recommendation.)

D—The USPSTF recommends against routinely providing [the service] to asymptomatic patients. (The USPSTF found at least fair evidence that [the service] is ineffective or that harms outweigh benefits.)

I—The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing [the service]. (Evidence that [the service] is effective is lacking, of poor quality, or conflicting and the balance of benefits and harms cannot be determined.)

Cancer screening

Breast Cancer (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommends** screening mammography, with or without clinical breast examination (CBE), every 1-2 years for women aged 40 and older **"B" Recommendation**

Bladder Cancer (1996)

Routine screening for bladder cancer with urine dipstick, microscopic urinalysis, or urine cytology is **not recommended** in asymptomatic persons.

All persons who smoke tobacco should be routinely counseled to quit smoking.

Cervical Cancer (Update, 2003 Release)

The USPSTF **strongly recommends** screening for cervical cancer in women who have been sexually active and have a cervix **("A" Recommendation)**

The USPSTF **recommends against** routinely screening women older than age 65 for cervical cancer if they have had adequate recent screening with normal Pap smears and are not otherwise at high risk for cervical cancer **("D" Recommendation)**

The USPSTF **recommends against** routine Pap smear screening in women who have had a total hysterectomy for benign disease **("D" Recommendation)**

The USPSTF concludes that **the evidence is insufficient to recommend for or against** the routine use of new technologies (such as liquid-based cytology, computerized rescreening, and algorithm based screening) to screen for cervical cancer**.**

The USPSTF concludes that **the evidence is insufficient to recommend for or against** the routine use of *human papillomavirus* (HPV) testing as a primary screening test for cervical cancer.

Colorectal Cancer (Update, 2002 Release)

The USPSTF **strongly recommends** that clinicians screen men and women 50 years of age or older for colorectal cancer. **("A" Recommendation)**

- The USPSTF found fair to good evidence that several screening methods are effective in reducing mortality from colorectal cancer. It found good evidence that periodic fecal occult blood testing (FOBT) reduces mortality from colorectal cancer and fair evidence that sigmoidoscopy alone or in combination with FOBT reduces mortality. The USPSTF did not find direct evidence that screening colonoscopy is effective in reducing colorectal cancer mortality; efficacy of colonoscopy is supported by its integral role in trials of FOBT, extrapolation from sigmoidoscopy studies, limited case-control evidence, and the ability of colonoscopy to inspect the proximal colon. Double-contrast barium enema offers an alternative means of whole-bowel examination, but it is less sensitive than colonoscopy, and there is no direct evidence that it is effective in reducing mortality rates. The USPSTF found insufficient evidence that newer screening technologies (for example, computed tomographic colography) are effective in improving health outcomes

Lung Cancer (1996)

Routine screening with chest radiography or sputum cytology in asymptomatic persons is **not recommended.**

All patients should be counseled against tobacco use.

Oral Cancer (1996)

There is **insufficient evidence to recommend for or against** routine screening of asymptomatic persons for oral cancer by primary care clinicians.

All patients should be counseled to:

Discontinue the use of all forms of tobacco.

Limit consumption of alcohol.

Clinicians should remain alert to signs and symptoms of oral cancer and premalignancy in persons who use tobacco or regularly use alcohol.

Ovarian Cancer (1996)

Routine screening for ovarian cancer by ultrasound, the measurement of serum tumor markers, or pelvic examination is **not recommended.**

There is **insufficient evidence to recommend for or against** the screening of asymptomatic women at increased risk of developing ovarian cancer.

Pancreatic Cancer (1996)

Routine screening for pancreatic cancer in asymptomatic persons, using abdominal palpation, ultrasonography, or serologic markers, is **not recommended**.

Prostate Cancer (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that **the evidence is insufficient to recommend for or against** routine screening for prostate cancer using prostate specific antigen (PSA) testing or digital rectal examination. (**"I" Recommendation)**

Skin Cancer (Update, 2001 Release)

The U.S. Preventive Services Task Force (USPSTF) concludes that **the evidence is insufficient to recommend for or against** routine screening for skin cancer using a total-body skin examination for the early detection of cutaneous melanoma, basal cell cancer, or squamous cell skin cancer. **"I" Recommendation**

Testicular Cancer (1996)

There is **insufficient evidence to recommend for or against** routine screening of asymptomatic men in the general population for testicular cancer by physician examination or patient self-examination.

Recommendations to discuss screening options with selected high-risk patients may be made on other grounds.

Thyroid Cancer (1996)

Routine screening for thyroid cancer using neck palpation or ultrasonography is **not recommended** for asymptomatic children or adults.

There is **insufficient evidence to recommend for or against** screening persons with a history of external head and neck irradiation in infancy or childhood, but recommendations for such screening may be made on other grounds.

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Screening for other conditions

Abdominal Aortic Aneurysm (1996)

There is **insufficient evidence to recommend for or against** routine screening of asymptomatic adults for abdominal aortic aneurysm with abdominal palpation or ultrasound.

Asymptomatic Carotid Artery Stenosis (1996)

There is **insufficient evidence to recommend for or against** screening asymptomatic persons for carotid artery stenosis using the physical examination or carotid ultrasound.

For selected high-risk patients, a recommendation to discuss the potential benefits of screening and carotid endarterectomy may be made on other grounds.

All persons should be screened for hypertension, and clinicians should provide counseling about smoking cessation.

Asymptomatic Coronary Artery Disease (1996)

There is **insufficient evidence to recommend for or against** screening middle-aged and older men and women for asymptomatic coronary artery disease, using resting elecrocardiography (ECG), ambulatory ECG, or exercise ECG.

Recommendations against routine screening can be made on other grounds for individuals who are not at high risk of developing clinical heart disease.

Routine screening is **not recommended** as part of the periodic health visit or pre-participation sports examination for children, adolescents, or young adults.

Clinicians should emphasize proven measures for the primary prevention of coronary disease.

Depression (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommend**s screening adults for depression in clinical practices that have systems in place to assure accurate diagnosis, effective treatment, and followup **("B" Recommendation)**

The USPSTF concludes **the evidence is insufficient to recommend for or against** routine screening of children or adolescents for depression.

Diabetes Mellitus, Adult Type II (Update, 2003 Release)

The USPSTF concludes that **the evidence is insufficient to recommend for or against** routinely screening asymptomatic adults for type 2 diabetes, impaired glucose tolerance, or impaired fasting glucose.

The USPSTF **recommends** screening for type 2 diabetes in adults with hypertension or hyperlipidemia. **("B" Recommendation)**

The U.S. Preventive Services Task Force (USPSTF) concludes that **the evidence is insufficient to recommend for or against** routine screening for gestational diabetes (GDM).

The USPSTF found **insufficient evidence** that screening for GDM substantially reduces important adverse health outcomes for mothers or their infants (for example, cesarean delivery, birth injury, or neonatal morbidity or mortality).

Hypertension (Update, 2003)

The USPSTF **strongly recommends** that clinicians screen adults aged 18 and older for high blood pressure ("A" Recommendation)

The USPSTF concludes that **the evidence is insufficient** to recommend for or against routine screening for high blood pressure in children and adolescents to reduce the risk of cardiovascular disease ("I" Recommendation)

Lipid Disorders in Adults (Update, 2001 Release)

The U.S. Preventive Services Task Force (USPSTF) **strongly recommends** that clinicians routinely screen men aged 35 years and older and women aged 45 years and older for lipid disorders and treat abnormal lipids in people who are at increased risk of coronary heart disease. **("A" Recommendation)**

The USPSTF **recommends** that clinicians routinely screen younger adults (men aged 20 to 35 and women aged 20 to 45) for lipid disorders if they have other risk factors for coronary heart disease **("B" Recommendation)**

The USPSTF **makes no recommendation** for or against routine screening for lipid disorders in younger adults (men aged 20 to 35 or women aged 20 to 45) in the absence of known risk factors for coronary heart disease **("C" Recommendation)**

The USPSTF **recommends** that screening for lipid disorders include measurement of total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C) **("B" Recommendation)**

The USPSTF concludes that **the evidence is insufficient to recommend for or against** triglyceride measurement as a part of routine screening for lipid disorders

Obesity (1996)

Periodic height and weight measurements are **recommended** for all patients.

Osteoporosis (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **recommends** that women aged 65 and older be screened routinely for osteoporosis. The USPSTF **recommends** that routine screening begin at age 60 for women at increased risk for osteoporotic fractures. **"B" Recommendation**

The USPSTF **makes no recommendation for or against** routine osteoporosis screening in postmenopausal women who are younger than 60 or in women aged 60-64 who are not at increased risk for osteoporotic fractures. **"C" Recommendation**

Peripheral Arterial Disease (1996)

Routine screening for peripheral arterial disease in asymptomatic persons is **not recommended.**

Clinicians should be alert to symptoms of peripheral arterial disease in persons at increased risk, and should evaluate patients who have clinical evidence of vascular disease.

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Counselling

Gynecologic Cancers (1996)

There is **insufficient evidence** to recommend for or against routine counseling of women about measures for the primary prevention of gynecologic cancers.

Clinicians counseling women about contraceptive practices should include information on the potential benefits of the following with respect to gynecologic cancers:

- Oral contraceptives.
- Barrier contraceptives.
- Tubal sterilization.

Clinicians should also promote other practices:

- Maintaining desirable body weight.
- Smoking cessation.
- Safe sex practices.

These measures may reduce the incidence of certain gynecologic cancers and have other proven health benefits.

Healthy Diet Counseling (Update, 2003 Release)

The USPSTF **recommends** intensive behavioral dietary counseling for adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease. Intensive counseling can be delivered by primary care clinicians or by referral to other specialists, such as nutritionists or dietitians. **("B" Recommendation)**

The U.S. Preventive Services Task Force (USPSTF) concludes that **the evidence is insufficient to recommend for or against** routine behavioral counseling to promote a healthy diet in unselected patients in primary care settings

Physical Activity Update, 2002 Release

The U.S. Preventive Services Task Force (USPSTF) concludes that the evidence is **insufficient to recommend for or against** behavioral counseling in primary care settings to promote physical activity. **"I" Recommendation**

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Chemoprevention

Aspirin for the Primary Prevention of Cardiovascular Events (Update, 2002 Release)

The U.S. Preventive Services Task Force (USPSTF) **strongly recommends** that clinicians discuss aspirin chemoprevention with adults who are at increased risk for coronary heart disease (CHD). Discussions with patients should address both the potential benefits and harms of aspirin therapy. **"A" Recommendation**

Vitamin Supplementation to Prevent Cancer and Cardiovascular Disease (New Topic, 2003)

The USPSTF concludes that **the evidence is insufficient** to recommend for or against the use of supplements of vitamins A, C, or E; multivitamins with folic acid; or antioxidant combinations for the prevention of cancer or cardiovascular disease **("I" Recommendation)**

The USPSTF **recommends against** the use of beta-carotene supplements, either alone or in combination, for the prevention of cancer or cardiovascular disease **("D" Recommendation)**

Appendix 5: Findings and Recommendations from "*Treating Tobacco Use and Dependence*" (CDC, 2000)

Tobacco dependence is a chronic condition that often requires repeated intervention.

However, effective treatments exist that can produce long-term or even permanent abstinence.

Because effective tobacco dependence treatments are available, every patient who uses tobacco should be offered at least one of these treatments.

- Patients *willing* to try to quit tobacco use should be provided treatments identified as effective in this guideline.

- Patients *unwilling* to try to quit tobacco use should be provided a brief intervention designed to increase their motivation to quit.

It is essential that clinicians and health care delivery systems (including administrators, insurers, and purchasers) institutionalize the consistent identification, documentation, and treatment of every tobacco user seen in a health care setting.

Brief tobacco dependence treatment is effective, and every patient who uses tobacco should be offered at least brief treatment.

There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness.

Treatments involving person-to-person contact (via individual, group, or proactive telephone counseling) are consistently effective, and their effectiveness increases with treatment intensity (e.g., minutes of contact).

Three types of counseling and behavioral therapies were found to be especially effective and should be used with all patients attempting tobacco cessation:

- Provision of practical counseling (problemsolving/skills training).

- Provision of social support as part of treatment (intra-treatment social support).

- Help in securing social support outside of treatment (extra-treatment social support).

Numerous effective pharmacotherapies for smoking cessation now exist. Except in the presence of contraindications, these should be used with all patients attempting to quit smoking.

Five *first-line* pharmacotherapies were identified that reliably increase long-term smoking abstinence rates:

- Bupropion SR.
- Nicotine gum.
- Nicotine inhaler.
- Nicotine nasal spray.
- Nicotine patch.

Two *second-line* pharmacotherapies were identified as efficacious and may be considered by clinicians if first-line pharmacotherapies are not effective:

- Clonidine.
- Nortriptyline.

Over-the-counter nicotine patches are effective relative to placebo, and their use should be encouraged.

Tobacco dependence treatments are both clinically effective and cost-effective relative to other medical and disease prevention interventions.

As such, insurers and purchasers should ensure that:

- All insurance plans include as a reimbursed benefit the counseling and pharmacotherapeutic treatments identified as effective in this guideline.
- Clinicians are reimbursed for providing tobacco dependence treatment just as they are reimbursed for treating other chronic conditions.

Appendix 6: Strategies and Goals for Improving Cardiovascular Health at the Community Level (Source: American Heart Association Guide – Pearson et al, 2003)

Assessment: All persons and communities should know that CVD and stroke are the leading causes of death and disability in men and women.

General health education: All communities should

- provide information to their members about the burden, causes, and early symptoms of CV D and stroke
- provide materials and programs to motivate and teach skills for changing risk behaviors that will target multiple population subgroups.

School and youth education: all schools should

- have research-based, comprehensive, and age-appropriate curricula about cardiovascular health and ways to improve health behaviors and reduce CVD risk
- implement age-appropriate curricula on changing dietary, physical activity, and smoking behaviors
- provide teaching of early warning signs of myocardial infarction and stroke and appropriate initial steps of emergency care.

Work site education: all worksites should

- provide materials and services to motivate and assist employees to adopt and maintain heart-healthy behaviors
- provide instruction in early warning signs of myocardial infarction and stroke and appropriate initial steps of emergency care.

Health care facility education: all health care facilities should make available research-based, effective educational materials and programs about changing and maintaining risk factors/risk behaviors, ways to prevent CVD and stroke, and early warning signs of CVD and stroke.

Community organization and partnering: All communities will

- have an action plan for CVD and stroke prevention and control with specific targets and goals
- provide materials and services for risk behavior and risk factor change that are research based whenever possible.

Assuring personal health services:

- Increased percentage of people at risk who will effectively reduce risk factors to goal levels as established by AHA Guidelines for primary and secondary prevention of heart disease and stroke

- increase the percentage of patients suffering acute coronary syndromes (e.g. myocardial infarction, cardiac arrhythmias) or cerebrovascular syndromes (e.g. stroke, transient ischaemic attack) who receive appropriate acute interventions within the time frame of maximal effectiveness

- provide training about smoking , physical activity , nutrition , a and effective behavior change counselling methods in medical schools and appropriate residency programs.

Environmental change:

- Assured access to healthy foods so that all members of the community can meet national dietary recommendations for saturated fat, sodium, grains, fruits and vegetables

- assure access to safe, appropriate, and enjoyable forms of physical activity so that people of all ages can meet national guidelines for moderate and vigorous physical activity

- ensure a tobacco-free environment for all citizens

Policy change:

- reduce initiation of tobacco use by adolescents and young adults

- provide adequate reimbursement for clinical preventive and rehabilitative services.