



Pathways to Support the Oral Health of Canadians



The CDHA Dental Hygiene Education Agenda

May 2009

ACKNOWLEDGEMENT

CDHA would like to thank the author of this paper, Susanne Sunell, the planning committee members (Sharon Compton, Dianne Landry, Judy Lux, and Susanne Sunell), workshop participants (Bonnie Blank, Louise Bourassa, Ginny Cathcart, Dr. Sharon Compton, Professor Bonnie Craig, Brenda Currie, Diane Gallagher, Patricia D. Grant, Kellie Hildebrandt, Linda Jamieson, Fran Richardson, Alexandra Sheppard, Dr. Susanne Sunell, Brenda Udahl, Patricia Manacki), CDHA staff (Judy Lux and Dr. Susan Ziebarth) and other stakeholders.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	1
Purpose.....	1
Context.....	1
Oral Health of Canadians.....	1
CDHA Education Outcomes.....	3
Conclusion.....	3
INTRODUCTION.....	4
THE DENTAL HYGIENE PROFESSION DEFINED.....	5
DENTAL HYGIENE EDUCATION IN CANADA.....	6
FACTORS IMPACTING THE ORAL HEALTH OF CANADIANS.....	7
The Mouth–Body Connection.....	7
Burden of Oral Disease.....	9
Building the Capacity of the Oral Health Workforce.....	12
1. <i>Using Research to Inform Practice</i>	13
2. <i>Health Literacy Abilities</i>	14
3. <i>Self Management Education Abilities</i>	14
4. <i>Abilities to Work in Interprofessional Teams</i>	15
Legislative Issues.....	16
Themes in Postsecondary Education.....	17
Need for Research in Dental Hygiene.....	23
PATHWAYS TO SUPPORT THE ORAL HEALTH OF CANADIANS.....	26
VISION FOR DENTAL HYGIENE EDUCATION.....	31
CONCLUSION.....	32
REFERENCES.....	34

EXECUTIVE SUMMARY

Building the capacity of the health workforce has become an issue of increasing importance nationally and internationally. It reflects the rising prevalence of chronic and preventable diseases in our societies, and the likelihood of pandemic emergencies. Health organizations are focusing on the abilities that are needed by health professionals to provide quality services and safe care in the 21st century. The focus is directed towards capacity building initiatives within the workplace and the alignment of educational programs to integrate the abilities identified as being increasingly important in health care. The education of entry-to-practice professionals is central to these discussions.

PURPOSE

This report is directed to the exploration of variables that are influencing the dental hygiene profession and impacting on the educational needs of dental hygienists as they strive to promote the oral health of Canadians. It will focus on the educational pathways needed for dental hygienists so they can assume a greater role in the shaping of the Canadian health care system to achieve better oral health outcomes for Canadians.

CONTEXT

Dental hygienists are primary oral health professionals who provide service in a variety of public and private health care settings. They specialize in services related to oral health education, health promotion and clinical services. The evolution of dental hygiene education in Canada has resulted in a diversity of entry-to-practice programs ranging from 2-year and 3-year diploma programs to 4-year bachelor's degree programs. However, the pathways for bachelor's degree education are few when compared to countries such as the United States, Sweden, Australia, Korea, Finland and the Netherlands. To access discipline-specific graduate programs, Canadian dental hygienists must go abroad.

ORAL HEALTH OF CANADIANS

The factors affecting oral health of Canadians are numerous and complex. They involve an increased awareness of the relationship between oral and general health including quality of life, and the increased recognition that the burden for oral disease involves populations that have the least capacity to access care. While our knowledge of oral health has led to improvements in the oral health status of Canadians, large disparities still exist among groups within our society with regard to the prevalence of oral diseases. There is evidence that health inequalities in Canada are growing despite the focus on health outcomes.

The WHO Commission on the Social Determinants of Health has highlighted the importance of social determinants and their influence at a global level. A multilevel and intersectoral approach is advocated to address the inequalities that occur along socio-economic, political and cultural stratifications. With the adoption of a population health approach the importance of oral health can no longer be ignored; general health is not possible in the absence of oral health.

For segments of the population, those with higher incomes or insurance plans or both, the existing model for dental services may be working. For those with incomes below the national median and without dental plans, the current model is not working. In particular, the current approach is wasteful of Canadian tax payer dollars. Costs are incurred for treatment of largely preventable oral conditions, and health care dollars are spent on palliative approaches through visits to physicians' offices and hospital emergency departments whose professional staff members generally do not have the knowledge and abilities to manage the non traumatic dental concerns presented. In addition to emergency visits, children are hospitalized for dental surgeries under general anaesthesia for treatment of rampant decay. For the working poor and homeless, physicians are often the only source of oral care available. This is ineffective and costly from a human and an economic perspective.

Building the capacity of the health workforce is a central theme nationally and internationally to support better health outcomes and increased client safety. The focus is directed towards capacity building initiatives within the workplace and the alignment of entry-to-practice educational programs to integrate the abilities identified as being increasingly important in health care. A number of abilities are highlighted to support quality and safe care including the following:

- using research to inform practice decisions including knowledge translation,
- developing health literacy skills,
- supporting self management,
- working collaboratively in interprofessional teams, and
- taking a leadership role in health care delivery.

It is recognized that these abilities are integral to the education of all health professions but such abilities also occur at many levels. The biomedical and psychosocial complexities of providing care for diverse population groups require more depth of abilities. A continuum of educational opportunities is required to provide health professionals with a range of abilities related to quality and safe care as described above.

The need for different abilities and more depth of abilities is compounded by the increased knowledge graduates need to understand the emerging literature on the mouth–body connections. Our body of knowledge in oral sciences is much larger than it was twenty years ago; the sheer volume of knowledge required for care has changed substantively. Changes in technology, particularly in the area of oral screening and diagnostics, must also be considered.

Building the capacity of our health professionals is critical for transformation of delivery approaches. We need to view dental hygienists as a health human resources asset rather than a cost. We need explore the best number and mix of oral health professionals, and where public funds could be best

spent. The costs of our current approach to oral health care are more problematic than the costs of additional post secondary education and a one-time delayed graduation. Dental hygienists are among the many health professionals who are prepared to assume greater responsibilities for the health of Canadians, but they need to be provided with access to additional educational pathways to develop their full capacity.

CDHA EDUCATION OUTCOMES

To prepare dental hygienists to become part of the solution in the transformation of oral health care delivery, CDHA has adopted the following educational outcomes. It will work towards the establishment of:

1. Bachelor's degree programs in dental hygiene for entry-to-practice that articulate with masters' programs;
2. Master degree programs with a dental hygiene focus to advance dental hygiene knowledge, research, and practice; and
3. Doctoral and post doctoral degree programs with a dental hygiene focus to advance dental hygiene knowledge, research, and practice.

These educational outcomes reaffirm the previous CDHA education policies and expand upon them. They are grounded in the analysis of the complex issues we face in oral health and the specific educational requirements to build the capacity of dental hygienists to assist in the transformation of oral care in the best interests of the Canadian public. Our increasing knowledge of the links between oral and general health create urgency for change to our approach to oral health. The outcomes represent short term and long term goals for the profession, and support the view that dental hygienists need access to higher education at all levels as do many other health professionals.

CONCLUSION

Our evolving understanding of the social determinants of health present many options for the transformation of the delivery approach to oral health services. However there is a need for more advanced abilities in key areas if the messages from the Ottawa Charter are ever going to be realized. Providing dental hygienists with increased educational pathways will provide them with opportunities to further develop the abilities that have been identified as being critical for the health workforce of the 21st century.

There are existing examples of innovative educational models in Canada that provide bachelor's degree opportunities for dental hygienists. However, only three options exist with one of these options having had its first intake in 2008. There is a need to create more numerous pathways for dental hygienists in their educational pursuits as these pathways will ultimately benefit the oral health of Canadians. The legislative changes occurring with dental hygiene regulation at the provincial level also support new pathways for access to oral care. However, increased access to bachelor's degree programs must also be complemented by master, doctoral and post doctoral studies that allow dental hygienists to use and expand their growing body of knowledge.

Creating new pathways in oral health care and education will need to be a collaborative project. All dental hygiene organizations, employers, and individual members of the profession have a shared responsibility to support the creation of these pathways. Dental hygienists are well positioned to spearhead the movement to improve access to care and to reconnect the mouth with the body. Expanded educational opportunities will solidify this position and enable them to work collaboratively with other health professions in making this a reality.

INTRODUCTION

Building the capacity of the health workforce has become an issue of increasing importance, nationally and internationally.^{1,2} It reflects the rising prevalence of chronic and preventable diseases in our societies, and the likelihood of pandemic emergencies. Health organizations are focusing on the abilities that are needed by health professionals to provide quality services and safe care for citizens in the 21st century.^{3,4} The focus is directed towards capacity building initiatives within the workplace and the alignment of educational programs to integrate the abilities identified as being increasingly important in health care.¹⁻⁴ The education of entry-to-practice professionals is central to these discussions, and the focus of this report.

This report explores the variables that are influencing the dental hygiene profession, and impacting on the educational needs of dental hygienists. This exploration is grounded in the context of the ever increasing role of dental hygienists in supporting the oral health and the general well being of Canadians. It describes opportunities for the profession to support the health of Canadians, and addresses the educational needs of dental hygienists that arise from the changing patterns of oral disease, population demographics, and our evolving understanding of the social determinants of health.

The theme of pathways is central to this document. It is recognized that there are many possible pathways to support access to oral health care, to reduce the burden associated with oral disease and to promote oral health. As well there are also many pathways to build the capacity of the current dental hygiene workforce and those entering the profession. The opportunities for such pathways are examined in this report.

THE DENTAL HYGIENE PROFESSION DEFINED

The initial descriptions of a dental hygienist often focused on detailed lists of clinical services found in regulatory acts. These definitions were then augmented in the 1980s by the Working Group on the Practice of Dental Hygiene initiated through Health and Welfare Canada.⁵ This group focused on the process of dental hygiene care including an assessment, planning, implementation, and evaluation phase. This emphasized the problem solving abilities that form the basis for the services provided by dental hygienists. Over the years the definition of the profession has included descriptions of the theory and sciences that underpin the profession, and the focus of dental hygienists on services directed towards clinical therapy, health promotion, and education to further “optimal oral health as an integral part of well-being.”⁶ Dental hygienists not only provide services to individuals but also to families, groups, organizations, and communities.⁶ They are “regulated primary oral health care professionals”⁶ who provide services in a variety of public and private health care settings.

The most recent definition emerged from a project directed towards the articulation of national competencies for dental hygienists.

Dental hygienists are primary oral health care providers guided by the principles of social justice who specialize in services related to:

- clinical therapy,
- oral health education, and
- health promotion.

Dental hygienists provide culturally sensitive oral health services for diverse clients throughout their life cycle. They work collaboratively with clients, guardians, and other professionals to enhance the quality of life of their clients and the public.⁷

These definitions draw attention to the role of dental hygienists as primary care providers; a role that has been increasingly recognized through legislative changes that allow for increased access to dental hygiene services for the public.

The abilities required for entry-to-practice by dental hygienists focus on shared abilities with other health providers. They include a focus on the role of the dental hygienist as a professional, a communicator and collaborator, a critical thinker, an advocate, and a coordinator.⁷ These competencies, and the shared codes of ethics in healthcare provide the foundation for interprofessional education and practice. Dental hygienists also provide specialized services including those of a clinical therapist, an oral health educator, and a health promoter. These competencies form the basis for dental hygiene educational programs, regulatory practice standards as well as national certification and accreditation.

DENTAL HYGIENE EDUCATION IN CANADA

The impetus for the development of dental hygiene programs came from the desire of the dental profession to increase access to dental care, with an emphasis on preventive services. In Canada, the driving force for recognition of dental hygiene came from the public health sector in the late 1940s.⁵ Legal recognition of dental hygiene occurred gradually between 1947 and 1968. The first dental hygiene program was established at the University of Toronto in 1951; this was then followed by additional programs at the University of Alberta, Dalhousie University, University of Manitoba, and the University of British Columbia.

Historically the Canadian Dental Association's (CDA) Council on Education had strongly recommended dental hygiene programs be implemented through faculties of dentistry.⁸ Based on the experiences in the United States with the development of junior and senior colleges, the CDA acknowledged the possibility of implementing dental hygiene programs within the college system. Subsequently, dental hygiene programs emerged in the colleges of Québec, Ontario, Saskatchewan, and British Columbia. This was followed by the creation of bachelor degree programs in dental hygiene to support the needs of university and college administrators for dental hygiene educators. These bachelor degree programs then provided access for graduates to master's and doctoral programs in oral health, and other disciplines. While opportunities exist for bachelor's degree education within the dental hygiene profession, these are few in number; only three options exist with one of these options having had its first intake in 2008. Access to graduate programs is also limited and discipline specific graduate programs do not currently exist in Canada.

The evolution of dental hygiene education has resulted in a diversity of entry-to-practice programs ranging from 2-year and 3-year diploma programs to 4-year bachelor degree programs (see Table 1). In essence there are currently many educational pathways for entry into the dental hygiene profession; this eclectic nature of dental hygiene education will be explored further as an opportunity to support dental hygienists in gaining further depth of abilities to support the oral health of Canadians. However, the diversity of entry-to-practice programs must also be recognized as a challenge to the development of a common standard of dental hygiene education and practice across Canada. This will also be explored further from the context of providing access for all dental hygienists to gain a common credential regardless of their year or province of graduation.

Table 1: Canadian dental hygiene program models

Models	Provinces
2-year diploma	NB, ON, SK
3-year diploma	AB, BC, MB, NS, QC
4-year degree	AB, BC, NS

FACTORS IMPACTING THE ORAL HEALTH OF CANADIANS

The factors affecting the oral health of Canadians are numerous and complex. They involve an increased awareness of the relationship between oral and general health, and an increased recognition that the burden for oral disease involves populations that have the least capacity to access care.^{9,10} People are living longer with ever increasing complex medical conditions; this adds pressure to health care systems already stretched for resources.^{1,4,10}

The need to build the capacity of health professionals to support the oral health of societies within our complex global environment has become increasingly evident.^{1,4,9} The post secondary educational system is seen as one vehicle for supporting this capacity building. However it is also recognized that employers have a role to play in supporting the ongoing development of the workforce in their practice contexts,^{1,3} and individual dental hygienists also have a responsibility to remain current as self regulating professionals.

THE MOUTH–BODY CONNECTION

The importance of oral health in contributing to general health and well being is increasingly recognized by scientific communities, governments, and members of the public. The mouth–body relationship is the focus of many studies and discussions. Researchers are exploring important conditions such as diabetes,^{11,12,13} cardiovascular disease,^{14,15,16} and preterm, low birth weight babies,^{17,18,19} and their relationship to periodontal pathologies involving the supporting structures of the teeth. Others are directing attention to the provision of mouth care in long term care facilities,^{20,21,22} and the relationship between dental hygiene services and the reduction in respiratory infections for the residents of such facilities.^{23,24} In the American Surgeon General’s report the mouth was described as the “mirror for general health and well being.”²⁵

The American Surgeon General's report drew attention to what he called a "silent epidemic" of oral disease.²⁵ The report provided a more holistic approach to oral health; it supported the World Health Organization's (WHO) view that health includes "a complete state of physical, mental and social well-being." The report drew attention to clinical manifestations of oral diseases as well as the quality of life factors related to oral health.

There is a growing recognition of the importance of oral health to quality of life.²⁶ The mouth has evolved from being an entrance into an organism to a highly specialized organ with a multiplicity of functions including sexual and social functions.²⁷ Researchers have identified relationships between poor oral health and factors such as:

- early childhood development,²⁸
- difficulties speaking,²⁹
- changes in smiling patterns³⁰⁻³²
- discomfort in eating,^{29,31,33,34}
- disturbed sleep patterns,³⁵
- low self esteem,^{32,36}
- social well being,^{31-34, 37-40} and
- pain.^{31-34,37,38}

Oral diseases affect individuals throughout the life span from childhood^{33,36,37} to adulthood^{39,41} to old age^{29,30,34} with their influences being more pronounced among the young^{33,36,37} and the elderly.^{29,30,34} The biological and social impact of oral disease is an important influence on health status and well being.

In recognition of the importance of oral health the Office of the Chief Dental Officer (OCDO) was established in 2004 to improve the oral health of Canadians (http://www.hc-sc.gc.ca/ahc-asc/branch-dirgen/fnihb-dgspni/ocdo-bdc/index_e.html). An initial step to work towards this goal was the articulation of the first Canadian Oral Health Strategy⁴¹ that identified inequities, disparities, and barriers to optimal oral health. The need to measure the current oral health of Canadians, and then to monitor that status was a central theme of the document. It also included strategies to support the oral health of Canadians focusing on increasing access to oral health care, and using a collaborative approach to health promotion.

The mouth-body connection has also received increasing attention from the public. On 24 January 2007, the CBC News carried a story about "meth-mouth" in the Yukon. A Whitehorse dentist is quoted as saying "Rampant decay, black and brown. It's pretty obvious. You could see it from across the street." On 10 February 2007, the Toronto Star published an article about Jason Jones. He was an unemployed young man who talked about the condition of his teeth being a social embarrassment, and a barrier to gaining employment. Several weeks later, a transformed Jason smiled from the pages of the newspaper showing his new dentures and implants. He talked about the impact of these new teeth on his life including his social relationships and his employment opportunities. On 3 July 3 2007 a further article in the same newspaper discussed issues of poverty and oral health. Mr. Pecaut, Chair of the Modernizing Income Security for Working-Age Adults, a coalition of academics, business leaders and activists, directed attention to the importance of oral health in addressing issues related to poverty. The coalition suggested making oral care an election issue. On 6 July 62007, NBCTV in San Francisco identified that a

local nursing home received a \$100,000 fine as a result of the death of a 76-year old resident in its care, a death which the California Department of Public Health attributed to a dental abscess that led to cardiopulmonary arrest. The public is recognizing that oral health has a substantial impact on general well-being. This awareness leads to discussions of access, equity, and social justice given that a universal health care system is deeply ingrained in Canadian values.

BURDEN OF ORAL DISEASE

While our knowledge of oral health has led to improvements in the oral health status of Canadians, large disparities still exist among groups within our society with regard to the prevalence of oral diseases.^{9,42,43} Canadians have experienced increased access to health care, and increased health but inequalities persist particularly in regard to oral health. There is some evidence that health inequalities in Canada are growing despite the focus on health outcomes.⁴⁴ This is not just a Canadian phenomenon; the prevalence and incidence of oral disease is high in both developed and developing countries.^{45,46} A comparison of national and international data indicates that similar patterns exist. The variables that are most predictive of oral disease patterns include age, sex, socioeconomic status, and race or ethnicity.^{9,10,25,42,43} New immigrants, First Nations and Inuit peoples, seniors and those living with disabilities are among those groups in which oral disease is most widespread. Socioeconomic factors are both a cause, and an outcome of oral health problems; the issues are interconnected and complex.⁹

Chronic diseases are a major health concern globally as well as nationally, and oral disease is one of them.^{9,45} Oral diseases share common risk factors with other chronic diseases in particular those associated with such lifestyle patterns as nutrition, smoking, and oral self care.⁴⁵⁻⁴⁸ It must, however, be recognized that personal health practices are influenced by other determinants of health such as individuals' social and economic environment.^{44,49} In Canada the incidence of chronic conditions such as obesity, diabetes, tobacco related conditions, and illnesses associated with poor nutrition are expected to rise.¹ This suggests that oral health issues will also increase given that relationships exist between these chronic conditions and oral diseases. For example, the links between tobacco use and periodontal conditions and oral cancer have been known for many years.^{50,51} A relationship between decay and obesity is also becoming evident.^{52,53} The burden for the individual clients and the health care system are substantial. For example, it is estimated that chronic diseases accounted for 42 per cent of total medical expenditures in 2002 in Canada,⁵⁴ and that oral cancer was responsible for 1,100 deaths in 2007.⁵⁵

The lack of access to treatment compounds the burden associated with oral diseases with the result that the most disadvantaged and vulnerable in our societies, including the elderly^{9,10,20,22} and children,⁵⁶⁻⁵⁹ bear the greatest burden. Dental decay rates and treatment needs have been found to be 2.5–3 times higher⁹ in children from lower socioeconomic backgrounds and even higher in Canadian First Nations and Inuit populations.^{9,57,59,60} A survey of Toronto children in 1999–2000⁶¹ found that 7 per cent of both five- and seven-year old children needed urgent dental care, a figure that exceeded the number affected by most other childhood conditions for which there is free care. Dental decay is the most common chronic disease in Canadian children;⁶² a report from British Columbia identified restorative dental treatment and extractions as the most common surgical procedures received by children in hospitals.⁶³

The challenge is that we have little data available with which to analyze the economic burden for Canadians with regard to chronic diseases in general⁶⁴ and oral diseases in particular.^{9,43} This situation is further complicated by the reality that people often have more than one chronic condition so it is challenging to tease the issues apart.

Canada's approach to oral health programs differs from other jurisdictions such as New Zealand, Australia, and many European countries where children's oral health programs are publicly funded.^{60,62} Although oral health is generally not addressed in our universal health care system, targeted programs do exist at the federal and provincial level (see <http://www.caphd-acsdp.org/Programs.htm> for a listing of these programs). These public dental programs have generally been restricted to specific groups.⁶¹ However, the federal government does play an important role as funder, regulator, as well as information and service provider.⁶⁵ In particular, First Nations and Inuit Health Branch is involved in collaborative initiatives with First Nations and Inuit communities to promote access to services and to help develop the capacity within these communities to deliver health services. Currently \$8.2 billion is spent on programs and services for Aboriginal peoples through 30 federal departments and agencies.⁶⁶

While the federal and provincial programs are important, they are limited in scope and resources.^{43,61} The federal, provincial and territorial Dental Directors have called on all governments to take leadership in the area of oral health given that a substantial percentage of Canadians have limited or no access to oral health services.⁹ Based on an analysis of national health surveys from 1951 to 1996, Leake⁶¹ identified that utilization of dental services increased from 15% to nearly 60% during this period, but this was also accompanied by increasing inequality in access for the lower socioeconomic groups. People in the highest income group visited the dentist 1.9 times as often as those in the lowest income group. This trend has continued; a 2005 report from the Canadian Institute of Health Information identified that high income earners are three times more likely to visit a dentist.⁶⁷ Several international studies^{68,69} have found that Canadians with incomes below the national median indicated that they had dental needs but did not see a dentist because of costs. The percentage of respondents reporting this ranged 26–42%.^{68,69} The majority of Canadians pay for their own dental care either directly, or through private insurance plans.^{67,70,71} Hence the use of services tends to be related to income rather than need.^{71,72} Leake and Birch⁷² argue that this represents a market failure given that people's capacity to purchase services is least when their need is greatest.

For segments of the population, those with higher incomes or insurance plans or both, the existing model for dental services may be working. For those with incomes below the national median and without dental plans, the current model is not working. Dentists^{61,70,71} and dental hygienists^{73,74} alike discuss the need for alternate payment mechanisms and delivery approaches to better support social goals related to oral health. Birch and Anderson⁷⁰ identify that there is "some indication of an increasing aversion" among some private clinicians to provide services for publicly funded clients. The current fee-for-service approach has limitations,^{61,70,73,74} and often hinders collaborative approaches to care.^{61,70,73}

The burden of oral disease not only affects individuals and communities but the public in general. An American study found that there were 2.95 million visits to emergency departments over a four year period from 1997 to 2000 related to complaints of tooth pain or injury.⁷⁵ Another study directed to paediatric clients found that 73% (n=809) presented with non traumatic dental issues.⁷⁶ Similar results were found in another paediatric study in which 40% of cases were related to decay and a further 9% were related to “other” concerns not related to trauma or decay.⁷⁷ In a random digital dialling telephone survey of 1005 Canadians, 5% reported that they had visited an emergency room because of tooth pain not associated with trauma.⁷⁸ Cohen et al.⁷⁹ studied non traumatic dental emergency visits, and found that approximately 2% of such visits resulted in a hospital admissions with costs ranging from \$949 to \$43,524 (m= \$5,793).

Although clients visit hospitals⁷⁵⁻⁷⁹ and physicians’ offices,⁸⁰ their problems are often not resolved; not surprisingly the care tends to be palliative, frequently involving multiple visits for medications to help control dental pain.^{74,76} The clients often leave with referrals and prescriptions they cannot fill.^{74,75} For many of the working poor and the homeless, hospital emergency services and physician practices are their primary source of dental care^{74-76; 80}; this creates an added financial burden to the health care system; it is an expensive and inefficient way to use our healthcare dollars. Several studies^{76,81} have found statistically significant increases in the number of visits from the 1980s to the 1990s so this is not a situation that will likely change without thoughtful interventions.

In addition to emergency visits children are hospitalized for dental surgeries under general anaesthesia for treatment of rampant decay. For example, early childhood decay was identified as the most common reason for surgical procedures under general anaesthesia for children in British Columbia.⁶³ Schroth⁸² conducted a retrospective study of First Nations and Inuit children who had experienced hospital surgeries for oral care in Alberta from 1996 to 2005. Of the 339 cases analyzed, 67% had undergone two surgeries for restorative dentistry and the remaining experienced three or more surgeries under general anaesthesia. The prevalence of early childhood decay in Canadian Aboriginal people and American Native populations ranges from 25% to 72%.⁵⁹

General anaesthesia is the most common approach for managing such advanced dental decay given the age of the children.⁸³ Costs associated with such procedures range between \$600 and \$1,500 for anaesthesia and facilities alone.⁸⁴ From the analysis of the Iowa Medicaid program in 1994, it was reported that the 272 children with early childhood caries who received general anaesthesia in a hospital setting accounted for ¼ of the \$2.1 million spent on dental care.⁸⁵ This indicates that fewer than 2% of the children under 6 years of age accounted for 25% of the dental resources in the program for that fiscal year. Given the waiting lists experienced in Canadian hospitals, children with early childhood decay frequently experience pain and acute infections prior to their surgeries;⁸⁴ as well, their general growth and development may be affected.²⁸ We have little data about such wait lists; however, a 1999 Canadian study in one hospital found a 6–8 month waiting period prior to surgery.³⁵ Despite the paucity of data, it is not unrealistic to suggest that explorations of intensive preventive interventions might be more effective from a financial as well as a human perspective. Children and adults with poor health place more pressures on our health care system and use more taxpayer dollars.⁴⁴

A study of national Canadian health information databases⁸⁶ from 1990 to 1998 found that expenditures on dental care increased from \$4.12 billion to \$6.77 billion during the decade; this represented a 64% increase. However the proportion of dental services paid by public resources declined from 9.2% to 5.8% over the decade. Among OECD countries, Canada's public expenditure on dental health care was second from the lowest, being only greater than that of the United States. In 1998, Canadian dental care costs were surpassed only by the costs for cardiovascular disease. These costs reflected the direct costs of illness and did not include such indirect expenditures as costs related to absence from work due to appointments or illness. From this limited data it is evident that the costs of oral disease are substantial.

The WHO Commission on the Social Determinants of Health⁴⁹ has highlighted the importance of social determinants and their influence at a global level. A multilevel and intersectoral approach is advocated to address the inequalities that occur along socioeconomic, political and cultural stratifications.^{44,49,87,88} Oral health problems in less affluent countries are obvious but in more affluent countries they are often hidden because of the countries' overall wealth.⁴⁸ With the adoption of a population health approach as advocated by the Standing Committee on Social Affairs, Science and Technology⁸⁷ the importance of oral health can no longer be ignored. There is a need for increasing the pathways for access to oral health services and integrating them with other health services. Our challenge is to move from a destructive circle of poverty with its poor health outcomes, to a circle going from policy to services,⁴⁹ in this case oral health services. Dental hygienists are ideally positioned to assume diverse roles in such an endeavour given their primary focus on health promotion, education, and the provision of preventive and therapeutic services.

BUILDING THE CAPACITY OF THE ORAL HEALTH WORKFORCE

Building the capacity of the health workforce is a central theme in the Canadian^{1,3,88,89} and international^{2,4,10,90-92} health policy areas.^{1,3,88,89} In the 2005 *WHO Bangkok Charter for Health Promotion in a Globalized World*,⁹¹ the capacity building issue was framed as capacity for knowledge translation, health literacy, health promotion, research, leadership and policy development. The participants of a recent international conference also emphasized the importance of abilities essential for health promotion.⁹² These participants framed health promotion to include a focus on advocacy, partnerships, facilitating change, and leadership.

In the Canadian context, the capacity building theme focused on the generation of shared competencies, and developing those competencies within the public health workforce as well as on integrating them into entry-to-practice programs.^{1,3} Supporting the alignment of education curricula with the needs of the health system is identified as an objective within the first goal of *A Framework for Collaborative Pan-Canadian Health Human Resource Planning* document. (<http://www.hc.sc.gc.ca/hcs-sss/pubs/hhrhs/2007-frame-cadre/object-eng.php>) Many reports^{1-4,10,45,47,88,91-93} emphasize the need for increased depth of abilities, and the need for different abilities for the health workforce to be able to provide better client outcomes and support client safety.

A number of abilities are highlighted to support quality and safe care including the following:

- using research to inform practice decisions including knowledge translation,
- health literacy skills,
- education to support self management,
- working collaboratively in interprofessional teams, and
- taking a leadership role in health care delivery.

It is recognized that these abilities are integral to all health professions but such abilities also occur at many levels.⁹¹ All health education programs need to support learners to gain basic skills in these abilities. However, gaining more depth and experiences in these abilities requires more extensive post secondary education. A continuum of educational opportunities is required to provide health professionals with a range of abilities in these areas.

1. USING RESEARCH TO INFORM PRACTICE

A prevalent direction in health care is the focus on evidence-based practice.^{60,94-97}

This approach is often described as the “systematic application of the best available evidence to the evaluation of options and to decision making in clinical, management and policy settings.”⁹⁸ It highlights the increasing pressure placed on health professions to ground their practice decisions in the best available evidence. Initially the definition of “evidence” was directed to specific methodologies expressed in a hierarchical fashion with randomized clinical trials being considered the gold standard.⁹⁹ While research evidence has remained central to the concept, it has been expanded to link with evidence from other sources such as practice information, gained through chart audits and other types of analyses as well as client perspectives.¹⁰⁰⁻¹⁰³

This focus on the use of research is part of the larger government agenda directed towards increased accountability.^{104,105} To support such an approach, health professionals must seek research, and apply it to their practice decisions.

When comparing differences between Swedish dental hygiene graduates of combined dental assisting and dental hygiene programs (1 plus 1 programs) and 2-year dental hygiene programs, Öhrn et al.¹⁰⁶ found statistically significant differences between the groups with regard to attitudes to research use, research seeking behaviour and research use, with the respondents from 2-year dental hygiene programs assigning higher ratings in each area. Similar findings are found in the nursing literature.^{96,107} Longer educational programs support the development of greater abilities with regard to critical thinking and using research,¹⁰⁶⁻¹⁰⁹ and using empirically supported services has been found to lead to better client outcomes.¹¹⁰ Developing a positive attitude towards research and developing the skills to find it, critique it, and integrate findings into practice requires learning experiences that can more easily be gained through longer educational programs.

The discussions about research use are also linked to challenges in the area of knowledge translation. A variety of terms are used to convey the “concept of moving knowledge into action.”¹¹¹ Regardless of the term used, the key focus of knowledge translation is directed towards bridging the gap between research and practice with the goal of improving health outcomes and efficiencies in health care systems. There are many challenges in making scientific information understandable, and then engaging health professionals in exploring the knowledge.^{111–116} Collins and Hayes¹¹⁶ suggest that the health promotion messages of the Ottawa Charter¹¹⁷ that focused on the process of enabling people to gain increased control over their lives and thus their health, can only become realized if we deal with the complexities and challenges of knowledge translation.

2. HEALTH LITERACY ABILITIES

While health professions have always tried to convey information to clients, the ability to do so is not as simple as it might appear.^{118,119} The issue of health literacy presents a complex challenge for health professionals. Health literacy is the skill “to enable access, understanding and use of information for health”.¹¹⁸ The literature on health literacy suggests that many people across the socioeconomic spectrum are not able to understand health information.^{42, 118–123} Canadian data from the International Adult Literacy Survey identifies that 60 per cent of adult Canadians do not have the ability to “obtain, understand and act upon health information and services to make appropriate health decisions on their own.”¹²³ There is also evidence to support that clients with less health literacy have less access to care and receive poorer quality of care;¹²³ overall, health status is linked to health literacy.^{42,122–125}

The issues surrounding health literacy are compounded further when one reflects on the integration of electronic health tools such as Telehealth¹²⁶ and eHealth¹²⁷ the added skill set required by health professionals as well as clients in the case of eHealth. Lloyd et al.¹²⁸ suggest an interprofessional approach to support clients whose health literacy skills place them at increased risk and this is congruent with the literature related to better client outcomes being associated with such an approach. While it is recognized that all health providers must have some basic skills in health literacy, there is also a need for more advanced abilities in these areas.

3. SELF MANAGEMENT EDUCATION ABILITIES

Helping individuals and groups develop self management abilities has become an important aspect of health promotion interventions.^{46,129} Traditionally health education has included the sharing of information and the development of technical skills, whereas self-management education focuses on the facilitation of problem solving skills.¹³⁰ Clients identify their own problems and are supported in their efforts to develop strategies to take action on these issues and manage their problems as factors in their lives change. It is directed to problem solving, goal setting, action plans and the development of self-efficacy. Developing skills to support clients with their self-management requires a different skill-set in the education domain. The nursing profession identifies self-care as a client outcome “whereby patients select and perform actions to maintain their own lives and healthy functioning.”¹²⁶

Self management education is described as a compliment to traditional educational approaches, not a substitute for them.¹³⁰ Self management programs have expanded to include “a life-course perspective” involving oral health promotion in schools and extending such interventions throughout the life span with an emphasis on “age-friendly” health care.⁴⁶ The increasing prevalence of chronic conditions has also influenced the emergence of integrated health promotion programs focused on a common risk factor approach.⁴⁸ Hobdell⁴⁸ suggests that “lone-standing” programs only focused on oral health are “a thing of the past.” An interprofessional approach to self management has the potential to support better client outcomes and increased cost efficiencies for the health care system.

4. ABILITIES TO WORK IN INTERPROFESSIONAL TEAMS

Discussions about interprofessional approaches to health care permeate the literature in health care reform.^{1-4,10,44-47,88,90,91,128,131,132} Interprofessional care is viewed as an approach to support increased quality of care and enhanced client safety; it is encouraged within practice contexts as well as entry-to-practice programs. However, this approach does not come without its challenges.^{131,133-135} The culture of the profession can often become a barrier.^{133,136} Hence leadership and teamwork is often discussed in reference to the abilities required to support better health outcomes for our societies.^{1-4,90-93} Regardless of the challenges, interprofessional approaches are seen as a key issue for health care reform to support multilevel and intersectoral approaches to health services.

The abilities that have been discussed in this section are not new abilities for health professionals; however, these abilities are now being discussed from the perspectives of increased depth of abilities being required by diverse groups within the health care sector. Abilities related to these areas are seen as integral to support change in health care approaches. In particular they are related to increased safety, and better health outcomes.

Safety issues have emerged from relative obscurity to central prominence in health care discussions in the last decade.¹³⁷ However this concept is now being viewed from the lens of the social determinants of health. The focus has shifted from a biological model of health to a broader model that also includes the social elements affecting health outcomes. This has led to discussion about the “culture of safety” within organizations and professions to support both clients and health professionals.⁹³ In the past the safety culture focused largely on acute care contexts directing attention largely on procedures, but it has now expanded to the community practice context.¹³⁸ Safety in a community context involves more complex considerations including the influence of the home environment, family and socioeconomic status. The value of a multidisciplinary approach including patients and families is identified as critical to support client safety^{138,139}

Lau et al.¹⁴⁰ discuss the concept of “health related safety”, a concept with multiple etiologies. It is defined as “the minimization of the probability of preventable, unintended harm in community-dwelling people”. This approach explores individual incidents to systematic breakdowns in our societal systems with a goal to creating safe homes and communities. For example, from an oral health perspective this could involve the use of fluoride and sports guards. This approach parallels client safety in our health care settings and is designed to increase the capacity of individuals and communities. Literature about safety in diverse settings underscores the value of collaboration and teamwork, and links them to better client outcomes as a result of reduced errors and better performance by professionals.^{93,141,142} For example, a study of an oral cancer screening program¹⁴³ highlighted the importance of client–provider communication in assuring high compliance with referrals. Communication, collaboration, and joint decision making are viewed as essential elements to develop safe care practices.^{141,144}

Aiken et al.¹⁴⁵ explored patient mortality rate and failure-to-rescue rates in hospitals with higher proportions of nurses educated at the bachelor’s degree or at a higher level. They found that hospitals with higher proportions of degree-educated nurses had significantly lower rates with regard to mortality and failure-to-rescue. Practice judgements made by health professionals are critical to client outcomes and increased client safety. The literature documented in this section supports the view that the capacity of health care professionals needs to be augmented. This has implications for professional development within the workplace as well as entry-to-practice education.

Dental hygienists are among the many health care workers who need to further develop their abilities in these areas. Their role in health promotion and education^{6,7} makes them ideal persons among oral health professionals to address issues of knowledge translation, health literacy, and self management education. In essence dental hygienists are the voice of health promotion within the oral health team. They are ideally positioned to assume an oral health “broker” role as nurses^{146,147} are assuming in their practice contexts. Their background makes them the ideal oral health professional to interface and to help mediate between clients and oral health providers to build the capacity of individuals and to support their access to oral health services.

LEGISLATIVE ISSUES

The legislative barriers restricting access to dental hygiene services have been decreasing in many provinces. Legislative changes range from the delivery of dental hygiene services in residential care and assisted community living settings to full self initiation of services with free standing dental hygiene clinics. Dental hygienists can now provide their services in diverse practice settings in many provinces. These changes have been supported by the Ministries of Health, the Competition Bureau of Canada, and the OECD.¹⁴⁸ These new pathways for access to dental hygiene services provide new opportunities to support the oral health of Canadians. An economic analysis by Manga¹⁴⁹ suggests that legislative changes allowing direct access to dental hygiene services will lead to increased access to care and more cost effective care given a more open market in the oral health care sector. These new delivery models also provide increased support for interprofessional approaches as legislative barriers often restrict opportunities for collaboration.^{133,134}

In March 2008, the Competition Bureau of Canada launched an exploration of regulatory practices within dentistry to assess the economic impact of these regulatory practices on consumer services (<http://www.competitionbureau.gc.ca/epic/site/cb-bc.nsf/en/02598e.html>). It is anticipated that further exploration of these issues will open additional pathways for the Canadian public to access the services of not only dental hygienists, but dental therapists and dental assistants as well. Working collaboratively, oral health professions have the potential of implementing new service delivery models to meet the needs of Canadians who currently are not able to access the current dentist-oriented private practice model. Reducing the current gatekeeper role of dentistry is anticipated to result in more innovation in delivery models and more cost effective services.¹⁴⁹

THEMES IN POSTSECONDARY EDUCATION

The major themes in postsecondary education continue to be directed towards affordable, accessible, and quality educational experiences.¹⁵⁰⁻¹⁵² McCall¹⁵⁰ identifies “the need to develop an integrated system that facilitates collaboration and supports life-long learning”. Similarly, an Alberta report¹⁵² calls for “seamless advanced learning” and “strategic advancement of learning opportunities” throughout the post secondary educational system. Such a system is seen to be important for Canadian citizens as well as for new immigrants who enter Canada hoping to integrate into our society.

Prior learning assessment and recognition (PLAR) supports such directions, as do increasing opportunities for articulation and transfer. Articulation involves the examination of course content by postsecondary organizations to match course work between organizations. This helps students in transferring course credits from one organization to others. The Canadian Information Centre for International Credentials (CICIC) acts as a national clearinghouse and referral service related to PLAR (<http://www.cicic.ca/431/about-the-centre.canada>). CICIC is a unit of the Council of Ministers of Education of Canada. CICIC’s work is directed to the recognition of international credentials to support portability and access to further educational opportunities within Canada. Similarly provincial admissions and transfer councils have been developed to encourage educational organizations to support transfer of credits among one another. These councils work collaboratively with post secondary organizations to support access and a seamless educational system (<http://www.bccat.bc.ca/about.cfm>). The Pan-Canadian Consortium on Admissions and Transfer helps learners to readily access provincial councils across Canada (<http://www.pccat.ca/links.cfm>). Such systems are important to provide learners with opportunities to have their abilities recognized, and to further build their abilities and credentials. Dental hygiene educators have been working closely with such organizations to support the transfer of credits among organizations and provinces. For example, current dental hygiene degree completion programs offer options for graduates of 2-year and 3-year accredited diploma programs from across Canada to gain block transfer for their dental hygiene education (see Table 2). This supports a seamless approach for access to bachelor’s degree dental hygiene education.

Table 2: Canadian degree completion options for dental hygienists

University	Opportunities for Graduates of		Degree Awarded
	2-year diploma programs	3-year diploma programs	
Dalhousie University	✓	✓	Bachelor of Dental Hygiene - BDH
University of Alberta	✓	✓	Bachelor of Science- BSc (DH)
University of British Columbia	✓	✓	Bachelor of Dental Science - BDS (DH)

As previously discussed, the abilities needed for interprofessional practice are identified as a major theme in health policy documents.^{1-4,10,45,47,91} To support professionals in developing these abilities they need to develop them within their entry-to-practice programs;^{1,3,90,136} learners cannot be taught in isolation and then be expected to practise effectively within an interprofessional context.^{136,153-157} However, an interprofessional approach does not come without its challenges.^{131,133-135,153,155} The lack of curriculum that defines common elements in the health professions is one such barrier.¹⁵⁵ The dental hygiene profession has taken steps to address this issue by the articulation of National Dental Hygiene Competencies for Entry-to-Practice.⁷ These competencies were developed with the support of a consortium of national organizations who agreed to integrate them into their work. The members included the following:

- Canadian Dental Hygienists Association (CDHA),
- Commission on Dental Accreditation of Canada (CDAC),
- Dental Hygiene Educators Canada (DHEC),
- Federation of Dental Hygiene Regulatory Authorities (FDHRA), and
- National Dental Hygiene Certification Board (NDHCB).

The competencies are grounded in the literature related to professional health education with particular emphasis on their relationship to the Core Competencies established by the Public Health Agency of Canada,³ the Discipline Competencies for Dental Public Health¹⁵⁸ and the harmonizing model generated by Verma et al.¹⁵⁵ that reflects shared abilities in physiotherapy, occupational therapy, nursing and medicine. See Table 3 for a comparison of the domains across these documents. The dental hygiene competencies also align with the competency domains articulated by the WHO related to providing care for clients with chronic health problems⁴ and the health promotion competencies developed by the international participants at the 2008 Gateway Consensus Conference.⁹² With these competencies dental hygiene educators are well positioned to support interprofessional educational experiences for their learners; they just need the program hours to implement these learning experiences to the depth suggested in these documents.^{3,4,92,155,158}

Table 3: Comparison of domain frameworks to support interprofessional education

PHAC Core³ CAPHD Discipline¹⁵⁸ Competencies	National Dental Hygiene Competencies⁷	Harmonizing Model¹⁵⁵
Diversity & Inclusiveness and Leadership	Professional	
Communication	Communicator and Collaborator	Communication, Cooperation, Collaborative Practice
Public Health Sciences	Critical thinker	
Partnerships, Collaboration and Advocacy	Advocate	Consultation, Cooperation
	Coordinator	Coordination
Assessment & Analysis Policy & Program Planning, Implementation and Evaluation	Clinical therapist Oral health educator Health promoter	

Degree granting status is being conferred on an increasing diversity of post secondary organizations such as universities, technical institutes, and community colleges. Several jurisdictions are also exploring the concept of applied degrees. The combination of diverse degree granting organizations and diverse bachelor’s degree educational models provide increased opportunities for all Canadians in accessing educational programs directed to their needs and interests.

The need for different abilities and more depth of abilities is compounded by the increased knowledge graduates require to understand the emerging literature on the mouth–body connections. Our body of knowledge in oral sciences is much larger than it was 20 years ago; the sheer volume of knowledge required for care has changed substantively. For example, with the increase in chronic conditions, the clients who present in private as well as public practices present with more complex profiles and needs. Health professionals must be supported in their endeavours to deal with the biomedical and psychosocial complexities of providing care for diverse population groups. As well, changes in technology, particularly in the area of oral screening and diagnostics, must also be considered.

There are studies in new technology for oral health interventions such as ozone therapy for decay,¹⁵⁹⁻¹⁶¹ laser therapy for periodontal care,¹⁶²⁻¹⁶⁴ and the use of technology to improve self care through digital assistants¹⁶⁵ or teledentistry to screen preschool children in remote areas.¹⁶⁶ However, the main area of technological change is occurring in screening approaches and diagnostics. Attention is being directed to the development of laboratory tests to support early detection of a variety of conditions such as cancer, cardiovascular disease,¹⁶⁷ HIV infection,¹⁶⁸ autoimmune disorders,¹⁶⁹ and periodontal conditions.^{170,171} In addition to early detection these tests are also being used to monitor health status and outcomes of treatment.¹⁷²

Saliva has become the biofluid of choice for many such tests;^{167,173,174} “oral fluid, often called the ‘mirror of the body’ is a perfect medium to be explored for health and disease surveillance”.¹⁷² It is readily obtained through noninvasive approaches even in nonclinical settings, and it can be assessed for biosensors and biomarkers associated with health and disease.^{167,172,175} One area of research is directed to the development of “lab-on-a-chip technology”;^{171,173,175} this technology allows for multiple analysis of oral fluids and it is anticipated to be available as a handheld device in the near future.¹⁷⁵ Oral cells are also being used as a source of DNA for diagnostic and forensic applications.¹⁷⁴ The potential applications of such tests for screening of high risk populations are enormous.

There are other areas of technology affecting oral health assessments. One such area incorporates the use of antigen technology; this involves the analysis of the human response during infections to gain a better understanding of the disease process; it is based on serum analysis.¹⁷⁶ This technology allows for categorization of the responses, and thus supports new point-of-care diagnostic tests in such conditions as chronic periodontal disease. Visualization devices such as autofluorescence are now also being used for detection and delineation of abnormal oral lesions such as precancerous and cancerous lesions.¹⁷⁷⁻¹⁷⁹ These devices are seen as adjuncts to current visual screening approaches.

In the last decade optical coherence tomography (OCT) has also been introduced to medicine and dentistry.¹⁸⁰ This technology was originally used for finding faults in fiber optic cables but it soon proved useful for assessing the human eye. In dentistry, OCT has been shown to detect carious lesions before surface structural changes become evident. Cone beam computed tomography is also a new technology in digital imaging that provides three dimensional perspectives to oral structures when compared to the two dimensional perspectives of current radiographic approaches.^{181,182}

Diploma education compromises the depth of understanding and abilities needed for new graduates entering practice. Bachelor’s degree education is warranted based on the expanding knowledge in oral health and its relationship to general health, advances in technology, changing delivery models for dental hygiene services as well as the complexity of the abilities needed by dental hygienists to meet the challenges of health care in the 21st century. It is anticipated that existing clinicians with diploma education will be grandparented, so that they will continue to be eligible for registration.

There are, of course, some drawbacks when considering increased education for dental hygienists. One concern is the issue of increased costs for such education; this requires an assessment of the long term cost to benefit ratio of such education. WHO reports that oral disease is the “4th most expensive disease to treat”.⁴⁶

A prevention and health promotion approach appears to be an obvious choice. However, the relationship between prevention and savings is complex. It is anticipated that reducing the prevalence of chronic diseases will indeed result in increased costs in the short run but substantial cost reductions in the long term.⁶⁴ The economic and health costs of chronic diseases are enormous;⁴² in 2002 it was estimated to account for 42 per cent of total medical expenditures.⁵⁴ For example, the medical costs of tobacco related diseases were estimated to be \$4.7 billion.⁶⁴ The additional costs in loss of productivity and premature death were estimated to be a further \$17.7 billion in the same year. This is just one area in which dental hygienists could make a difference.⁴⁷ The knowledge of dental hygienists in this area is recognized internationally as exemplified by the fact that the Director of the University of Alberta Dental Hygiene Program was invited to an international conference related to tobacco intervention strategies this summer in Croatia; she was the only Canadian invited to participate in this event.

Dental hygienists could have a much greater impact on the prevention of oral diseases, given their primary focus is on education and health promotion,^{183,184} thus supporting increased efficiencies in oral health care.¹⁴⁹ The impact of oral disease is substantial in terms of pain, suffering, loss of function, and quality of life.^{26-37,46} In general we know the issues, and we have some interventions and technology to address them; we just need to take action.

The financial cost to students is another important issue that needs to be considered. Many dental hygiene graduates have three years of post secondary education, yet only receive a diploma credential so their educational and career pathways are limited. For example, general arts and science students at the University of Manitoba are awarded a bachelor's degree after three years, while the dental hygiene students receive a diploma for essentially equivalent post secondary education; this raises issues of equity and justice. Surveys of these dental hygiene students have consistently identified their desire to complete a 4-year bachelor's degree program but they are not provided this opportunity at their university. Similarly data from Alberta and British Columbia show that dental hygiene students see value in degree education; the escalating number of students in these programs suggests that the benefits outweigh the costs. In a study of dental hygiene graduates from British Columbia,¹⁸⁵ 93 per cent reported "personal satisfaction" to be *very important*. Other factors rated *very important* by more than 50 per cent of the respondents included: increased knowledge (85%) and career development (56%). For many, the difference between the costs of four years versus three years of education may be seen as an investment in their future.

Many applicants to dental hygiene programs already possess a bachelor's degree. Estimates from program directors range from 25% to 35% in western and Atlantic provinces; the estimates are lower in the case of central Canada. This is supported by a 2001 study of practising dental hygienists (n=1730) in which 10% indicated that they had a bachelor's degree in another discipline and 1.2% indicated a master's degree.¹⁸⁶ In a 2007 membership survey by the Canadian Dental Hygiene Association 5% of respondents (n=2533) reported having a bachelor's degree in dental hygiene with a further 14% reporting a bachelor's degree in another discipline. Students often say that they went to university to obtain a degree, and then went into dental hygiene to gain a profession. This circuitous route to the dental hygiene profession is costly to students and parents as well as taxpayers.

Another concern about additional education is the increased salary that graduates of a bachelor's degree program may request. This is often stated in terms of the increased costs of care for the public. This does not appear to be the case in the dental hygiene profession where salaries in the private sector tend to be higher than other sectors. Imai¹⁸⁵ found that the great majority of the dental hygiene bachelor's degree graduates *disagreed* that the degree had increased their income (74%) or their benefits (80%). However, 80 per cent agreed that the degree "improved their opportunities for professional / career advancement". The costs of dental hygiene services for the public are also impacted by changing regulations as previously discussed. The new regulations are projected to lower costs for these services by about 20–40% based on extrapolations from such regulatory changes in other sectors.¹⁴⁹

The issue of delayed graduation and its impact on employers is often another concern raised. The data related to the growth of the dental hygiene profession minimize this concern. The latest report by the Canadian Institute of Health Information¹⁸⁷ identifies that the number of dental hygienists has increased by 45% between 1996 to 2005; the number of dentists during the same period increased by only 18%. The number of dentists per 100,000 Canadians during this time was 58 compared to 57 for dental hygienists. Since that time the number of dentistry programs has not increased, but the number of dental hygiene programs has escalated. In 1996 there were 27 accredited entry-to-practice dental hygiene programs in Canada.⁸ This number has now increased to 39 accredited programs in 2008 with approximately 12 other programs currently seeking accreditation status.

(http://www.cdha.ca/content/careers/hygiene_programs.asp#diploma).

In British Columbia alone three new entry-to-practice university based dental hygiene programs have been established during the past four years. Based on these growth patterns, it is estimated that dental hygienists may currently outnumber dentists in Canada. A one-time delay in graduation is anticipated to have a minimal impact on the needs of current employers in the private sector. It may, in fact, be a tremendous boost to the public health sector in their search for employees who possess the newly articulated core competencies for public health professionals.³

The human resource issue is more complex than the issue of delayed graduation. Shortages of professional staff are being experienced by many public sector employers, and these shortages are anticipated to increase.^{189,190} However, discussions about human resources are often directed to increasing the supply of different professionals,¹⁴⁵ and the discussions also tend to focus predominantly on physicians and nurses rather than the full complement of health professionals.¹⁸⁸ We need to explore the best number and mix of health professionals, and the educational pathways for these health professionals. The public may be better served by directing attention to bachelor's degree education for dental hygienists so that they can assume greater preventive and health promotion roles within diverse health care settings rather than producing more dental hygienists for dentists in private practice. As Aiken et al.¹⁴⁵ argue, little attention is being directed to the analysis of educational pathways to determine where public funds could be best spent.

There is a need to transform our health care system, and one aspect of this transformation will involve shifting roles and responsibilities of health professionals with dental hygienists only being one of these. There is a need to consider innovative approaches to the delivery of services. In the United States there is increased pressure for dental hygienists with expanded functions;¹⁹¹ in the Netherlands, Australia, New Zealand, and England this is already the case.¹⁹²⁻¹⁹⁴ We need to view dental hygienists as a health human resource asset rather than a cost. We need to provide entry-to-practice graduates the abilities to support them in helping transform our health delivery approach.

The costs to taxpayers of current oral health services are expensive from a human and an economic perspective.^{72,74-85} Costs are incurred for treatment of largely preventable oral conditions and health care dollars are being spent on palliative approaches^{72,74,76,79} through our hospitals whose professional staff members generally do not have the knowledge and abilities to manage the non traumatic dental concerns presented.^{75,76,80} Additional costs are incurred from surgeries with general anaesthesia for children with decay,^{59,63,82-84} and for those related to the management of such chronic diseases as cancer and others associated with tobacco use.^{54,55} These expenditures are more problematic from a human and financial perspective than the dollars needed for additional post secondary education, and a one-time delayed graduation.

Building the capacity of our health professionals is critical for transformation of delivery approaches. Dental hygienists are among the many health professionals who are prepared to assume greater responsibilities for the health of Canadians, but they need to be provided with access to educational pathways to develop their full capacity.

NEED FOR RESEARCH IN DENTAL HYGIENE

Recent evidence suggests that the gap between the rich and the poor is increasing despite our efforts to address disparities.^{44,49,87} An escalation of chronic health conditions has also been predicted;^{1,4} oral health problems are a component of this reality. There is a need to go beyond explaining such inequities; we now need to tackle the issues. The challenge is that we have little research to help us understand the interventions that would be most effective in reducing health inequities.^{9,44,49,60,88,115} There is a need for more research to support a better understanding of the services provided, and the client outcomes achieved.

The CDHA has long recognized the importance of research to enhance the oral health and general wellbeing of Canadians.¹⁹⁵ CDHA's *Dental Hygiene Research Agenda*, 2003, identified the need to build the research capacity of dental hygienists to improve knowledge dissemination, and to foster new partnerships.¹⁹⁶

The need for dental hygiene research has also been recognized internationally for many years,^{197,198} and the CDHA is in the process of publishing *Dental Hygiene at a Crossroads: Knowledge Creation and Capacity Building in the 21st Century*, which reflects the diversity of research needs within the profession.¹⁹⁵ This document highlights the importance for dental hygiene research in:

- Oral Health Promotion and Public Awareness,
- Oral Health, and Oral Disease and Disabilities,
- Improving Access to Care and Reducing Barriers to Oral Health Care,
- Monitoring, Surveillance and Research, and
- Human Resources.¹⁹⁵

It is essential for the dental hygiene profession to develop its knowledge base to support evidence-informed practice. As well, there is a need to understand the new practice models given the legislative changes that allow for increased access to care and different scopes of practice. In the case of Alberta, dental hygienists can now prescribe medications associated with dental hygiene services. The dental hygiene profession is self regulated, and it exists as a unique profession directed to oral health promotion and prevention. However, it does not currently have a well established body of knowledge to support its practice.^{95,199} Developing this body of knowledge is important to support dental hygienists in assuming ever increasing roles in promoting the oral health of Canadians.

Dental hygiene education has emerged as the most substantive challenge impacting on dental hygiene research in Canada. Bachelor's degree education opens the pathways to graduate work where research abilities are gained. In essence doctoral education has become the entry-to-practice credential for the practice of research in all professions. There is a need for discipline specific programs for Canadian dental hygienists beyond the diploma level to support the establishment of an increased body of knowledge and theory related to dental hygiene services.

Internationally, many dental hygiene students have access to bachelor's degree education (see Table 4). Bachelor's degree programs exist in fourteen countries; this number represents a 100 per cent increase from 1998 to 2006.¹⁹² Bachelor's degree education is the entry-to-practice credential for Finland, Italy, the Netherlands, and the Slovak Republic.¹⁹² In Finland, dental hygiene education has only been offered at the bachelor's degree level¹⁹² since the first program was established in 1973.²⁰⁰ Bachelor's degree as the entry-to-practice credential is anticipated in Australia, New Zealand, the United Kingdom, Norway, Sweden, Korea and the United States.¹⁹²

The number of countries with master degree programs in dental hygiene have also increased from two in 1998 to four in 2006.¹⁹² The 2006 survey respondents reported eleven such programs in the United States, four in Finland, one in the Netherlands, and Italy reported its existence but not the number. Norway reported both master and doctoral programs under development, and doctoral programs are also being discussed in the United States.¹⁹¹

Since 2006 the number of bachelor degree programs in the United States has increased; there are currently 48 accredited 4-year Bachelor of Science in Dental Hygiene programs identified on the American Dental Hygienists Association website. (http://www.adha.org/downloads/edu/Bachelor_Degree_Schools_for_Web_Site.pdf). However, Canadian students currently have access to only three bachelor degree programs; two in western Canada and one in Nova Scotia that commenced in 2008. When differences in populations between the countries are analyzed, this still represents 33 per cent more opportunities for bachelor's degree dental hygiene education in the US. The lack of opportunities for bachelor's degree education in Canada severely limits the pathways for career development, and access to graduate programs. The situation is further affected by the reality that there are no discipline specific graduate programs for dental hygienists in Canada.¹⁹² In contrast, there are currently sixteen Master of Science programs in dental hygiene in the United States.¹⁹¹ Canadian dental hygienists must currently access international programs for discipline specific graduate education.

Table 4: International dental hygiene bachelor degree programs in 2006*

Country	# of Bachelor Degree Programs
United States	33
Sweden	7
Australia	7
Korea	6
Finland	4
Netherlands	4
Japan	3
Slovak Republic	3
United Kingdom	3
Canada	2
New Zealand	2
Norway	2
Denmark	1
South Africa	1
Portugal**	n=not indicated
Lithuania**	n=not indicated

*data mainly from Johnson PM. International profiles of dental hygiene: a 21-nation study 1987 - 2006 report. Toronto: PMJ Consultants, 2007

** data specific from Luciak-Donnsberger C, Hovius M. Dental hygiene curriculum proposal for the EDHF. International Federation of Dental Hygienists, 2003.

Increasing educational opportunities at the undergraduate and graduate level is essential to provide dental hygienists with the educational pathways to graduate programs that will allow them to develop research abilities. The research directions of the dental hygiene profession align well with the current directions of the Canadian Institute of Health Research (CIHR). CIHR²⁰¹ has emphasized the need to bridge the gap between research and practice. It has also highlighted the importance of building the capacity of researchers and focusing on new investigators as they bring new ideas to the table. In recognition of the need for dental hygiene research, the CIHR has partnered with the Canadian Foundation of Dental Hygiene Research and Education (CFDHRE) to establish an award for dental hygiene research at a master's degree level (http://www.cfdhre.com/call_for_proposals.asp). In 2008, a dental hygiene researcher from Dalhousie University received CIHR funding for a collaborative research project; this is the first time a dental hygienist has been the principal investigator for a CIHR grant. Dental hygienists have the abilities and the dedication to be at the research table; they just need additional educational opportunities to be there in greater numbers. Their focus on oral health education and health promotion make them ideal candidates for research in oral health.

There are many factors impacting on the oral health of Canadians, and they are complex in nature as is evident from the previous discussions. However, a consistent theme surrounds the importance of health promotion in transforming our health care system to support the social goals of our society. As the participants in the international Gateway Conference identified; “health promotion and health education are uniquely poised to provide the vision and leadership to have a significant impact on global health”.⁹² Dental hygienists can support such a vision in oral health; they just need increased opportunities to participate.

PATHWAYS TO SUPPORT THE ORAL HEALTH OF CANADIANS

The need for oral health services in Canada is well supported in the literature as previously discussed and more specific information is anticipated to arise from the Canadian Health Measures Survey (CHMS) that will collect information related to oral health (http://www.hc-sc.gc.ca/ahc-asc/branch-dirgen/fnihb-dgspni/ocdo-bdc/project_e.html#1). The first phase includes questions about oral health, and the second phase contains clinical assessments including data collection about decayed, missing, filled or treated teeth or both, as well as about the health of oral soft tissues. It is anticipated that these data will be able to shed further light on the relationship between oral health and the determinants of health in general as well as some major conditions of concern such as cardiovascular and respiratory disease, diabetes and obesity. We can no longer ignore the importance of oral health to general health, and quality of life.

The current legislative changes related to self initiation by dental hygienist will provide increased opportunities to access dental hygiene services. There is a need for consistency in this legislation across Canada, particularly in such remote geographical locations as Inuit communities where there are few or no practising oral health professionals. Standardization of dental hygiene education at the bachelor's degree level will help support the evolution of new delivery models, and provide increased access to oral health services across Canada. The dental hygiene workforce is an important human resource to make oral care more accessible and cost efficient. The preventive and health promotion services of dental hygienists have the potential to significantly reduce the costs of oral health care down the road.

The current position of dental hygienists in private dental practices is anticipated to continue; it is still likely to be the most prevalent practice context for dental hygienists for many years to come. However, new opportunities are arising in both the public and the private sectors; increased options for partnerships between these sectors are also recognized. This currently occurs in residential care facilities where dental hygienists have contracts with the facility to provide assessments and daily care plans for residents. Additional dental hygiene services are then managed on a fee-for-service basis with the residents. Tele-Oral Health Services and e-Oral Health services also provide opportunities to integrate oral health as part of general health approaches. Just as cross cultural brokers¹⁴⁷ have facilitated access to health care and other services for new immigrants, and nurses have assumed a broker role in residential care,¹⁴⁶ dental hygienist have a role to play as “oral health brokers” to facilitate access to appropriate dental services for the working poor, and other high priority groups.

The care of clients with chronic conditions provides another example of the roles dental hygienists could assume. Client outcomes have been reported to be better when chronic conditions are monitored more closely,^{129,202–205} and the prevalence of chronic conditions are predicted to escalate in the future.^{1,4} In Ontario alone, it is estimated that over a million residents will be enrolled in formal disease management programs by 2020.²⁰² The need for all health professionals to develop further abilities in this area has been documented internationally. “To provide effective care for chronic conditions, the skills of health professionals must be expanded to meet these new complexities.”¹⁰

Another important area for dental hygienists involves screening programs for oral cancer, and other oral and general diseases. Canadians have access to other screening programs such as screening for breast and cervical cancer, but these opportunities do not exist for oral cancer. In a randomized clinical trial in India, a 34 per cent difference was found in reductions of mortality from oral cancer for users of alcohol or tobacco or both through a visual oral screening program.²⁰⁶ Sankaranarayanan et al.²⁰⁶ calculate that these results would suggest the potential to prevent 37,000 premature deaths per year worldwide. Opportunities are, of course, not limited to the above examples.

Dental hygienists specialize in health promotion, oral health education as well as providing preventive and therapeutic services to support and maintain oral health. The combination of these abilities makes them strong contenders to provide increased access to oral health services for Canadians who currently cannot access private dental practices. Dental hygienists could assume increased roles in the continuum of care sectors, from public health, emergency services, acute care, rehabilitation services and long term care to palliative care. There are multiple opportunities for dental hygienists to collaborate with oral health professionals as well other health care professionals in supporting the oral health of Canadians.

Self initiation has been granted to dental hygienists in recognition of their abilities. The educational background and practice experience of dental hygienists supports this trend.²⁰⁷ However, there is a need for increased educational opportunities to support dental hygienists in integrating more fully into the health care system, and in providing diverse access pathways for oral health services. The standard of care twenty years ago is no longer the current standard of care; the need to expand dental hygiene education is being recognized internationally.¹⁹²

The PHAC Core Competencies³ provides an example of the changing standard of education in health care; they were developed at the bachelor’s degree level to support increased capacity building of the Canadian public health workforce. The Public Health Agency of Canada and the Office of the Chief Dental Officer recently commissioned a scan to determine the composition of the Canadian dental public health workforce in terms of fulltime equivalents (see Table 5). It is evident from this table that dental hygienists compose the major part of the oral health workforce in the public health sector. Given their central role in public health, they need to have the depth of abilities as articulated in the PHAC document.³

The current dental hygiene entry-to-practice education cannot provide the learning experiences that have been articulated at the national and international levels as being critical for health care in the 21st century. Like other health professionals, dental hygienists need to be prepared to work with a population health approach. Learners need more experiences to develop the abilities that will allow them to contribute substantively at an interprofessional and intersectoral level.

Table 5: Dental Public Health Human Resources*

Health Human Resources in Canada Dental Public Health				
Dentists	Dental Therapists	Dental Hygienists	Dental Assistants	Other
120 ¹	158 ²	452 ³	242	148 ⁴

* from website of the Office of the Chief Dental Officer Projects: http://www.hc-sc.gc.ca/ahc-asc/branch-dirgen/fnihb-dgspni/ocdo-bdc/project_e.html#9

¹ Nationally/Provincially recognized or trained Dental Public Health dentists.

² 128 of these in Saskatchewan, Manitoba and Territories

³ 347 of these in Quebec and Ontario

⁴ Includes Dental Educators, Health Promoters, Licensed Practical Nurses, program coordinators, data entry personnel, secretaries, clerks, non-dental managers.

Educational models currently exist in Canada for the support of bachelor degree education for dental hygienists; the programs include access for graduates of 2-year and 3-year diploma programs (See Table 2). The most diversified model is found in British Columbia; it will be used as an example to identify opportunities for other jurisdictions. It involves a collaborative approach between all accredited diploma dental hygiene programs and the Dental Hygiene Degree Program at the University of British Columbia (UBC). It integrates the recognition of prior learning for dental assistants found within the college system and provides opportunities for the transfer of block credits in recognition of graduation from an accredited program.

The dental hygiene education model in British Columbia includes the following elements:

- Access program for certified dental assistants through Prior Learning Assessment and Recognition (PLAR). It also provides opportunities for taking online didactic courses for the second year to allow learners to stay in their communities.
- Access program for immigrants with oral health backgrounds through PLAR. This element is part of the Vancouver Community College model but has yet to be implemented. The certified dental assisting access option was the first phase to be implemented, and was reviewed in May 2008 for national accreditation.
- Direct access for graduates of the 3-year accredited diploma programs in British Columbia to the fourth year UBC Dental Hygiene Degree courses without admission costs.
- Completion of the fourth year of the UBC Dental Hygiene Degree Program through online courses.
- Opportunities for dental hygienists from across Canada to gain a bachelor's degree in dental hygiene. The graduates of 2-year accredited programs complete a 2-year online program, and the graduates of 3-year accredited programs complete a 1-year online program.
- A direct degree option at UBC which includes collaboration with the colleges and university colleges for the second and third year courses. The students enter first year at UBC and then select a college or university college for their second and third year; they then return to UBC for their fourth year.
- An entry-to-practice option including all four years implemented at UBC.
- Opportunities for international graduates to access degree completion opportunities through a PLAR process involving the National Dental Hygiene Certification Board.

The BC model is an inclusive and accessible model with four options for access to discipline specific bachelor degree education. However, UBC does not have the capacity to provide opportunities for all learners in Canadian dental hygiene programs. The University of Alberta also implements a bachelor's degree in dental hygiene that provides degree completion opportunities for dental hygienists, and Dalhousie University commenced its fourth year in the fall of 2008. The University of Manitoba Senate has also approved a bachelor's degree program for dental hygienists.

In summary bachelor's degree opportunities exist for Canadian dental hygienists through the following pathways:

- 2-year diploma and 2-year degree completion;
- 3-year diploma and 1-year degree completion;
- 1st year prerequisites, year 2 and 3 in a diploma program followed by 1-year degree completion; and
- 4-year entry-to-practice program.

There are opportunities in the other provinces (New Brunswick, Québec, Ontario and Saskatchewan) to establish partnerships with provincial degree granting organization to provide access to bachelor degree education for dental hygienists. Many educators are working on such collaborations. Data from British Columbia and Alberta suggest that dental hygiene diploma graduates will continue to bachelor degree education given programs in an accessible format. The data also indicate that 30 per cent of the UBC bachelor's degree graduates have proceeded to graduate studies. Opportunities for graduate studies are provided through programs in oral health sciences and other discipline areas. However, dental hygienists must currently access programs internationally for discipline-specific graduate studies.

The various pathways discussed in this report identify the critical need to provide dental hygienists with bachelor's degree opportunities as well as opportunities for access to master's, doctoral and postdoctoral studies to support dental hygiene education, research, and practice. It is important to provide dental hygienists with increased abilities in a number of areas as previously discussed. Abilities related to research use, education, health promotion, communication, collaboration, and interprofessional care are critical for increased client safety and improved client outcomes. Dental hygienists have these abilities but it is the degree to which they have them that must be considered. It is essential to increase the depths of these abilities for dental hygienists to be able to assume increasing and diverse roles in the transformation and evolution of the Canadian health care system.

Bachelor degree education opens opportunities for graduate work to allow dental hygienists to build a body of knowledge to guide the profession and support the oral health of Canadians. Many areas of research have been identified in oral health; they can only be addressed by increased access for dental hygienists to graduate programs. There are clear pathways to the various levels of education but they need to be further developed and made more accessible for an increased number of dental hygienists.

VISION FOR DENTAL HYGIENE EDUCATION

The following vision reflects areas in which dental hygienists can assume an increased role in promoting the oral health of Canadians. Dental hygienists will:

- be integral members of interprofessional teams as they provide the clinical, health promotion, and educational insights associated with the promotion of oral health;
- provide screening assessments for underserved Canadians with regard to oral cancer and other diseases through salivary and swab tests, new adjunctive technology as well as biopsy techniques;
- provide the oral health perspective within surveillance and risk reduction programs;
- provide the oral health perspective to chronic disease management programs;
- act in the capacity of “oral health brokers” to assist underserved Canadians in understanding oral health care, and the diverse and most cost-effective opportunities they have for accessing oral and general health services;
- provide educational, health promotion, preventive and therapeutic oral health services in diverse settings to individual clients and groups that commonly do not have access to our current dental delivery model;
- assist in the management of pandemic events in coordination with other health professionals (Dental hygienists’ ability with local anaesthesia makes them important should safe injections sites be required for the control of pandemic events.); and
- be members of research teams as equal partners based on their research credentials and experience.

To support this vision the following outcomes were adopted for the Dental Hygiene Education Agenda. The CDHA will work towards the establishment of:

5. Bachelors degree programs in dental hygiene for entry-to-practice that articulate with masters programs;
6. Master degree programs with a dental hygiene focus to advance dental hygiene knowledge, research and practice; and
7. Doctoral and post-doctoral degree programs with a dental hygiene focus to advance dental hygiene knowledge, research and practice.

These educational outcomes reaffirm the previous CDHA education policies^{208,209} and expand upon them. They align well with the values of the profession to promote the physical, mental and social well-being of Canadians. They are grounded in the analysis of the complex issues we face in oral health and the specific educational requirements needed to build the capacity of dental hygienists to assist in the transformation of oral care in the best interests of the Canadian public. Our increasing knowledge of the links between oral and general health create an urgency for change in our approach to oral health; such an urgency is echoed by the Canadian Public Health Association in their call to reduce health inequalities in Canada (<http://www.cpha.ca/en/conferences/archives/conf2008/action.aspx>) The educational outcomes represent short-term and long term goals for the profession, and support the view that dental hygienists need access to higher education at all levels as do many other health professionals.

Initial action plans will be directed towards the creation of bachelor degree educational opportunities for dental hygienists in all Canadian jurisdictions. This is the critical element that will open further educational pathways. However, there is also a need to work concurrently on the development of master programs to provide additional pathways for the current bachelor degree graduates to further their education and to develop their research abilities within a discipline specific context.

CONCLUSION

General health is not possible in the absence of oral health; it is important that we take steps to reconnect the body with the mouth. Canadians need additional pathways to access oral health services and the dental hygiene profession is ideally suited to provide new access points. Dental hygienists are oral health professionals with a commitment to solving the root causes of oral disease through multilevel and intersectoral initiatives focusing on early detection, prevention, education and health promotion.

There are new legislative pathways that support increased opportunities to provide oral health care in diverse practice contexts. Alberta currently provides the greatest opportunities for access to care and increased scope of care. However, further legislative changes could expand and build on these opportunities nationally. The combination of legislative changes and educational opportunities could be very powerful in helping to address the oral health needs of Canadians.

There are existing examples of innovative models within Canadian dental hygiene education that support the continuing competency of the profession. There are, of course, also other pathways to consider given the plurality inherent in the Canadian context. However, there is a need to create more numerous pathways for dental hygienists in their educational pursuits as these pathways will ultimately benefit the oral health of the Canadian public. Increased access to bachelor degree programs must be complemented by master, doctoral, and post-doctoral studies that allow dental hygienists to use and expand their growing body of knowledge.

Creating new pathways in oral health care and education will need to be a collaborative project. All dental hygiene organizations, employers and individual members of the profession have a shared responsibility to support the creation of these pathways that will ultimately help to support the oral health of Canadians and thus contribute to their well-being. Dental hygienists are well positioned to spearhead the movement to improve access to care and to reconnect the mouth with the body. Expanded educational opportunities will solidify this position and enable dental hygienists to work collaboratively with other health professions in making this a reality.

REFERENCES

1. Federal/Provincial/Territorial Joint Task Group on Public Health Human Resources. Building the public health workforce for the 21st century. Ottawa, 2006.
2. World Health Organization. A safer future: global public health security in the 21st century. Geneva, CH; WHO, 2007.
3. Public Health Agency of Canada (PHAC). Core competencies for public health in Canada: release 1.0. Ottawa: PHAC, 2007. Available at www.phac-aspc.gc.ca/core_competencies and www.aspc-phac.gc.ca/competences_essentielles.
4. World Health Organization. Preparing a health care workforce for the 21st century: the challenge of chronic conditions. Geneva, CH: Noncommunicable Disease and Mental Health Cluster, Chronic Disease and Health Promotion Department, 2005.
5. Health and Welfare Canada. The practice of dental hygiene in Canada: descriptions, guidelines and recommendations: report of the working group on the practice of dental hygiene in Canada. Ottawa, ON: Minister of Supply and Services Canada, 1988.
6. Canadian Dental Hygienists Association (CDHA). Dental hygiene definition and scope. Ottawa, ON: CDHA, 2002. Available at: <http://cdha.ca>.
7. Dental Hygiene Educators Canada (DHEC), Canadian Dental Hygienists Association (CDHA), National Dental Hygiene Certification Board (NDHCB), Federation of Dental Hygiene Regulatory Authorities (FDHRA). National dental hygiene competencies for entry-to-practice. Ottawa, ON: 2008.
8. Sunell S. The impact of specialized accreditation on Canadian dental hygiene diploma programs. Master's thesis. Vancouver, BC: University of British Columbia, 1996.
9. Federal, Provincial and Territorial Dental Directors. A Canadian oral health strategy. Ottawa, ON: Federal, Provincial and Territorial Dental Directors, 2005.
10. Petersen PE, Yamamoto T. Improving the oral health of older people: the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* 2005; 33: 81–92.
11. Khader YS, Dauod AS, El-Qaderi SS, Alkafajei A, Batayha WQ. Periodontal status of diabetics compared with nondiabetics: a meta-analysis. *J Diabetes Complications* 2006; 20: 59-68.
12. Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiological perspective. *Ann Periodontol* 2001; 6: 99-112.
13. Janket SJ, Wightman A, Baird AE, Van Dyke TE, Jones JA. Does periodontal treatment improve glycemic control in diabetic patients? A meta-analysis of intervention studies. *J Dent Res* 2005;84(12):1154-1159.
14. Desvarieux M, Demmer R, Rundek T, Boden-Albala B, Jacobs D Jr, Sacco R, Papapanou P. Periodontal microbiota and carotid intima-media thickness: the oral infections and vascular disease epidemiology study (INVEST). *Circulation* 2005; 111(5): 576-82.
15. Beck JD, Eke P, Heiss G, Madianos P, Couper D, Lin D, Moss K, Elter J, Offenbacher S. Periodontal disease and coronary heart disease: a reappraisal of the exposure. *Circulation* 2005; 112(1): 19-24.
16. Mustapha IZ, Debrey S, Oladubu M, Ugarte R. Markers of systemic bacterial exposure in periodontal disease and cardiovascular disease risk: a systematic review and meta-analysis. *J Periodontol* 2007; 78(12): 2289-302.

17. Khader YS, Ta'ani Q. Periodontal disease and the risk of preterm birth and low birth weight: a meta-analysis. *J Periodontol* 2005; 76(2): 161-165.
18. Lopez NJ, Smith PC, Gutierrez J. Higher risk of preterm birth and low birth weight in women with periodontal disease. *J Dent Res* 2002; 81: 58–63
19. Jeffcoat MK, Hauth JC, Geurs NC, Reddy MS, Cliver Sp, Hodgkins PM, et al. Periodontal disease and preterm birth: results of a pilot intervention study. *J Periodontol* 2003; 74(8): 1212-1218.
20. MacEntee MI, Wyatt CCL, Beattie BL, Paterson B, Levy-Milne R, McCandless L, Kazanjian A. Provision of mouth-care in long-term care facilities: an educational trial. *Community Dent Oral Epidemiol* 2007; 35: 25–34.
21. Chalmers JM, Carter KD, Spencer AJ. Caries incidence and increments in Adelaide nursing home residents. *Spec Care Dentist* 2005; 25(2): 95-105.
22. Arpin, S, Brodeur JM, Corbeil P. Dental caries, problems perceived and use of services among institutionalized elderly in 3 regions of Québec, Canada. *J Can Dent Assoc* 2008; 74(9): 807a-807d.
23. Adachi M, Ishihara K, Abe S, Okuda K. Professional oral health care by dental hygienists reduced respiratory infections in elderly persons requiring nursing care. *IJDH* 2007; 5 (2): 69–74.
24. Limeback H. implications of oral infections on systemic diseases in the institutionalized elderly with a special focus on pneumonia. *Ann Periodontol* 1998; 3(1): 262-275.
25. U.S. Department of Health and Human Services. Oral health in America: a report of the Surgeon General. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000.
26. Mariño R, Schofield M, Wright C, Calache H, Minichiello V. [Self-reported and clinically determined oral health status predictors for quality of life in dentate older migrant adults.](#) *Community Dent Oral Epidemiol* 2008; 36(1): 85-94.
27. Eriksen HM, Dimitrov V. The human mouth: oral functions in a social complexity perspective. *ACTA Odontol Scand* 2003; 61: 172-177.
28. Acs G, Lodolini G, Kaminsky S, Cisernos G. Effect of nursing caries on body weight in a pediatric population. *Pediatr Dent* 1992; 14(5):302–305.
29. Zini A, Sgan-Cohen HD. [The effect of oral health on quality of life in an underprivileged homebound and non-homebound elderly population in Jerusalem.](#) *J Am Geriatr Soc* 2008; 56(1): 99-104.
30. Patel RR, Richards PS, Inglehart MR. Periodontal health, quality of life and smiling patterns – an exploration. *J Periodontol* 2008; 79(2): 224-231.
31. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Impact of treated and untreated dental injuries on the quality of life of Ontario school children. *Dent Traumatol* 2008; 24: 309-313.
32. Moore R, Brødsgaard I, Rosenberg N. The contribution of embarrassment to phobic dental anxiety: a qualitative research study. *BMC Psychiatry* 2004; 4(10): 1-11.
33. Barbosa TS; Gaviao MBD. [Oral health-related quality of life in children: part II. Effects of clinical oral health status: a systematic review.](#) *Int J Dent Hyg* 2008; 6(2):100-107.

34. Lawrence HP, Thomson WM, Broadbent JM, Poulton R. [Oral health-related quality of life in a birth cohort of 32-year olds](#). *Community Dent Oral Epidemiol* 2008; 36 (4): 305-316.
35. Low W, Tan S, Schwartz S. The effect of severe caries on the quality of life in young children. *Pediatr Dent* 1999; 21(6): 325–326.
36. Agou S, Locker D, Streiner DL, Thompson B. Impact of self-esteem on the oral-health-related quality of life of children with malocclusion. *Am J Orthod Dentofacial Orthop* 2008; 134 (4): 484-489.
37. Easton JA, Landgraf JM, Casamassimo PS, Wilson S, Ganzberg S. [Evaluation of a generic quality of life instrument for early childhood caries-related pain](#). *Community Dent Oral Epidemiol* 2008; 36(5): 434-440.
38. Slade GD, Spencer AJ, Locer D, Hunt RJ, Strauss RP, Beck JD. Variations in the social impact of oral conditions among older adults in South Australia, Ontario and North Carolina. *J Dent Res* 1996; 75(7): 1439-1450.
39. Klages U, Bruckner A, Zentner A. Dental aesthetics, self-awareness and oral health-related quality of life in young adults. *Eur J Orthod* 2004; 26(5): 507-514.
40. Wong, ATY, McMillan AS, McGrath C. Oral health-related quality of life and severe hypodontia. *J Oral Rehabil* 2006; 33: 869-871.
41. Baker SR, Pankhurst CL, Robinson PG. Utility of two oral health-related quality-of-life measures in patients with xerostomia. *Community Dent Oral Epidemiol* 2006; 34: 351–362.
42. Health Disparities Task Group of the Federal/Provincial/Territorial Advisory Committee on Population Health and Health Security. Reducing health disparities—roles of the health sector: discussion paper. Ottawa, ON: Ministry of Health, 2005.
43. Lawrence HP, Leake JL. The US Surgeon General’s report on oral health in America: a Canadian perspective. *J Can Dent Assoc* 2001; 67(10): 1-10.
44. Ministry of Health. Chief Public Health Officer’s report on the state of public health in Canada. Ottawa, ON: Ministry of Health, 2008.
45. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Program. *Community Dent Oral Epidemiol* 2003; 31(Supple 1): 3-24.
46. World Health Organization. Oral health: action plan for promotion and integrated disease prevention-Executive Board 120th Session. Geneva, CH; WHO, 2006.
47. Petersen, PE, Gougeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral disease and risks to oral health. Bulletin of World Health Organization September 2005.
48. Hobdell MH. Poverty, oral health and human development: contemporary issues affecting the provision of primary oral health care. *J Am Dent Assoc* 2007; 138: 1433-1436.
49. CSDH. Closing the gap in a generation: health equity through action on the social determinants of health: final report of the Commission on Social Determinants of Health. Geneva, CH; World Health Organization, 2008.
50. Binnie VI, McHugh S, Jenkins W, Borland W, Macpherson LM. A randomised controlled trial of a smoking cessation intervention delivered by dental hygienists: a feasibility study. *BMC Oral Health* 2007; 7(5): 1-9.
51. Dobrossy L. Epidemiology of head and neck cancer: Magnitude of the problem. *Cancer Metastasis Rev* 2005; 24: 9–17.

52. Marshall TA, Eichenberger-Gilmore JM, Broffitt BA, Warren JJ, Levy SM. Dental caries and childhood obesity: roles of diet and socioeconomic status. *Community Dent Oral Epidemiol* 2007; 35 (6): 449–458.
53. Bailleul-Forestier I, Lopes K, Souames M, Azoguy-Levy S, Frelut ML, Boy-Lefevre ML. Caries experience in a severely obese adolescent population. *Int J Paediatr Dent* 2007; 17 (5): 358-63.
54. Mirolla M. The cost of chronic disease in Canada. The Chronic Disease Prevention Alliance of Canada, January 2004.
55. Canadian Cancer Society/National Cancer Institute of Canada. Canadian cancer statistics 2007 [serial online] 2007 Apr [cited 2008 Feb 2]; [116 screens]. Available at:
URL:http://www.cancer.ca/vgn/images/portal/cit_86751114/36/15/1816216925cw_2007stats_en.pdf.
56. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Impact of treated and untreated dental injuries on the quality of life of Ontario school children. *Dent Traumatol* 2008; 24(3): 309-13.
57. Pine CM, Adair PM, Nicoll AD, Burnside G, Petersen PE, Beighton D, et al. International comparisons of health inequalities in childhood dental caries. *Community Dent Health*. 2004 Mar; 21(1 Suppl):121-30.
58. Schroth RJ, Smith PJ, Whalen JC, Lekic C, Moffatt ME. Prevalence of caries among preschool-aged children in a northern Manitoba community. *J Can Dent Assoc* 2005; 71(1): 27a-27f.
59. Peressini S, Leake JL, Mayhall JT, Maar M, Trudeau R. Prevalence of early childhood caries among First Nations children, District of Manitoulin, Ontario. *Int J Paediatr Dent* 2004; 14(2):101-110.
60. Keon WJ, Pépin L. Population health policy: international perspectives – 1st report of the Subcommittee on Population Health. Ottawa, ON: Standing Senate Committee on Social Affairs, Science and Technology, 2008.
61. Leake JL. Why do we need an oral health care policy in Canada? *J Can Dent Assoc* 2006; 72(4): 317-317j.
62. Leitch KK. Reaching for the top: a report by the advisory on healthy children & youth. Ottawa, ON: Minister of Health, 2007.
63. Ministry of Health and Ministry Responsible for Seniors. A report on the health of British Columbians: the health and well-being of British Columbia's children. Victoria, BC: Ministry, 1998.
64. Patra J, Popova S, Rehm J, Bondy S, Flint R, Giesbrecht N. Economic costs of chronic disease in Canada 1995-2003. Toronto, ON; Prepared for Ontario Chronic Disease Prevention Alliance and Ontario Public Health Association, 2007.
65. Ministry of Health. Health Canada's 2008-2009 report on plans and priorities. Ottawa, ON: Author, 2008.
66. Keon WJ, Pépin L. Population health policy: federal, provincial and territorial perspectives – 3rd report of the Subcommittee on Population Health. Ottawa, ON: Standing Senate Committee on Social Affairs, Science and Technology, 2008.
67. Canadian Institute for Health Information (CIHI). Exploring the 70/30 split: how Canada's health care system is financed. Ottawa, ON: CIHI, 2005.
68. Harris Interactive. International Health Perspectives, 2004, [online], last modified July 8, 2004, cited August 23, 2008, from http://www.cmwf.org/usr_doc/IHP2004_topline_results.pdf
69. Blendon RJ, Schoen C, DesRoches CM, Osborne R, Scoles KL, Zapert K. Inequities in health care: a five-country survey. *Health Affairs* 2002;21(3):182-91.

70. Birch S, Anderson R. Financing and delivering oral health care: what can we learn from other countries? *J Can Dent Assoc* 2005; 71(4): 243-243d.
71. Leake JL, Birch S. Public policy and the market for dental services. *Community Dent Oral Epidemiol* 2008; 36(4):287-295.
72. Sabbah W, Leake JL. Comparing characteristics of Canadians who visited dentists and physicians during 1993/94: a secondary analysis. *J Can Dent Assoc* 2000;66 (2):90-05.
73. Canadian Dental Hygienists Association (CDHA). Financing Canada's oral health system: brief submitted to the House of Commons Standing Committee on Finance. Ottawa ON: CDHA, 2002.
74. Melanson SL. Establishing a social clinic: addressing unmet dental needs. *Can J Dent Hygiene* 2008; 42(4):185-193.
75. Lewis C, Lynch H, Johnston B. Dental complaints in emergency departments: a national perspective. *Ann Emerg Med* 2003; 42 (1): 93-99.
76. Ladrillo TE, Hobdell MH, Caviness C. Increasing prevalence of emergency department visits for pediatric dental care, 1997-2001. *J Am Dent Assoc* 2006; 137(3): 379-385.
77. Scott R, Sheller B, Bryan W. Utilization of a hospital for treatment of pediatric dental emergencies. *Pediatr Dent* 2006; 28(1): 10-17.
78. Quiñonez C, Locker D. An omnibus survey on oral health and dental care. Presentation at CAPHD/ACSDP Scientific Conference, Halifax, Nova Scotia, May 31, 2008. Available at: <http://www.caphd-acsdp.org/AGM-Overview.htm>.
79. Cohen LA, Magder LS, Manski RJ, Mullins CD. Hospital admissions associated with nontraumatic dental emergencies in a Medicaid population. *Am J Emerg Med* 2003; 21 (7): 540-554.
80. Cohen L A, Manski RJ, Magder LS, Mullins CD. A Medicaid population's use of physicians' offices for dental problems. *Am J Public* 2003; 93(8): 1297-1301.
81. Waldrop RD, Binh H, Reed S. Increasing frequency of dental patients in the urban ED. *Am J Emerg Med* 2000; 18(6): 687-689.
82. Schroth RJ. A review of repeat general anesthesia for Pediatric dental surgery in Alberta, Canada. *Pediatr Dent* 2007; 29(6): 480-487.
83. Berkowitz RJ: Causes, treatment and prevention of early childhood caries: a microbiologic perspective. *J Can Dent Assoc* 2003; 69(5): 304-307.
84. Miles AR. Intravenous procedural sedation: an alternative to general anesthesia in the treatment of early childhood caries. *J Can Dent Assoc* 2003; 69(5): 298-302.
85. Kanellis MJ, Damiano PC, Momany ET. Medicaid costs associated with the hospitalization of young children for restorative dental treatment under general anesthesia. *J Public Health Dent* 2000;60(1):28-32.
86. Baldota KK, Leake JL. A macroeconomic review of dentistry in Canada in the 1990s. *J Can Dent Assoc* 2004; 70 (9):604-609.
87. Keon WJ, Pépin L. Population health policy: issues and options – 4th report of the Subcommittee on Population Health. Ottawa, ON: Standing Senate Committee on Social Affairs, Science and Technology, 2008.

88. Public Health Agency of Canada (PHAC), Canadian Public Health Association (CPHA). Moving ahead, together; launch of a national dialogue on public health and sustainable development in Canada- workshop summary report. Ottawa ON: PHAC, 2007.
89. Pierre N, Seibel H. The frontline health dialogues: report from Ottawa roundtable. Ottawa, ON: Canadian Policy Research Networks, 2007.
90. International Union for Health Promotion Education (IUHPE) & Canadian Consortium for Health Promotion (CCHP). Shaping the future of health promotion: priorities for action. *Health Promot Int* 2007; 23(1):98-102.
91. World Health Organization. Bangkok charter for health promotion in a globalized world. Geneva, CH; WHO, 2005
92. International Union for Health Promotion (IUHP), Society for Public Health Education (SOPHIE). Towards domains of core competency for building capacity in health promotion: the Galway consensus conference statement. June 2008. Available at: <http://www.sophe.org/>.
93. Lowe GS. The role of healthcare work environments in shaping a safety culture. *Healthc Q* 2008; 11(2): 43-51.
94. Lavigne S, Forrest J. Do no harm – are you? Is your dental hygiene practice evidence-based? Part 1. *Canadian Journal of Dental Hygiene* 2004; 38(5): 210-219.
95. Cobban SJ. Evidence-based practice and the professionalization of dental hygiene. *Int J Dent Hyg* 2004; 2: 152-160.
96. Estabrooks C, Wallin L, Milner M. Measuring Knowledge Utilization in Health Care. *Int J Policy Analysis & Evaluation* 2003; 1(1): 23-36.
97. Ministry of Health. An ounce of prevention revisited: provincial health officer's annual report. Victoria, BC: Ministry of Health, 2006.
98. National Forum on Health. Creating a culture of evidence-based decision making in health. Ottawa, ON: Secretariat, National Forum on Health, 1997.
99. Evidence-Based Medicine Working Group. Evidence-based medicine: a new approach to teaching the practice of medicine. *JAMA* 1992; 268(17): 2420–2425.
100. Goode CJ, Piedalue F. Evidence-based clinical practice. *J Nurs Admin* 1999; 29(6):15–21.
101. Estabrooks CA. Will evidence-based nursing practice make practice perfect? *Can J Nurs Res* 1998; 30(1):15–36.
102. Buetow S, Kenealy T. Evidence-based medicine: the need for a new definition. *J Eval Clin Prac* 2000; 6(2): 85–92.
103. Cobban SJ. Evidence-based practice and the professionalization of dental hygiene. *Int J Dent Hyg* 2004; (2):152-160.
104. Belkhdja O, Amara N, Landry R, Ouimet M. The extent and organizational determinants of research utilization in Canadian health services organizations. *Sci Commun* 2007; 28(3): 377-417
105. Hanney S. Personal interaction with researchers or detached synthesis of the evidence: modelling the health policy paradox. *Evaluation & Research in Education* 2004; 18(1/2): 72-82.
106. Öhrn K, Olsson C, Wallin L. Research utilization among dental hygienists in Sweden – a national survey. *Int J Dent Hyg* 2005; 3:104-111.
107. Veramah V. Utilization of research findings by graduate nurses and midwives. *J Adv Nurs* 2004; 47: 183–191.

108. Chichester S, Wilder R, Mann G. Incorporation of evidence-based principles in baccalaureate and non-baccalaureate degree dental hygiene programs. *J Dent Hyg* 2002; 76: 60–66.
109. Finley-Zarse SR, Overman PR, Mayberry WE, Corry AM. Information-seeking behaviors of U.S. practicing dental hygienists and full-time dental hygiene educators. *J Dent Hyg* 2002; 76(2):116-124.
110. Cukrowicz KC, White BA, Reitzel LR, Burns AB, Driscoll KA, Kemper TS, Joiner TE. Improved treatment outcome associated with the shift to empirically supported treatments in a graduate training clinic. *Prof Psychol Res Pr* 2005; 36(3):330-337.
111. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, Robinson N. Lost in knowledge translation: time for a map? *J Contin Educ Health Prof* 2006; 26(1): 13-24.
112. Lang E, Wyer P, Haynes R. Knowledge translation: closing the evidence-to-practice gap. *Ann Emerg Med* 2003; 49(3): 355-363
113. Glasgow RE, Lichtenstein E, Marcus AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *Am J Public Health* 2003; 93(8):1261-1267.
114. Landry R, Amara N, Pablos-Mendes A, Shademani R, Gold I. The knowledge-value chain: a conceptual framework for knowledge translation in health. *Bulletin of the World Health Organization* 2006; 84(8): 597-602.
115. Lavis J. Research, public policymaking, and knowledge-translation processes: Canadian efforts to build bridges. *J Contin Educ Health Prof* 2006; 26(1): 37-45.
116. Collins PA, Hayes MV. Twenty years since Ottawa and Epp: researchers' reflections on challenges, gains and future prospect for reducing health inequities in Canada. *Health Promotion International* 2007; 22(4): 337-345.
117. World Health Organization. *The Ottawa Charter for health promotion: first international conference on health promotion.* Geneva, CH: WHO, 1986.
118. Canadian Council on Learning (CCL). *Health literacy in Canada: a healthy understanding.* Ottawa, ON: CCL, 2008.
119. Rootman I, Ronson B. Literacy and health research in Canada: where have we been and where should we go? *Can J Public Health* 2005; 96(Suppl 2): 62-77.
120. Ponce NA, Hays RD, Cunningham WE. Linguistic disparities in health care access and health status among older adults. *J Gen Intern Med* 2006; 21:786-791.
121. Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Gohlman LT, Rudd RR. The prevalence of limited health literacy. *J Gen Intern Med* 2005; 20: 175-184.
122. Sudore RL, Mehta K, Simonsick EM, Harris TB, Newman AB, Saterfield S, Rosano C, Rooks RN, Rubin SM, Ayonayon HN, Yaffe K. Limited literacy in older people and disparities in health and healthcare access. *J Am Geriatr Soc* 2006; 54(5): 770-776.
123. Canadian Council on Learning (CCL). *Health literacy in Canada: initial results from the international adult literacy and skills survey 2007.* Ottawa, ON: CCL, 2007.
124. Gregg J, Saha S. Communicative competence: a framework for understanding language barriers in health care. *J Gen Intern Med* 2007; 22(Suppl 2): 368-370.
125. Mancuso CA, Rincon M. Impact of health literacy on longitudinal asthma outcomes. *J Gen Intern Med* 2006; 21: 813-817.

126. Coyle MK, Duffy JR, Martin EM. Teaching/learning health promoting behaviors through telehealth. *Nurs Educ Perspect* 2007; 28(1): 18-23.
127. Norman CD, Skinner HA. eHealth literacy: essential skills for consumer health in a networked world. *J Med Internet Res* 2006; 8(2) e9.
128. Lloyd LLJ, Ammary NJ, Epstein LG, Jonson R, Rhee K. A transdisciplinary approach to improve health literacy and reduce disparities. *Health Promot Pract* 2006; 7(3): 331-335.
129. Bodenheimer T. Planned visits to help patients self-manage chronic conditions. *Am Fam Physician* 2005; 72(8): 1454-1456.
130. Bodenheimer T. Patient self-management of chronic disease in primary care. *JAMA* 2002; 288(19): 2469-2474.
131. Oandasan I, Baker GR, Barker K, Bosco C, D'Amour D, Jones L, Kimpton S, Lemieux-Charles L, Nasmith L, San Martin Rodrigues L, Tepper J, Way D. Teamwork in healthcare: promoting effective teamwork in healthcare in Canada. Ottawa, ON: Canadian Health Services Research Foundation, 2006.
132. Romanow RJ. Building on values: the future of health care in Canada. Ottawa, ON: Commission on the Future of Health Care in Canada. Available at: http://www.cbc.ca/healthcare/final_report.pdf, 2002.
133. Thornhill J, Dault M, Clements D. Ready, set ... collaborate? The evidence says "go," so what's slowing adoption of inter-professional collaboration in primary healthcare? *Healthc Q* 2008; 11(2): 14-16.
134. Clements D, Helmer J. Teamwork in healthcare: pulling it all together. *Healthc Q* 2006; 9(4): 16-17.
135. Clements D, Dault M, Priest A. Effective teamwork in healthcare. *Healthc Pap* 2007; 7(Special issue): 26-34.
136. Kipp J, Pimlott JF, Satzinger F. Universities preparing health professionals for the 21st century: can something new come out of the traditional establishment? *J Interprof Care* 2007; 21(6): 633-644.
137. Gilkey MB. Applying health education theory to patient safety programs: three case studies. *Health Promot Pract* 2008; 9(2): 123-129.
138. Stevenson L, McRae C, Mughal W. Moving to a culture of safety in community home health care. *J Health Serv Res Policy* 2008; 13(1): 20-24.
139. Connor M, Ponte PR, Conway J. Multidisciplinary approaches to reducing error and risk in a patient care setting. *Crit Care Nurs Clin North Am* 2002; 14(4): 359-367.
140. Lau DT, Scandrett KG, Jarzebowski M, Holman K, Emanuel L Health-related safety: a framework to address barriers to aging in place. *Gerontologist* 2007; 47(6): 830-837.
141. Ponte PR, Connor M, DeMarco R, Price J. Linking patient and family-centered care and patient safety: the next leap. *Nurs Econ* 2004; 22(4): 211-215.
142. Kilbridge PM, Classen DC. The informatics opportunities at the intersection of patient safety and clinical informatics. *J Am Med Inform Assoc* 2008; 15(4): 397-407.
143. Ramadas K, Arrossi S, Thara S, G. Thomas G, Jissa V, Fayette JM, Mathew B, Sankaranarayanan R. Which socio-demographic factors are associated with participation in oral cancer screening in the developing world? Results from a population-based screening project in India. *Cancer Detect Prev* 2008; 32:109-115.

144. Feng X, Bobay K, Weiss M. Patient safety culture in nursing: a dimensional concept analysis. *Cancer Detect Prev* 2008; 63(3): 310-319.
145. Aiken LH, Clarke SP, Cheung RB, Sloane DM, Silber JH. Educational levels of hospital nurses and surgical patient mortality. *JAMA* 2003; 290(12): 1617-1623.
146. Jeong SY, Higgins I, McMillan M. Advance care planning (ACP): the nurse as 'broker' in residential aged care facilities. *Contemp Nurse* 2007; 26(2): 184-95.
147. Kinnaird L. Health care providers as cultural brokers: paying attention to the first interaction. *Creat Nurs* 2007; 13(1): 11-12.
148. Organization for Economic Co-operation and Development (OECD). Enhancing beneficial competition in the health professions. Paris: OECD Directorate for Financial and Enterprise Affairs, 2005.
149. Manga P. The political economy of dental hygiene in Canada. Ottawa, ON: Canadian Dental Hygienists Association, 2002
150. McCall W. Postsecondary education: accessibility and affordability review. Regina, Sask: Ministry of Advanced Education and Employment, 2007.
151. Voakes V, Chan J. A higher education act in Ontario: enshrining access, affordability, accountability and quality in postsecondary education. Toronto, ON: Ontario Undergraduate Student Alliance, 2005.
152. Alberta Advanced Education. A learning Alberta: final report of the steering committee. Edmonton, AB: Alberta Advanced Education, 2006.
153. Carlisle C, Cooper H, Watkins C. "Do none of you talk to each other?" the challenges facing the implementation of interprofessional education. *Med Tech* 2002; 26(6): 545-552.
154. Barr H. Competent to collaborate: towards a competency-based model for interprofessional education. *J Interprof Care* 1998; 12(2): 181-186.
155. Verma S, Paterson M, Medves J. Core competencies for health care professionals: what medicine, nursing, occupational therapy and physiotherapy share. *J Allied Health* 2006 Fall; 35(2): 109-15.
156. Zwarenstein M, Reeves S, Barr H. Interprofessional education: effects on professional practice and health care outcomes. *Cochran Database of Systematic Reviews*, 2005.
157. Health Canada. Interprofessional education on patient centered collaborative practice (IECPCP). [homepage on the Internet] Ottawa, On: Health Canada [cited 2007 April 10]. Available at: http://www.hc-sc.gc.ca/hcs-sss/hhr-rhs/strateg/interprof/index_e.html
158. Canadian Association of Public Health Dentistry (CAPHD). Discipline competencies for dental public health. Edmonton, AB: CAPHD, 2008, Available at: <http://www.caphd-acsdp.org/>.
159. Nogales CG, Ferrari PH, Kantorovich EO, Lage-Marques JL. Ozone therapy in medicine and dentistry. *J Contemp Dent Pract* 2008; 9 (4): 75-84.
160. Fagrell TG, Dietz W, Lingström P, Steiniger F, Norén JG. Effect of ozone treatment on different cariogenic microorganisms in vitro. *Swed Dent J* 2008; 32 (3): 139-147.

161. Brazzelli M, McKenzie L, Fielding S, Fraser C, Clarkson J, Kilonzo M, Waugh N. Systematic review of the effectiveness and cost-effectiveness of HealOzone for the treatment of occlusal pit/fissure caries and root caries. *Health Technol Assess* 2006; 10 (16): iii-iii-iv,ix.
162. Karlsson MR, Diogo Löfgren CI, Jansson HM. The effect of laser therapy as an adjunct to non-surgical periodontal treatment in subjects with chronic periodontitis: a systematic review. *J Periodontol* 2008; 79 (11): 2021-2028.
163. Lopes BM, Marcantonio RA, Thompson GM, Neves LH, Theodoro LH. Short-term clinical and immunologic effects of scaling and root planing with Er:YAG laser in chronic periodontitis. *J Periodontol* 2008; 79 (7): 1158-1167.
164. de Almeida JM, Theodoro LH, Bosco AF, Nagata MJ, Oshiiwa M, Garcia VG. In vivo effect of photodynamic therapy on periodontal bone loss in dental furcations. *J Periodontol* 2008; 79 (6): 1081-1088.
165. O'Hara DM, Seagriff-Curtin P, Levitz M, Davies D, Stock S. Using personal digital assistants to improve self-care in oral health. *J Telemed Telecare* 2008; 14(3): 150-151.
166. Kopycka-Kedzierawski DT, Billings RJ, McConnochie KM. Dental screening of preschool children using teledentistry: a feasibility study. *Pediatr Dent* 2007; 29(3): 209-213.
167. Gau V, Wong D. Oral fluid nanosensor test (OFNASET) with advanced electrochemical-based molecular analysis platform. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 401-410.
168. Branson BM. State of the art for diagnosis of HIV infection. *Clin Infect Dis* 2007; 45(Suppl 4): S221-S225.
169. Moser KL, Graffney PM, Grandits ME, Emamian ES, Machado DB, Baechler EC, Rhodus NL, Behrens TW. The use of microarrays to study autoimmunity. *J Invest Dermatol Symp Proc* 2004; 9(1): 18-22.
170. Kinney JS, Ramseier CA, Giannobile WV. Oral fluid-based biomarkers of alveolar bone loss in periodontitis. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 230-251.
171. Christodoulides N, Floriano PN, Miller CS, Ebersole JL, Mohanty S, Dharshan P, Griffin M, Lennart A, Ballard KL, Michael K, Charles P, Langub MC, Kryscio RJ, Thomas MV, McDevitt JT. Lab-on-a-Chip methods for point-of-care measurements of salivary biomarkers of periodontitis. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 411-428.
172. Wong DT, Segal A. Salivary diagnostics: enhancing disease detection and making medicine better. *Eur J Dent Educ* 2008; 12(Suppl 1): 22-29.
173. Abrams WR, Barber CA, McCann K, Gary T, Zongyuan C, Mauk MG, Jing W, Volkov A, Bourdelle P, Corstjens PLAM, Zuiderwijk M, Kardos K, Shang L, Tanke HJ, Niedbala RS, Malamud D, Bau H. Development of a microfluidic device for detection of pathogens in oral samples using upconverting phosphor technology (UPT). *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 375-388.
174. Zimmermann BG, Noh JP, Wong DT. Genomic targets in saliva. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 184-191.
175. Tanke HJ. Genomics and proteomics. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 330-334.
176. Handfield M, Hillman JD. In vivo induced antigen technology (IVIAT) and change mediated antigen technology (CMAT). *Infect Disord Drug Targets* 2006; 6(3): 327-334.
177. Mallia RJ, Thomas SS, Mathews A, Kumar RR, Sebastian P, Madhavan J, Subhash N. Laser-induced autofluorescence spectral ratio reference standard for early discrimination of oral cancer. *Cancer* 2008; 112(7): 1503-1512.
178. Rosin MP, Poh CF, Guillard M, Williams PM, Lewei Z, MacAulay C. Visualization and other emerging technologies as change makers for oral cancer prevention. *Ann N Y Acad Sci* 2007; 1098(Suppl 1): 167-183.

179. Poh, CF, Samson PN, Williams PJ, Zhang L, Laronde DM, Lane P, MacAulay C, Rosin MP. Direct fluorescence visualization of clinically occult high-risk oral premalignant disease using a simple hand-held device. *Head Neck* 2007; January: 71-76.
180. Freitas AZ, Zezell DM, Vieira ND, Ribeiro AC, Gomes ALS. Imaging carious human dental tissue with optical coherence tomography. *J Appl Phys* 2006; 99(2): 6p.
181. Howerton WB, Mora MA. Advancements in digital imaging: what is new and on the horizon? *J Am Dent Assoc* 2008; 139(Suppl): 20S-24S.
182. Ruprecht A. Oral and maxillofacial radiology: then and now. *J Am Dent Assoc* 2008;139(Suppl): S5-S6.
183. Canadian Dental Hygienists Association (CDHA). Brief to the Commission on the Future of Health Care in Canada. Ottawa, ON: CDHA, 2001.
184. Canadian Dental Hygienists Association (CDHA). Access angst: a CDHA position paper on access to oral health services. Ottawa, ON: CDHA, 2003.
185. Imai PH. Profile of the University of British Columbia's bachelor of dental science in dental hygiene graduates from 1994 to 2003. *CJDH* 2005; 39(3): 117-129.
186. Johnson PM. Dental hygiene practice in Canada 2001: report no. 3 findings. Ottawa, ON: Canadian Dental Hygienists Association, 2002.
187. Canadian Institute for Health Information (CIHI). Canada's health care providers, 2007. Ottawa, ON; CIHI, 2007.
188. Health Care Canada. A framework for collaborative Pan-Canadian health human resources planning: the case for a collaborative approach to HHR planning. Ottawa, ON: Health Care Canada, 2007 (<http://www.hc-sc.gc.ca/hcs-ss/pub/hhrhs/2007-frame-cadre/case-apporache-eng.php>)
189. Department of Health. Changing Nova Scotia's health care system: crating sustainability through transformation. Halifax, NS: department of Health, Province of Nova Scotia, 2007.
190. Minister of Health. Health action plan: status report. Edmonton, AB: Minister of Health, 2008.
191. Heson HA, Gurenlian JR, Boyd LD. The doctorate in dental hygiene: has its time come? *Access* 2008: 10-14.
192. Johnson PM. International profiles of dental hygiene: a 21-nation study 1987 - 2006 report. Toronto: PMJ Consultants, 2007.
193. Luciak-Donsberger C, Aldenhove S. Dental hygiene in Australia: a global perspective. *Int J Dent Hyg* 2004; 2: 165-171.
194. van der Heuvel J, Jongbloed-Zoet C, Eaton K. The new style dental hygienist—changing oral health care professions in the Netherlands. *Dent Health* 2005; 45(6): 3-4,6,8.
195. Canadian Dental Hygienists Association (CDHA). Dental hygiene at the crossroads: knowledge creation and capacity building in the 21st century. Ottawa, ON: CDHA, 2008.
196. Canadian Dental Hygienists Association (CDHA). Dental hygiene research agenda. Ottawa, ON: CDHA, 2003.
197. Forrest JL, Lyons KJ, Bross TM, Gitlin LN, Kraemer LG. Reaching consensus on the national dental hygiene research agenda: a delphi study. *J Dent Hyg* 1995; 69(6): 261-269.

198. Gadbury-Amyot CC, Doherty F, Stach DJ, Wyche CJ, Connolly I, Wilder R. [Prioritization of the national dental hygiene research agenda](#). *J Dent Hyg* 2002; 76(2): 157-166.
199. Clovis J. The professional status of dental hygiene in Canada: part one: progress and challenges. *Probe* 1999; 33(6) 186-195.
200. Luciak-Donnsberger C, Hovius M. Dental hygiene curriculum proposal for the IFDH. International Dental Hygienists' Association, 2003.
201. Canadian Institute of Health Research (CIHR). Investing in Canada's future: CIHR's blueprint for health research and innovation. Ottawa, ON: CIHR, 2007.
202. Decter MB. Health care systems and organizations: implications for health human resources. *Healthc Q* 2006; 11(2): 80-84.
203. Renders CM, Valk GD, Griffin SJ, Wagner EH, Eijk V, Jacques T, Assendelft WJJ. [Interventions to improve the management of diabetes in primary care, outpatient, and community settings](#). *Diabetes Care* 2001; 24(10):1821-1833.
204. Lamothe L, Fortin JP, Labbé F, Gagnon MP, Messikh D. [Impacts of telehomecare on patients, providers, and organizations \[abstract\]](#). *Telemed J E Health* 2006; 12 (3): 363-369.
205. So WY, Tong PCY, Ko GTC, Leung WYS, Chow C, Yeung VTF, Chan W, Critchley JAJ, Cockram CS, Chan JCN. [Effects of protocol-driven care versus usual outpatient clinic care on survival rates in patients with type 2 diabetes](#). *Am J Manag Care* 2003; 9 (9): 606-615.
206. Sankaranarayanan R, Dinshaw K, Nene BM, Ramadas K, Esmey PO, Jayant K, Thara S, Shastri S. Cervical and oral cancer screening in India. *J Med Screen* 2006; 13(Suppl 1): S35-S38
207. Atherley G. Opinion for the College of Dental Hygienists of Ontario on the report of an expert panel on the education of dental hygienists for self initiation of the controlled acts of scaling and root planing in Ontario. Toronto, ON: Greyhead Associates, 2007.
208. Canadian Dental Hygienists Association (CDHA). Task force on dental hygiene education: report to the CDHA Board. Ottawa, ON: CDHA, 2000.
209. Canadian Dental Hygienists Association (CDHA). Policy framework for dental hygiene education. Ottawa, ON: CDHA, 2002.