A Look at the (Near) Future Based on the (Recent) Past — How Our Patients Have Changed and How They Will Change

• **Michael MacEntee,** PhD, LDS(I), Dip Prosth, FRCD(C) •

Abstract

Remedies for dental diseases have been in use for as long as 4,000 years, and various materials and methods have been used over the millennia. Dentistry continues to change in response to changes in the age distribution, origins, financial means and health of the population, as well as to changes within the profession itself. The Canadian population is very unevenly distributed geographically and ethnically. Furthermore, it is aging rapidly and life expectancy is increasing. Although the average income of Canadians has increased, the increase was unevenly distributed, and the gap between rich and poor continues to expand. There has been a steady rise in the number of Canadians with dental insurance, although the proportion of the population with insurance varies from one province to another. Not surprisingly, people with dental insurance compared to those without are more frequent users of dental services. The rate of caries attack has diminished in industrialized countries, but people are keeping their teeth longer, so caries will remain a significant public health problem, particularly among elderly people. In addition, smoking tobacco is strongly associated with periodontal disease; thus, there should be more action within the dental community in support of smoking cessation programs. The composition of the dental care community is also changing. The ratios of dentists and dental hygienists to the population have increased, the services offered by dental technicians have expanded greatly, and the services offered by denturists have also increased as these services gain more widespread acceptance. Use of dental services in Canada remains reasonably broad; however, denture-wearers continue to regard uncomfortable dentures as a normal part of aging. The pattern of uneven distribution of disease and access to service remains the major challenge facing the dental profession.

MeSH Key Words: *dental care for the aged; forecasting; needs assessment/trends; prosthodontics/trends*

© J Can Dent Assoc 2005; 71(5):331
This article has been peer reviewed.

The need and desire to replace natural teeth have origins in a time when survival depended on having teeth to cut or crush food and to attract or repel mates. Given that much of our food today is highly processed, the need to chew food is not as critical as it once was; however, the presence of at least the front teeth is as critical as ever for our reproductive needs and for social comfort and attraction.

For millennia, human ingenuity has developed effective remedies for dental diseases and disorders. About 4,000 years ago the Chinese recognized and codified caries and periodontal disease.[1] They attributed caries to worms and an overly active libido, and used particles of deer horn to fill dental cavities. Later, the Egyptians tried to cure caries with a mixture of "women's blood," a mole and donkey manure boiled in oil and applied to the teeth. The Babylonians restored teeth with henbane seed and gum mastic and more recently, around 400 BC, the Etruscans used gold bands and wire to splint or retain anterior teeth in preparation for burial. During the Renaissance the Tuscans were adept in using leaves of gold to fill dental cavities, and the Bishop of Chichester (England) warned in 1521 against "pulling out any tooth, for pull out one, and pull out more."[2] At about the same time, edentulous patients in Japan and Switzerland could get dentures carved remarkably well from pagodite, ivory and other biomaterials. The Mayans in South America, falling prey to human vanity, planted the seeds of contemporary "cosmedontics" by adorning their anterior teeth with coloured gems cemented in place with a zinc-oxide-like luting agent. In essence, dentistry evolved

over thousands of years to meet the demands of societies unable to control caries and tooth loss, yet valuing the attractiveness of a youthful smile.

A Political Pawn

Around 1903 dentistry gained recognition when Britain and the Dominion of Canada investigated the poor performance of their troops in the Boer War.[3] Military authorities in London reported that more than 3,000 troops had been invalided home from the war because of dental disease. Consequently, the connection between dental health and national security was acknowledged at the highest levels of government, both in London and in Ottawa.[4] Further introspection by public health officials identified caries as a disease of epidemic proportions in Britain, and the War Office encouraged oral hygiene instruction and the systematic inspection of children's teeth by dentists. Surveys of schoolchildren between 1906 and 1908 found that 90% of 12-year-olds had an average of 4 carious teeth.[5] This widespread epidemic of caries and tooth extractions continued into the 1960s, which explains in large part why so many elderly Canadians today have no natural teeth.

Changing Populations

National Growth

Worldwide, there was an increase of 7% in the human population between 1995 and 2000. The growth rate of the Canadian population, at 4% per year over the last few years, lies between the smaller growth (1.5%) of some industrialized countries and the larger growth (8%) of less industrialized countries (**Fig. 1**).[6] A major defining characteristic of change over the past century has been the global movement of people from the countryside into cities. In 2001, for example, nearly two-thirds (64%) of Canada's population (up slightly from 63% in 1996) lived in 27 metropolitan areas, but mainly around Montreal, southern Ontario, Calgary and Edmonton, the Lower Mainland of British Columbia and southern Vancouver Island. In the 5 years between 1996 and 2001, these regions together grew by almost 8% whereas there was less than 1% growth in the rest of the country.

Immigration

The 1996 Canadian census revealed that immigrants accounted for nearly one-fifth (18%) of the Canadian population at that time. They were the principal source of population growth between 1996 and 2001; by 2000 they accounted for 22% of the Canadian population. While there was a decline in the natural increase of the population (difference between births and deaths) during this 5-year period, immigration accounted for more than half of Canada's population growth. Immigrants to Canada before 1970 came mostly from Europe in 2 major waves — initially (before 1867) from Britain and France, and later from Central and Eastern Europe.[7] Other small but cohesive groups came to the west coast from southern China and Japan before 1970, but since the 1980s immigrants have been arriving mostly from China, India, the Caribbean, and South and Central America. Since 1994 Canada has had a policy of reunifying immigrant families, with the result that almost one-third of immigrants today are older parents or grandparents of recent immigrants who settled in major cities. This trend poses a special cultural challenge for health workers because older immigrants adapt to their new surroundings with difficulty and many of them tend to social isolation.[8]

Old Age

Over the past few decades, populations everywhere have aged dramatically, and most countries, particularly those with smaller market economies, expect further increases in the number of old people over the next quarter century (**Fig. 2**).[9] By the year 2000, more than half (59%) of the older population (i.e., people older than 65 years) were living in nonindustrialized countries, with projections that the proportion will rise to 71% by 2030.

In Canada, a 126% increase in the number of people over 65 years of age is expected between 2000 and 2030; in Singapore the number of people in this age group will almost quadruple, but in Italy the increase should be much smaller, because over 18% of the population is already at this age.

On a percentage basis, these increases in the population over 80 years of age will be even more striking: Japan (107%) and Germany (76%) will lead, followed more modestly by Canada (42%), Australia (30%) and the United States (14%).[6] Aging is not necessarily associated with wealth or industrial expansion; however, there will be substantial increases in the number of older people requiring and seeking dental services over the next 30 years, with relatively fewer younger people in the work force to support them (**Fig. 3**).[9] The economic consequences of this turn of event are not all clear.

Life Expectancy

During the early part of the 20th century, men's health was influenced strongly by poor working environments and industrial pollutants and by abuse of tobacco and alcohol. Typically, they died from cardiovascular disease, cancer and cirrhosis of the liver. Women, in contrast, have traditionally been at grave risk from multiple childbirths, but improvements in obstetric methods have reduced their risks considerably over the past half-century. As a result, there are today nearly twice as many older women as older men. In 1931, men and women could expect to live on average about 60 years, but by 2000 this expectation had increased to 79 years in Canada, on a par with Iceland, higher than the 77 years of citizens in the United States and surpassed only

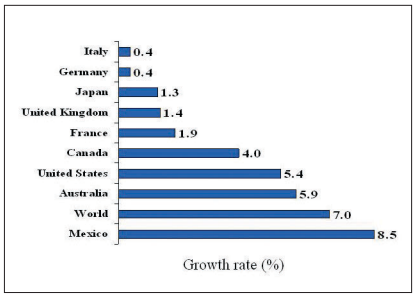

Figure 1: *Population growth rate, 1995–2000. Source: 2001 census of population.*[6]

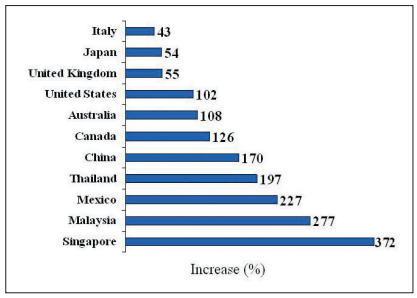

Figure 2: *Increase in population over 65 years of age, 2000–2030.*[9]

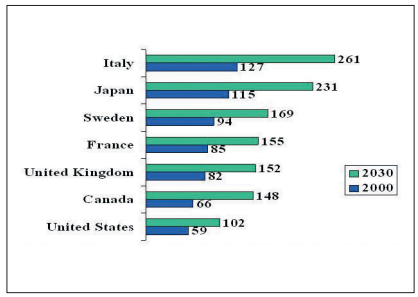

Figure 3: *Change in aging index, 2000–2030 (people aged 65 and over per 100 people aged 0–14).*[9]

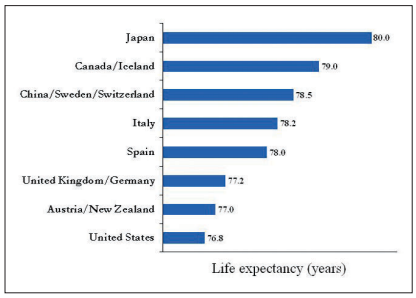

Figure 4: *Life expentancy in selected countries.*[10]

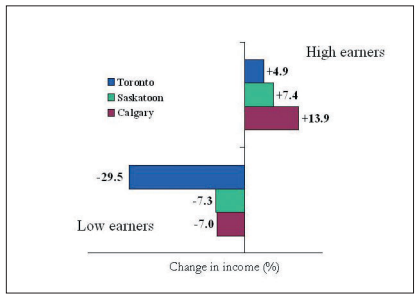

Figure 5: *Income change among high and low earners, 1992–1998.*[15]

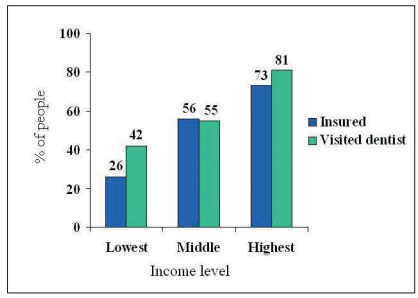

Figure 6: *Use of dental services by income.*[17]

by Japan's 80 years (**Fig. 4**).[10] Currently, the median age is around 40 years in Canada, and by 2030 it will be closer to 44 years, whereas in Italy, Israel, Japan and Bulgaria, it will be around 50 years.[6,9] Socioeconomic differences explain most of the large differences in life expectancies within countries and even within cities. For example, the aboriginal population in Canada, which has a much lower socioeconomic status than the rest of the Canadian population, has a life expectancy as much as 10 years lower than the rest of the population.[10]

Changing Financial Situations

Incomes

The average income of a Canadian family increased by 15%, from $50,280 to $58,016, between 1991 and 2001.[11] In contrast, families consisting of older people saw a slight (1%) drop in income, from $40,780 to $40,343. The income gap between rich and poor expanded considerably over the past quarter century, as top earners increased their share to 41% of the national income, bottom earners remained constant with about 6%, and the share to those in the middle decreased slightly.[12] Controversy surrounds the definition and recognition of poverty, low income and basic income needs. However, there is some justification to the assertion that almost 1 in 5 (17%) Canadian residents — 36% of single people and 14% of families — had incomes below a poverty line in 1995, which means they had practically no money to spend on reasonably important services, such as dentistry and oral health care.[13]

Poverty rates in most industrial countries have been rising slowly in recent years, especially among vulnerable population groups. In 1980, immigrants to Canada accounted for 20% of low-income earners and 20% of the total population; by 2002 the proportion had risen to 29% of all low earners, yet they represented only 22% of the total population.[14] The significant increase in poverty rates among immigrants over the past 2 decades — especially among Asian, African and southern European groups — occurred independently of education and age group. Income disparities have also been more obvious within major urban centres. For example, from 1992 to 1998, low-income earners sustained a net decrease in income of 30% in Toronto and 7% in Calgary and Saskatoon (**Fig. 5**).[15] At the end of the 1990s, annual incomes for 48% of single people, 41% of lone-parent families and 15% of 2-parent families in Toronto were below $20,000, which, by any reasonable measure of poverty, is barely a subsistence income.[13]

Dental Insurance

One perspective defines poverty as a lack of resources "for achieving self-respect, taking part in the life of the community, (and) appearing in public without shame."[16] In this context, it is clear that access to dentistry plays an important role in an individual's sense of well-being or hardship. There has been a steady rise in the number of people with dental insurance in Canada — from less than 3 million in 1976 to more than 15 million in 2000.[10]

However, the proportion of the population with dental insurance differs among provinces: in Alberta and Ontario the rate is more than 60%, whereas in Newfoundland, Prince Edward Island and Quebec it is less than 50%.[10] In addition, people without dental insurance are less frequent users of dental services than those who have such insurance (**Fig. 6**).[17] Because it is usually an employee benefit, private dental insurance does little to address the needs of the unemployed or low-income groups. Indeed, the proportion of low-income families without dental insurance has increased lately, so dentistry has effectively become inaccessible to more of them. Unfortunately, the recent trend in income disparities shows no signs of change in the near future.

Changing Health

Health and Chronic Disability

People are living longer and healthier lives, largely because of improvements in living and working conditions,[18] and there is now a growing interest in health and the impact of chronic illness on quality of life.[19] The World Health Organization views health as a practical and interactive mix of personal and environmental conditions, which is consistent with current views of health and disablement in an aging society where chronic rather than acute illness and disability prevails.[19,20] Disability is an inevitable characteristic of old age and is not solely a reflection of ill health or disease. Everyone in adult life will, to some extent, become disabled. Indeed, experiences in dentistry confirm that tooth loss, while potentially very disabling, is managed effectively by most people without substantial detraction from their quality of life.[21] Furthermore, by age 75 nearly everyone has at least one chronic disorder, and as age increases, the burden of chronic impairment mounts so that the assistance and protection of a nursing home or long-term care facility eventually becomes a necessity. Unfortunately, dentistry has yet to establish an effective presence in most nursing homes, and the dental care available to most residents is restricted to emergency services.[22]

Caries

During the mid-1990s over half (52%) of the children aged 5 to 9 years in the United States had at least one carious lesion or filling, and by age 18, nearly everyone (85%) had a filled or openly decayed tooth.[23] Caries remains the major cause of tooth loss, either directly as invasive lesions or indirectly as a consequence of endodontic infections and fractured teeth.[24,25] The risk of caries continues and might even increase in old age with the abundant use of medications that disturb saliva, and the increased consumption of cariogenic foods.[26] With the aggressive marketing of cariogenic foods and drinks, and the increased use of medications that disturb saliva, caries is likely to remain a significant public health problem for the foreseeable future, especially in older age groups. Nonetheless, there has been a marked improvement in the incidence of caries relative to the devastating situation up to the mid-60s, when the benefits of fluoridated water supplies and toothpastes were realized.

Periodontal Disease

Contrary to earlier predictions, severe periodontal disease causing tooth loss is not a particularly prevalent disease but is limited in all age groups to a few susceptible individuals.[27] Recent clinical surveys indicate that about 20% of people 55 to 64 years old and 25% of those 65 to 74 years old with natural teeth have lost more than 6 mm of periodontal attachment.[23] This attachment loss can threaten the survival of teeth when it occurs, but for most people, especially those in older age groups, it is a small problem.

A recent Finnish study has shown that tooth loss, whether from periodontal disease or caries, is associated strongly with the amount of tobacco smoked.[28] Therefore, smoking cessation programs should have a beneficial impact on the incidence of periodontal disease over the coming years. Between 1985 and 2001, there was a substantial (21%) drop in the proportion of the Canadian population smoking tobacco, and even among those who continued to smoke, the quantity of cigarettes consumed dropped from 20 per day in 1985 to 16 per day in 2003.[29] Smoking continues to be a serious problem among teenagers, with 19% of teenage girls and 16% of teenage boys addicted to nicotine. Dentists in Canada seem to pay less attention than physicians to the dangers of tobacco: of those who stopped smoking recently, 71% had visited a doctor and 56% a dentist, but more people received encouragement to stop from physicians (52%) than from dentists (23%).[29] Clearly, the dental professions should play a much larger role in the health promotional campaigns to end nicotine addiction.

Tooth Loss

Loss of some natural teeth remains a common occurrence everywhere despite widespread use of fluoride, improved oral hygiene and the efforts of dental professionals. In the United States, for example, the Surgeon General reported recently that, on average, Americans had lost at least 1 tooth by age 17 and 12 teeth by age 50.[23] Worse still, about 10% of Americans over 18 years and about 33% of those over 65 years had lost all of their natural teeth. More optimistically, there has been a marked decrease in edentulism everywhere, particularly over the past quarter century, and indications are that this decrease will continue. Total tooth loss in the United States has dropped by about 10% each decade for the past 30 years,[30] and Europe projects an ongoing decline in edentulism and demand for complete dentures over the next 30 years.[31]

Changing Oral Health Care Providers

Formal dental education with good clinical training has changed the quality of dentistry and the social status of dental professionals over the past century. Dentistry has expanded in many countries to encompass dentists, dental assistants, dental hygienists and denturists as integral contributors to the delivery of a sophisticated health service. The mix of providers continues to fluctuate under the influence of changing disease patterns and in response to changing demands for care. Awareness of the importance of oral hygiene in the control and management of oral disease has increased demand for dental hygienists who work closely with dentists or, more recently, in independent practice. Similarly, changes to dental public health services in many jurisdictions offer a greater clinical role for dental hygienists than for dentists in school-based programs and in residential care.[32] In Canada, for example, the number of dentists per 100,000 population increased from 52 to 54 (a 4% increase) between 1989 and 1997, whereas the number of dental hygienists per 100,000 population increased much more significantly, from 29 to 44 (a 52% increase) during the same period.[10]

The role of dental laboratory technicians has also changed over the past century in response to public demand. Initially, they performed only the technical laboratory procedures required to make dental prostheses as prescribed by dentists. During the middle of the last century a group of dental technicians began providing a clinical removable denture service directly to patients, and lobbied openly for professional independence as clinical denturists. Demand for removable prostheses was high, and dentists were generally reluctant to provide such services.[33] Consequently, after many years of evolution, denturists gained public acceptance and professional recognition across most of Canada and in many other countries.[34]

Use of Dental Services

According to the *Joint Canada/United States Survey of Health, 2002–03*,[35] 63% of the residents in each country had visited a dentist in the preceding year, another 13% had visited a dentist between 1 and 2 years ago, and fewer than 3% had never been to a dentist.

In 1998/99, 60% of Canadian residents 12 years and older (62% of women, 57% of men and 31% of those older than 65 years) reported a consultation with a dental professional during the previous 12 months — up from the 56% who had reported such consultations 4 years previously.[36] In 1997 a similar proportion (65%) of the U.S. population 2 years and older had visited a dentist in the preceding year, also an increase (from 55% in 1983).[23] Use of dental services in Canada changed by region in 1998/99, with most use reported in Ontario (64%) and British Columbia (63%) and least in Saskatchewan (52%) and New Brunswick (51%).[36]

Reasons for Dental Consultations

People typically consult dentists and physicians when they feel that something is wrong, and they usually relate their symptoms to previous experiences and the experiences of others under similar circumstances. In Western society, most people with natural teeth routinely consult dentists for preventive care, unless their income is low or they are from a minority group.[23] Among denture-wearers there is a widespread resignation to the limitations of complete dentures, especially when the person's peers are in similar circumstances.[37] Nonetheless, a pattern of preventive health care established in youth usually prevails into old age, at least until there is a catastrophic decline in health.[38] Elderly denture-wearers, for example, frequently report that nothing is wrong with their uncomfortable dentures because such discomfort has become an accepted part of aging.

Social Interactions

Tooth loss can cause clinically significant psychological disturbances, along with the stigma of social embarrassment characteristic of all chronic illness.[39,40] For some, edentulism presents all the characteristics of a chronic illness — incurable, disruptive and socially stigmatizing.[41] Social embarrassment because of dentures is now more likely among younger adults, for whom complete tooth loss is the exception, whereas half a century ago most people over 50 years of age had no natural teeth and wore complete dentures. Today, total tooth loss has become almost synonymous with poverty and personal neglect, given the emphasis in our culture on personal appearance, grooming, physical fitness and youth.

Conclusions

There have been major changes since dentistry was the profession of a few skilful surgeons or the trade of many artful tooth pullers. Developments in biomaterials, surgical and operative techniques, pharmacology, radiology and biology have had profoundly beneficial impacts on the services offered by the dental profession. The discovery and use of fluoride to inhibit the epidemic of caries is a major public health achievement. Today we face the challenges of a changing population that is aging rapidly and retaining natural teeth. Yet dental services are inaccessible to many of those in most need of treatment. Frail elders living in long-term care facilities are essentially limited to emergency dental services, while our nursing and medical colleagues working in geriatrics know little about the risks and discomforts of poor oral health. The changing economy, with an expansion of the gap between high and low income earners, has increased the number of people who cannot afford dentistry. Immigration is changing the structure of Canadian society through different cultural outlooks and expectations, and an increase in the number of people who feel socially isolated. Educational improvements, along

with the expansion of dentistry to include other professional groups, continue to change the scope and quality of dental services, mostly for the better. Certainly, the professional emphasis on continuing education and "evidence-based practice" encourages awareness of the need for constant change. Dentistry as a profession in many forms has professional privilege and status only because it is aware of this need for change, and because it is equipped to both encourage and accept it. ➧

Dr. MacEntee *is a professor in the department of oral health sciences at the University of British Columbia, Vancouver, British Columbia.*

Correspondence to: *Dr. Michael I. MacEntee, University of British Columbia, 2199 Wesbrook Mall, Vancouver, BC V6T 1Z3. E-mail: macentee@interchange.ubc.ca.*

The author has no declared financial interests.

References

1. Xu Y, MacEntee MI. The roots of dentistry in ancient China. *J Can Dent Assoc* 1994; 60(7):613–6.

2. King R. The history of dentistry, technique and demand. Cambridge Wellcome Unit, Cambridge University; 1997.

3. Robertson E. Public health and dentistry: a dog that didn't bite. History of dentistry Research Group Newsletter. Issue No. 6; April 2000. Available from: URL: http://www.rcpsglasg.ac.uk/hdrg/October2.htm (accessed April 5, 2005).

4. Crawford R. The Canadian Dental Association: 1902-2002 — a century of service. Military dentistry (Part five of a series). Canadian Dental Association. Available from: URL: http://www.dcf-fdc.ca/centenary/english/HSPart5.pdf (accessed April 5, 2005).

5. Rugg-Gunn A. Founders' and Benefactors' lecture 2001. Preventing the preventable — the enigma of dental caries. *Brit Dent J* 2001; 191(9):478–82, 485–8.

6. Statistics Canada. A profile of the Canadian population: where we live. Canada's 2001 population: growth rates and trends. Available from: URL: http://geodepot.statcan.ca/Diss/Highlights/Highlights_e.cfm (accessed April 5, 2005).

7. Fleras A, Elliott JL. Unequal relations: an introduction to race, ethnic, and aboriginal dynamics in Canada. Toronto: Prentice Hall; 1999.

8. Waxler-Morrison NA, Anderson JM, Richardson E, editors. Cross-cultural caring: a handbook for health professionals in Western Canada. Vancouver (BC): University of British Columbia Press; 1990.

9. Kinsella K, Velkoff VA. U.S. Census Bureau, Series P95/01-1, An Aging World: 2001, U.S. Government Printing Office, Washington, DC; 2001. Available from: URL: http://www.census.gov/prod/2001pubs/p95-01-1.pdf (accessed April 5, 2005).

10. Canadian Institute for Health Information. Health care in Canada 2000: a first annual report. Ottawa (ONT): Canadian Institute for Health Information; 2000. Available from: URL: www.cihi.ca.

11. BC Statistics. Earnings and employment trends, 1996–8. Victoria: Government of British Columbia, Ministry of Finance and Corporate Relations; 1997.

12. Urmetzer P, Guppy N. Changing income inequality in Canada. In: Curtis J, Grabb E, Guppy N, editors. Social inequality in Canada: patterns, problems, policies. 3rd ed. Scarborough (ON): Prentice-Hall Canada Inc.; 1999. p. 56–65.

13. National Council of Welfare. Poverty in Canada. In: Curtis J, Grabb E, Guppy N, editors. Social inequality in Canada: patterns, problems, policies. 3rd ed. Scarborough (ON): Prentice-Hall Canada Inc.; 1999. p. 78–83.

14. Picot G, Hou F. The rise in low-income rates among immigrants in Canada. Ottawa: Statistics Canada. Analytical Studies Branch. 2003. Available from: URL: http://www.statcan.ca/english/IPS/Data/11F0019MIE2003198.htm (accessed April 6, 2005).

15. Federation of Canadian Municipalities. Falling behind: our growing income gap. A report prepared by Caryl Arundel and Associates in association with Henson Consulting Ltd. Available from: URL: http://www.fcm.ca/english/communications/igover.pdf (accessed April 6, 2005).

16. Sen A. Development as freedom. Oxford: Oxford University Press; 1999. p. 73–5.

17. Statistics Canada. Statistical report on the health of Canadians: Part A. Determinants of health services. Dental visits, Table 21, p. 99. Available from: URL: http://www.statcan.ca/english/freepub/82-570-XIE/15_29.pdf (accessed July 28 2004).

18. Evans RG, Stoddart GL. Producing health, consuming health care. In: Evans RG, Barer ML, Marmor TR, editors. Why are some people healthy and others not? The determinants of health of populations. New York: Aldine de Gruyter; 1994. p. 28.

19. Bury M. Illness narratives: fact or fiction? *Soc Health Illn* 2001; 23(3):263–85.

20. World Health Organization. International classification of functioning, disability and health. Geneva: WHO. Available from: URL: http://www3.who.int/icf/intros/ICF-Eng-Intro.pdf (accessed April 8, 2005).

21. MacEntee MI. The impact of edentulism on function and quality of life. In: Feine J, Carlsson G, editors. Implant overdentures as the standard of care for edentulous patients. Chicago: Quintessence International; 2003. p. 23–8.

22. MacEntee MI, Thorne S, Kazanjian A. Conflicting priorities: oral health in long-term care. *Special Care Dent* 1999; 19(4):164–72.

23. United States Department of Health and Human Services. Oral health in America: a report of the Surgeon General. Part 2. Chapter 4: The magnitude of the problem. Dental caries, periodontal diseases, and tooth loss. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000. Available from: URL: http://www.nidr.nih.gov/sgr/sgrohweb/chap4.htm (accessed April 5, 2005).

24. Stephens RG, Kogon SL, Jarvis AM. A study of the reasons for tooth extraction in a Canadian population sample. *J Can Dent Assoc* 1991; 57(6):501–4.

25. Nevalainen MJ, Narhi TO, Siukosaari P, Schmidt-Kaunisaho K, Ainamo A. Prosthetic rehabilitation in the elderly inhabitants of Helsinki, Finland. *J Oral Rehabil* 1996; 23(11):722–8.

26. MacEntee MI, Clark DC, Glick N. Predictors of caries in old age. *Gerodontology* 1993; 10(2):90–7.

27. Papapanou PN. Epidemiology of periodontal diseases: an update. *J Int Acad Periodontol* 1999; 1(4):110–6.

28. Ylostalo P, Sakki T, Laitinen J, Jarvelin,MR, Knuuttila M. The relation of tobacco smoking to tooth loss among young adults. *Euro J Oral Sci* 2004; 112(2):121–6.

29. Health Canada. Canadian tobacco use monitoring survey (CTUMS). 2004. Available from: URL: http://www.hc-sc.gc.ca/hecs-sesc/tobacco/research/ctums/ (accessed April 6, 2005).

30. Douglass CW, Shih A, Ostry L. Will there be a need for complete dentures in the United States in 2020? *J Prosthet Dent* 2002; 87(1):5–8.

31. Mojon P, Thomason JM, Walls AW. The impact of falling rates of edentulism. *Int J Prosthodont* 2004; 17(4):434–40.

32. Baltutis LM, Gussy MG, Morgan MV. The role of the dental hygienist in the public health sector; an Australian perspective. *Int Dent J* 2000; 50(1):29–35.

33. MacEntee MI, Pierce CA, Williamson MF. Removable prosthodontic services by B.C. dentists. *J Can Dent Assoc* 1980; 46(12):764–7.

34. MacEntee MI. The denturist movement in Canada. Part III: current status and potential. *J Can Dent Assoc* 1981; 47(8):528–33.

35. Sanmartin C, Ng E, Blackwell D, Gentleman J, Martinez M, Simile C. Joint Canada/United States survey of health, 2002–03. Ottawa :

Statistics Canada; 2004. Available from: URL: http://www.cdc.gov/nchs/data/nhis/jcush_analyticalreport.pdf (accessed April 6, 2005).

36. Statistics Canada. Contact with dental professionals. *Health Indic* 2003; 2003(2). Available from: URL: http://www.statcan.ca/english/freepub/82-221-XIE/01103/high/canada/cdental.htm (accessed April 6, 2005).

37. MacEntee MI, Hill PM, Wong G, Mojon P, Berkowitz J, Glick N. Predicting concerns for oral health among institutionalized elders. *J Public Health Dent* 1991; 51(2):82–90.

38. MacEntee MI, Stolar E, Glick N. The influence of age and gender on oral health and related behaviour in an independent elderly population. *Community Dent Oral Epidemiol* 1993; 21(4):234–9.

39. MacEntee MI, Hole R, Stolar E. The significance of the mouth in old age. *Soc Sci Med* 1997; 45(9):1449–58.

40. Fiske J. Davis DM, Frances C, Gelbier S. The emotional effects of tooth loss in edentulous people. *Brit Dent J* 1998; 184(2):90–3.

41. Locker D. Disability and disadvantage: the consequences of chronic illness. London: Tavistock Publications; 1983.