

# Is There a Sound Basis for Deciding How Many Dentists Should Be Trained to Meet the Dental Needs of the Canadian Population? Systematic Review of Literature (1968-1999)

• Gerardo Maupomé, CD, M.Sc., DDPH RCS(E), PhD •

• H. Jack Hann, DDS, MPH, FRCD(C) •

• Jeannine M. Ray, BA, M.Sc. •

## A b s t r a c t

*A systematic review was conducted of the literature on human resources planning (HRP) in dentistry in Canada, critically assessing the scientific strength of 1968-1999 publications. Inclusion and exclusion criteria were applied to 176 peer-reviewed publications and "grey literature" reports. Thirty papers were subsequently assessed for strength of design and relevance of evidence to objectively address HRP. Twelve papers were position statements or experts' reports not amenable for inclusion in the system. Of the remaining 18 papers, 4 were classified as projections from manpower-to-population ratios, 4 as dental practitioner opinion surveys, 8 as estimates of requisite demand to absorb current capacity and 2 as need-based, demand-weighted studies. Within the 30.5 years reviewed, 53.4% of papers were published between 1982 and 1987. Overall, many papers called for a reduction in human resources, a message that dominated HRP during the 1980s, or noted an increase in the demand for services. HRP publications often had questionable strength or analytic frameworks. The paradigm of busyness-scarcity evolved from a belief around an economic model for the profession into a fundamental tenet of HRP. A formal analysis to establish its existence beyond arbitrary dentist:population ratios has usually been lacking.*

**MeSH key words:** Canada; dentists/supply and distribution; health manpower

For more information, see <http://www.cda-adc.ca/jcda/vol-67/issue-2/87.html>

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Decisions about the organization of health care services should be based on state-of-the-art information on health technology, epidemiological data, the effectiveness of treatment interventions and professional practices in specific settings.<sup>1</sup> Basic organizational aspects are the number and profile of professionals that would meet the needs of a population. This issue has been a matter of debate in Canada; symposia, task force groups, independent researchers and many dental professionals have discussed it. However, it is not known how close we are to determining the ideal number or mix of personnel required to serve an increasingly heterogeneous population.<sup>2</sup>

One problem is the lack of an evaluation framework to assess the body of knowledge addressing human resources planning (HRP) in dentistry. The most obvious solution is to undertake a systematic review whereby the literature is

appraised through a strict design to make the review process more comprehensive, to minimize the chance of bias and to strengthen its reliability.<sup>1</sup>

This study is a systematic review of the literature on HRP in Canada between 1968 and 1999.

### Materials and Methods

This review was undertaken using primarily standard methods.<sup>1</sup>

The first step was to select databases for conducting the review. Initially, Medline, Embase, Current Contents and Biological Abstracts were the electronic databases selected. Once it had been established that they overlapped substantially, only Medline was used. MeSH terms employed were dentistry, dental health services, dentists, dental staff, public health dentistry, dental care, dental auxiliaries, dental

hygienists and dental assistants. Each of the terms was focused to trends, manpower, and supply and distribution. All searches were then combined with the term Canada and “exploded” to include all 10 provinces. A keyword search was also undertaken for dentistry or dental or dentists plus the term manpower, subsequently combined with the term Canada. Results were limited to the years 1968 to 1999.

Second, the references cited in relevant articles were searched by hand.

Third, since a great deal of “grey” literature was known to exist, a catalogue search (non-serial publications) of the University of British Columbia library system was undertaken. This university biomedical collection is the second largest in Canada. The keyword searches were dentistry or dental or dentists or hygienists plus manpower and Canada and 1968 to 1999. Before starting the search for publications, a data extraction sheet was designed by 2 calibrated public health dentists from examples used in other systematic reviews. The sheet was used in pilot trials and improved several times to test operational definitions. An article was included in the review if it was (i) original research, symposia proceedings, a position statement or an experts’ report addressing the planning of human resources (HR) in dentistry and allied dental professions in Canada, (ii) written in English or French, (iii) published from January 1968 to July 1999 or (iv) part of the “grey” literature, i.e., not listed in mainstream databases but published by a professional, governmental or scientific body. A publication was excluded if it was (i) a case report, editorial, letter, news or comment, unless it addressed in a meaningful way the evidence discussed in other included publications, or (ii) a description of HR without a clear planning emphasis. After reviewing these features, a decision was made to include or exclude a paper.

An inventory of included papers was developed according to the type of document, the use of research methods (if applicable), the HRP factors involved, a summary of the study design and the conclusions and recommendations implicitly or explicitly outlined. Papers were classified according to their HRP approaches following the DeFriese and Barker<sup>3</sup> system (see **Table 1**, <http://cda-adc.ca/jcda/vol-67/issue-2/87.html>). This system offers a critical appraisal of the relative sophistication of the methodologies used in HRP studies. It implicitly assumes that health needs and health care needs are met by dental personnel, therefore relegating to a secondary position the impact of population-based interventions or individual preventive strategies. The system does not take into account changes in technology or shifts in the emphasis placed on underemployed preventive technologies. Perhaps most importantly, the DeFriese and Barker system implies that dental education is a product that is purchased almost independently of it being a means to improve health or meeting demands for care of the population.

Data were analyzed as required using descriptive statistics and Spearman’s rho test.

## Results

Of the 176 papers that resulted from the searches, 146 were reviewed and eliminated. Only 30 papers were included in the review (see **Tables 2 to 6**, <http://www.cda-adc.ca/jcda/vol-67/issue-2/87.html>).<sup>4-33</sup> Eleven were position statements and one was an experts’ report not amenable to direct inclusion in the DeFriese and Barker system (**Table 2**). A further 9 experts’ reports, one symposium proceedings and 8 original research papers were included in the system.<sup>3</sup> Of these 18 papers, 4 were projections from manpower-to-population ratios (**Table 3**), 4 were dental practitioner opinion surveys (**Table 4**), and 8 were estimates of requisite demand to absorb current capacity (**Table 5**). While no econometric practice-productivity studies were found, 2 need-based, demand-weighted studies (**Table 6**) were published in the 30.5-year interval. Half of the papers (53.4%) were published during 1982 to 1987.

To establish whether studies published more recently had more sophisticated designs, Spearman’s rho analysis was done on the year of publication and the categories of the system<sup>3</sup> (excluding the 12 unclassified papers). We assumed that the higher the category, the more sophisticated the design of the study. The rho coefficient was +0.472 ( $p = 0.048$ ), suggesting that more recent papers described more sophisticated approaches in addressing HRP issues.

One of the most important items in this body of literature is the overall position conveyed on the need to increase or decrease the HR supply. Thirteen papers (43.3%) concluded that an HR oversupply might already exist or was about to occur at the time of publication.<sup>9-13,15,17,18,20,24,28,29,32</sup> Many of these reports called for a specific reduction in HR for all of the schools. The need to protect the academic and research capabilities of schools was emphasized by certain authors, indicating that it would be preferable to reduce the number of schools than to implement a dramatic reduction for entering students in each faculty.<sup>32</sup> An increase in the demand for dental services (insurance-generated) was also contemplated as a solution to the oversupply problem. Eight papers (26.7%) indicated or implied that the HR were appropriate to their evaluation framework or should be increased.<sup>7,8,19,21,23,25,27,33</sup> A further 9 papers (30%) either did not offer an unequivocal statement about whether HR should increase or decrease or offered both recommendations depending on different types of personnel or situations.<sup>4-6,14,16,22,26,30,31</sup> The small number of studies precluded the use of a statistical test, but by charting the year of publication together with the recommendation to increase or reduce HR, we concluded that papers lacking an unequivocal statement were evenly distributed along the 30.5 years reviewed. Calls for increases were more common in the 1970s and virtually ceased after 1985. Recommendations to reduce HR started to appear in the late 1970s and became the dominant theme during the 1980s.

## Discussion

It is not feasible to include every paper in a review of the literature. The present approach offers a novel strategy to

understanding HRP literature relevant to Canada. It cannot, however, be considered an exhaustive processing of the information, as some publications may have been omitted by virtue of the terms under which they were listed in the databases. In other cases a subtle challenge was posed, in that certain papers had a borderline status between the included and excluded categories. Furthermore, the heterogeneity of reviewed studies made it infeasible to synthesize the findings in a single measure (using meta-analytic techniques).

What are the methods used so far to estimate the number and profile of dental personnel that should be trained? **Tables 2 to 6** describe the various HRP factors and methods that were contemplated in the papers reviewed. The factors are fairly comprehensive and should allow a broad overview of the evolving HRP situation at the national or provincial level. The main problem with the methods used so far is the questionable strength of the majority of strategies selected: 73.3% of the documents are position statements, experts' reports or symposia proceedings. The largest individual category of papers did not resort to a systematic approach to HRP (**Table 2**) as classified by DeFries and Barker.<sup>3</sup> In the case of research papers, the scientific standards were heterogeneous. While some designs were solid in their planning and undertaking,<sup>11,14,21</sup> other papers were thinly disguised personal manifestos in which evidence, methods and conclusions or recommendations were poorly related or lacked scientific rigor.<sup>12</sup> A further group of papers failed to include information essential to understanding what was actually done or assumed in the planning process,<sup>15-17</sup> and it was therefore difficult to fully evaluate their contributions. A great many assumptions and even hearsay underlie this literature, suggesting that the main thrust of some documents was their political or policy motivations. There is nothing intrinsically wrong with this feature: HRP is not an apolitical enterprise.<sup>3</sup> What is problematic is the generalized assumption that in the absence of sound evidence, a perceived HR oversupply can be considered a sufficient basis for closing dental schools or reducing enrolment, a conclusion stated in 43.3% of papers. Similarly, an increase in HR should be driven by the epidemiological profile and the features of the demand for services in the population.<sup>31</sup> An argument to reduce dental personnel should not be based on fears of lack of busyness or a deviation from an arbitrary dentist:population ratio. Resources available to support a health care system are finite; choices have to be made to meet basic needs within a clearly defined social contract.<sup>34</sup>

Where does this trend to reduce the HR supply come from? As a result of recommendations made in the 1960s by the Royal Commission on Health Services, a policy was introduced to expand dental HR. At that time, the clinical practice model, the technological state of the art and the prevalence of oral morbidity and tooth mortality in the population offered a large marketplace to dental practice. In this affluent environment, no real necessity was perceived for planning the type of services needed or the health status goals that would define success in professional endeavours. Many concepts had blurred boundaries between access and demand, between health status

and health care and between perceived individual need and social responsibility. The dominant thinking was that an HR undersupply would ensure a favourable marketplace in the future. We call such thinking the paradigm of busyness-scarcity, i.e., a belief that as long as the number of dentists is slightly less than what the market would bear, business will be good for the profession. Such an economic model was accepted as part of a knowledge structure and an explanation of reality.<sup>35</sup> The professional discourse endorsing the paradigm became stronger during the 1970s and was taken for granted in the 1980s, even though contradictions were becoming apparent. As early as 1972, Lewis<sup>22</sup> drew attention to the danger of simplistic interpretations derived from the paradigm. An evaluation of the basis for such a paradigm indicates that no formal analysis supported most papers. In many instances, the reactive character of these documents emphasizes that no objective criteria were used to define a given resources:demand relationship. DeFries and Barker<sup>3</sup> summarized this shortcoming as follows: "Planners and health professionals have a tendency to see manpower as an end in itself, rather than a means to the attainment of more general health goals. All too often, health *manpower* ... rather than the health-care *services* that people seek ... is given primary emphasis in the planning process." The conceptual simplicity of the paradigm and the inherent risk implied for dentists' income encouraged the professional associations<sup>32</sup> and the planners<sup>15,17,18,30</sup> to believe that the number of HR was the main "problem" that needed attention. Such hegemonic ideology supported by repetition<sup>36</sup> strengthened the paradigm, and in so doing defined policies and political statements.

By acknowledging that one of the challenges to HRP is to preserve the social relevance of, and social responsibility within, dental education, while evolving synchronously with the needs of the population,<sup>37</sup> it is feasible to recognize the necessity of documenting the burden of illness as a prerequisite in the allocation of resources in HRP.<sup>3</sup> Such documentation makes easier the task of distinguishing the advantages and disadvantages of the different HRP methods. Overall, only 2 studies<sup>14,33</sup> employed a clearly outlined research rationale coupled with an approach whereby the actual needs and demands of the population were considered in HRP. As in other publications, these 2 papers assumed that, in the absence of Canadian data accurately portraying preventive and rehabilitative needs, American data could be used instead. There are no Canada-wide epidemiological studies on oral health status. While this solution to assessing needs is simple, it undermines the relevance of the analyses to the Canadian scenario. Perhaps more importantly, it also highlights the paradox of Canadian society spending \$4.7 billion in dental care annually (1993 direct expenditures)<sup>38</sup> without accurately establishing how those funds should be targeted or how successfully the actual patterns of disease are being addressed. To place this expenditure in context, similar figures for cancer and pregnancy costs were \$3.2 and \$2.0 billion, respectively. Such lack of information precludes the undertaking of need-based, demand-weighted studies that constitute the gold standard in HRP

today. While Canadian epidemiological trends suggest that decay experience and tooth loss are declining, it is still unclear how oral care needs are changing across diverse groups. There are substantial treatment needs in the younger groups in North America,<sup>39</sup> and new cohorts of Canadians are reaching old age with considerable treatment needs in more teeth.<sup>40</sup>

The foundations that we propose to support a more rational HRP process are, first, to accept the necessity of conducting periodic national surveys to objectively determine oral health needs and demands.<sup>9</sup> Second, by negotiating the application of ethical guidelines, it should be possible to agree on directives to allocate resources effectively, to compensate providers fairly and to offer a reasonable range of services<sup>41</sup> to maintain a functional level of oral health for the population at large. Finally, an indirect result of the first 2 phases would be to define acceptable minimum standards for oral health status and oral health care for the Canadian population through consensus by professional, academic, governmental and lay stakeholders. Such standards should be pertinent to the needs of the various age groups, culturally acceptable and subject to cost-benefit analyses to determine their viability compared to alternative options. Such options must objectively appraise the benefits and costs of implementing alternative models of health care delivery. ♦

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*Dr. Maupomé* is clinical assistant professor at the faculty of dentistry, University of British Columbia, Vancouver, B.C., and investigator at the Center for Health Research, Portland, Oregon.

*Dr. Hann* is professor emeritus at the faculty of dentistry, University of British Columbia, Vancouver, B.C.

*Ms. Ray* is a fourth-year dental student in the faculty of dentistry, University of British Columbia, Vancouver, B.C.

*Correspondence to:* Dr. Gerardo Maupomé, Center for Health Research, 3800 North Interstate Ave., Portland OR 97227-1110 USA. E-mail: maupome@interchange.ubc.ca

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## C D A R E S O U R C E C E N T R E

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The CDA Web site has statistics on the number of dentists/specialists practising in Canada. The information can be found at: <http://www.cda-adc.ca>. Click on "Practising Dentistry," then on "Number of dentists."

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CDA members from across the country can access the Resource Centre. Services can be requested by telephone, fax, e-mail or regular mail. For information on loans (books and videos), photocopies of journal articles or Medline searches, please contact the Resource Centre.

### Recent Acquisitions

- Axelsson, Per. Diagnosis and risk prediction of dental caries. Quintessence, 2000.
- Blaes, Joe and Booth, Nate. 555 ways to reward your dental team. Harrison Acorn Press, 2000.
- Burstone, Charles J. and Marcotte, Micheal R. Problem solving in orthodontics. Quintessence, 2000.
- Daskalogiannakis, John. Glossary of orthodontic terms. Quintessence, 2000.
- Finkbeiner, Betty Ladley. Four-handed dentistry. Prentice Hall, 2001.
- Reichart, Peter and Philipsen Hans P. Oral pathology. Color atlas of oral medicine series. Thieme Medical Publishers, 2000
- Sato Ni. Periodontal surgery: a clinical atlas. Quintessence, 2000.
- Schmidseder, Josef. Aesthetic dentistry. Color atlas of oral surgery series. Thieme Medical Publishers, 2000.
- Taylor, Thomas D. Clinical maxillofacial prosthetics. Quintessence, 2000.

**Table 1 The DeFriese and Barker<sup>3</sup> paper classification system**

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**Projections from Manpower-to-Population Ratios.** This simple and straightforward technique attempts to estimate the supply of dentists in some future year by examining 5 factors: the current stock of practitioners, projections from current statistics of the future retention of graduates of in-state dental schools, the influx from out-of-state schools, retirements and deaths. Population estimates are obtained from appropriate state or federal agencies, and manpower-to-population ratios are calculated for each year from the present to the target year. Such analyses usually suggest either an oversupply or an undersupply of dentists according to an arbitrary ratio standard. The method is usually employed when no other data are available.

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**Dental Practitioner Opinion Surveys.** A questionnaire survey of the practising dentists in a state or sub-state region asks them to describe briefly the structure and size of their practices and to indicate whether, in their opinion, there is a shortage of dental manpower in the vicinity of their practices. This sort of question might be combined with one that asks how "busy" dentists are or an estimate of the number of additional patients a practice might handle. On the basis of the answers received, particular counties or communities are defined as dental manpower shortage areas.

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**Estimates of Requisite Demand to Absorb Current Capacity.** This method is less common and more complex than the practitioner opinion survey, as it requires information on the practice structure and patient volume, as well as estimates of demand for dental care services. Rather than focus only on the supply of health manpower, this approach attempts to measure the extent and manner in which demand must be stimulated by some future date in order to utilize fully the supply of dental services that will be available.

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**Econometric Practice-Productivity Study.** This approach attempts to measure a large number of variables known to correlate with the output (measured usually in terms of visits, patients, procedures or time) of dental practice for a given period and to relate these variables, through the use of regression equations, to the utilization of (demand for) dental services. Such studies are somewhat more complicated conceptually and methodologically than the first 3 types.

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**Need-Based, Demand-Weighted Studies.** This approach is distinguished from the others principally by its emphasis on the measurement of the incidence and prevalence of conditions (disease and other needs for service or treatment) in the general population and its use of these data as the basis for the estimation of manpower requirements. The technique involves the translation of epidemiological measures of dental conditions into standardized measures of treatment needs and the measurement of the productive capacity of dental practices. Estimates derived from this analysis are of the percentage increase in productivity — measured in units of time, procedures or visits — required to meet the treatment or service needs of the population. This approach can be supplemented, or weighted, through the use of a measure of demand for care. The approach is relatively uncommon because of the number of separate factors that must be measured and taken into account.

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**Table 2** Position statement and experts' report not amenable to classification within the DeFriese and Barker system<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
Belliveau, 1968 <sup>7</sup>	Demographic profile	To outline the similarities and differences in the HR situation and in the future between medical and dental personnel, demographic and supply/demand phenomena are reflected upon. Technological change and increased access to care are deemed to be major agents for increased supply needs.	<u>Conclusions:</u> - While affected by distribution problems, both medical and dental HRP should strive to get more graduates to meet demand for service. - The demand for dental services could, and probably will, increase in response to public education efforts leading to higher dental IQ. - Dental schools' capacity cannot currently meet the applications for enrollment due to their large number. The situation for applicants to medical schools is the opposite.
Position statement	Supply of dentists		
N/A	Insurance schemes Technology improvement/development		
Botterell, 1969 <sup>8</sup>	Dental insurance	To satisfy large unmet needs reportedly affecting considerable segments of the population in Ontario, a selected committee examined various factors that hinder access to dental care.	<u>Conclusion:</u> There will be a substantial increase in the demand. <u>Recommendations:</u> (1) The dental services within the Department of Health should be expanded. (2) The number of dentists, dental auxiliary personnel and dental therapists should be increased. Education facilities and faculty/staff should be expanded. (3) The dental auxiliary personnel should take over many tasks to free up time for dentists to the more sophisticated tasks. (4) To support the overall intervention for better oral health, water fluoridation measures, dental programs for schoolchildren and social assistance should be introduced.
Experts' report	Supply of dentists and auxiliary personnel (universities and colleges), including gender restrictions Development of faculty/staff to train auxiliary personnel Policy on topical fluoridation and water fluoridation Support for ongoing evaluation of impact of health services and quality of care, including a school dental health program Demographic profile		
Unclear			
Lewis, 1972 <sup>22</sup>	Supply of dentists	To address the perception of HR shortages while some dentists report not being busy enough, attention is drawn to the position that judgements of HR adequacy should hinge upon actual needs for prevention or treatment, not only on perceived or expressed needs.	<u>Conclusion:</u> Lack of busyness of some dentists does not mean there is no shortage of supply. <u>Recommendations:</u> - Consider actual dental health status in the community when assessing HR. - Try to restore balance between supply and demand by maximizing use of HR to improve dental health status.
Position statement	Busyness		
N/A	Unmet and met needs		
Lang, 1977 <sup>20</sup>	Supply of professional personnel	To address the impending oversupply of dentists in the country, examples from other professional fields should guide the measures and monitoring of supply that is needed.	<u>Conclusion:</u> On the verge of oversupply crisis at the national level. <u>Recommendation:</u> Supply planning should be implemented by bringing provincial governments, licensing bodies, dental associations and universities to yearly meetings.
Position statement	Busyness		
N/A	Immigration policy for dentists Inter-provincial supply balance		
Clappison, 1980 <sup>13</sup>	University funding	To assess the evolving scenario in which future dentists will work, considerations are made of	<u>Conclusions:</u> - There is an oversupply of dentists, as evidenced by changing plans to establish independent practices upon graduation.
Position statement	Supply of dentists		

**Table 2** Position statement and experts' report not amenable to classification within the DeFriese and Barker system<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
N/A	Versatility of dentists to refocus professional goals Dental insurance Changes in level and type of treatment needs	the underlying priorities to plan university professional training when reduced busyness is deemed widespread.	- University finances and the current scheme for government funding of higher and professional education stimulate dentists' overproduction. This is an incorrect framework for HRP.



**Table 2** Position statement and experts' report not amenable to classification within the DeFriese and Barker system<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
McDermott and Oles, 1985 <sup>28</sup>	Demographic trends Dentist:population ratios Demand for dental services	A review of national and provincial dental HRP reports with special attention to Saskatchewan documents the perceived oversupply of dental personnel, together with demographic and demand factors that affect the balance of the dentist:population ratio.	<u>Conclusions:</u> - Dental manpower oversupply exists in the country and will worsen because demand lags behind the increase in supply. - Free market forces are expected to correct maldistribution of HR. - As a result of the imbalance between supply and demand, the income level of the dental profession will drop. A lowering of prestige and professional status will follow.
Unclear Combination of surveys	Technological changes affecting clinical practice Supply of dentists and auxiliary dental personnel Secular trends in oral health status		
Johnson, 1985 <sup>19</sup>	Dental hygienist supply and employment Demand Roles of auxiliary personnel and dentists to meet demand	To address the relationship between supply and demand in the dental market, the complementary roles of various types of dental personnel are examined and reflected upon as the basis for HRP.	<u>Conclusions:</u> - No evidence of oversupply of dental hygienists. - Current changes in disease trends support the increased involvement of dental hygienists in meeting the demand. <u>Recommendations:</u> - Changes in the number of dental hygienists should be implemented by adjusting dental hygiene class size rather than by closing dental hygiene training programs. - There is a need to consider expanded roles for dental hygienists in the future in the new dental care market.
Beagrie, 1986 <sup>6</sup>	Demographic profiles Treatment patterns and modalities Number and profile of dentists Preventive agents Dental insurance Cariogenic factors	To reflect upon the necessary factors to offer a comprehensive appraisal of HRP, the author outlines the interaction between factors. The WHO view is incorporated together with some figures from B.C. to be used as a case demonstration.	<u>Conclusion:</u> HRP should be based on data collection from the population, treatment need and demand, type of care requested, care organization and financing, research in prevention and care technology, education and re-education of personnel, and political, social and economic policies. <u>Recommendations:</u> - Establish a national planning and monitoring group for oral health (with representation from the consumer, national associations and government). - Complete the change in the role of dentist to "oral physician".
Pamenter, 1986 <sup>29</sup>	Supply of dentists Busyness Atlantic provinces (mainly Nova Scotia) perspectives, but encompassing the national scenario	To address the impending oversupply of dentists and its assorted sequels, there is a need to manipulate the supply/demand relationship.	<u>Conclusions:</u> - Atlantic provinces are on the verge of oversupply. - There is a need to increase demand and reduce supply. - Through implementing a national program, the projected national demand should be monitored and measures introduced to achieve a favourable relationship.
Schwartz, 1986 <sup>31</sup>	Unclear Demands for dental care, met and unmet HRP evolving priorities	To reflect upon the priorities that should guide HRP, a discussion of values implicit in setting the priorities and planning services is made.	<u>Conclusion:</u> The future of dentistry depends on dental schools for education and research. HRP should consider issues of access to care. <u>Recommendation:</u> HRP should involve professional representatives, government, universities and the public.

**Table 2** Position statement and experts' report not amenable to classification within the DeFriese and Barker system<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
Silver, 1986 <sup>32</sup>	Supply of dentists	To assess the viability of adjusting the supply of dentists to the actual needs of the profession (in terms of busyness), the relative contributions of changing disease profiles and demographic profile are considered.	<p><u>Conclusions:</u> - There is an oversupply of dentists, as evidenced by reports of lack of busyness.</p> <p>- Changes in disease trends are not making up for a decrease in caries levels by substitution for other reasons for demand.</p> <p>- HR cohorts should reflect the needs of population cohorts.</p> <p><u>Recommendations:</u> - While reduction in enrollment appears to be the first choice to adjust the supply, it would be a better strategy to close some faculties altogether. This measure would reduce supply and preserve the viability of remaining faculties.</p> <p>- HRP should contemplate shifts in the HR mix to reduce the number of dentists and increase auxiliary personnel.</p>
Position statement	Changes in level and type of treatment needs		
N/A	Demographic profile Enrollment adjustment		
Bascombe, 1992 <sup>5</sup>	Dental hygiene working conditions	To reflect upon the issue at play while determining whether there is a shortage or a surplus of dental hygienists, the document reflects on the factors involved in HRP for the dental hygiene profession.	<p><u>Conclusions:</u> While HRP should be reviewed having the aspect of access to care in mind, it is difficult to select any one approach to design a comprehensive planning model. Emphases on economic, demographic and epidemiological needs should offer different results.</p>
Position statement	Dental hygiene professional development		
N/A	Epidemiological and economic situations		

**Table 3** Projections from manpower-to-population ratios (DeFriese and Barker system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
Lewis, 1974 <sup>23</sup> Experts' report	Supply of dental services/chairside hours, productivity	To summarize the main considerations and results for 4 HRP studies, a combination of frameworks and components was designed to offer an overview of HRP in Ontario. Three of the 4 studies were unpublished at the time.	<u>Conclusions:</u> Lewis and Brown <sup>25</sup> - With current levels of productivity, the country needs between 2 and 2.6 times more dentists, whether denticare is introduced or not. If there is an increase in the number of dental therapists, the increase in the number of dentists would decrease by approximately 50%. Three unpublished studies - Without adding another dental school in Ontario, more dental auxiliaries need to be trained. There is a need to employ auxiliaries as a means to alleviate supply deficiencies in certain geographic areas. An incentive scheme would be needed to attain this goal. In areas with supply deficiencies, mobile clinics may need to be introduced.
Unclear Charting of trends, combination of surveys	Profile of needs/sociodemographic and insurance components Dental auxiliary personnel (with and without expanded functions) Geographic distribution of personnel		
House and others, Experts' report	Unclear Growth of dentists' supply	Unclear. Charting of supply and demand factors.	Unclear conclusions; no recommendations. There is an excess number of dentists and dental hygienists. For dentists, the worst effects of this oversupply were finished at the time of publication (1982). For dental hygienists, the increase in supply and the uncertainty as to the demographic/labour/employment profiles made it difficult to predict the outcome. However, dental hygienist supply could be excessive.
Unclear	Growth of population in B.C. Impact of auxiliaries on supply of dental services Impact of productivity of auxiliaries Impact of UBC enrollment on supply Impact of immigration Impact of retirement rates Impact of specialty training		- Too many dentists graduated in the 1960s and 1970s. - B.C. would likely attract enough population to dilute the oversupply. - No significant change was estimated for 1982 to 2000 in the dentist:population ratio. - Factors affecting HR include immigration, retirement age, role of auxiliaries, number of graduates, etc.
Peat, Marwick and Partners, 1982 <sup>30</sup> Original research	Supply of dental personnel Demand for dental services Dental personnel:population ratios	By reviewing past reports and consulting with professional/government authorities, ideal dental personnel:population ratios were designed and extrapolated to the future demographic growth in Western Canadian provinces. This strategy allowed the production of a series of adjustments to the actual HRP figures and sources for the 1980s and beyond.	<u>Conclusions for certified dental assistants and dental hygienists:</u> Potential exists for a small dental hygienist surplus in Western Canada, but the impact of this situation is uneven across the 4 provinces and partly constrained by oversupply of dentists. <u>Recommendations for certified dental assistants and dental hygienists:</u> No changes are recommended in the training programs at the time in any of the 4 provinces, except for minor adjustments for certified dental assistant enrollments. <u>Conclusions for dentists:</u> - Projected surplus exists in Western Canada and at the provincial level. Currently a surplus exists in B.C. (1982) and will increase. Other provinces are more stable. - Increases in productivity through technological change and changes in organization of practice will worsen the surplus as a side effect of increased capacity of the dental care system. - The impact of insurance coverage on demand for dental services in the future is unclear. - The immigration of dentists into Western Canada suggests that the control and monitoring of dentist supply must take into account the national situation.
Charting of supply and demand trends for dental hygienists, certified dental assistants and dentists			

**Table 3** Projections from manpower-to-population ratios (DeFriese and Barker system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
			<u>Recommendations for dentists:</u> - Maintain dentist enrollment in Alberta, Saskatchewan and Manitoba at the current levels.
			- Reduce enrollment in B.C. by approximately 40%.
			- Maintain the present system of one dental school per province.

**Table 3** Projections from manpower-to-population ratios (DeFriese and Barker system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
House and others, Experts' report Unclear	Unclear Population growth Dentist supply growth Mobility of dentists Policy changes Immigration of dentists Retirement age/financial outlook Number of graduates Full-time equivalents for dental personnel (mainly female)	Unclear. Charting of supply for dentist, dental hygienist and certified dental assistant figures at the national and provincial levels, by age of dentist and gender.	<u>Conclusions:</u> - Dentist supply will increase 40% in the next 20 years; population will grow much less. Public sector opportunities unlikely to grow. - Policy changes alone have tightened immigration patterns; supply will decrease 5% to 6% by 2001. - Supply of dentists depends on number of graduates, net inflow from other provinces/countries, policy changes and retirement patterns (age and financial considerations). - These factors should be carefully considered in HRP.

**Table 4** Dental practitioner opinion surveys (DeFriese and Barker DHHRP system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
MacLean, 1970 <sup>26</sup>	Dental hygiene employment lifespan	Survey of dental hygiene graduates from the University of Alberta between 1963 and 1969 to determine province of origin, actual (potential) years of employment in various fields and practice location. An appraisal was made of the relationship between dentists and dental hygienists for HRP purposes.	<ul style="list-style-type: none"> <li>- Dental hygienists graduating from the University of Alberta and participating in the survey had 3.18 years of work expectancy — not too different from potential years.</li> <li>- To maintain the dentist:dental hygienist ratio, about 250 to 300 dental hygienists would need to graduate per year (Alberta). National figures suggest that over 2,000 dental hygienists graduate per year, compared to the current figure of 110 (1970).</li> </ul>
Original research	Dental hygiene graduates/year		
Survey of opinion	Dentist graduates/year Dentist supply		
Manning and others, Experts' report	Current employment status of dental auxiliaries and unfilled vacancies (dental hygienists, chairside assistants, certified dental assistants), as well as projections within 2 years of the survey	To determine whether a need exists for expanding the number of auxiliary personnel in B.C., a survey of opinion amongst practising dentists was undertaken. Both the current situation and their perceived projection of need for hiring auxiliary personnel were surveyed.	<p><b>Conclusions:</b></p> <ul style="list-style-type: none"> <li>- The hiring pattern will remain the same except for changes in the ratio of employment across various types of personnel.</li> <li>- The greatest need to supply personnel will be for dental hygienists.</li> <li>- While certified dental assistants will also increase, the change will be more modest.</li> <li>- Dental hygienists will become a majority of auxiliary personnel, thus replacing certified dental assistants.</li> <li>- The priority in HR would thus be dental hygienists, then certified dental assistants, then chairside.</li> </ul>
Survey of opinion			
Leake, 1983 <sup>21</sup>	Public health dentist positions available	Survey of opinion among public health dentist authorities in the country to assess the immediate past and developments within the previous 10 years in terms of public health dentist personnel. This is not a clinical specialty but some public health dentists are practising clinicians.	<p><b>Conclusions:</b></p> <ul style="list-style-type: none"> <li>- Not enough HR in public health dentistry. Number of public health dentist positions will increase, with an estimated need to train approximately 134 public health dentists in the next 10 years. Quebec and the Prairies may suffer more to address needs for public health dentists.</li> <li>- Lack of HRP has led to (i) positions being left unfilled, (ii) positions being filled with non-public health dentists and (iii) recruitment of foreign public health dentists.</li> </ul> <p><b>Recommendation:</b> Increase salaries to make public health dentistry more attractive vis-a-vis number in private practice and increased training requirements.</p>
Original research	Public health dentist positions filled Public health dentist position expansion plans		
Christensen, 1986 <sup>12</sup>	Dentists' perceptions of shifts in demand, in supply and in the number/type of procedures performed	To achieve a better understanding of how the market is being perceived by Canadian and American dentists, a convenience sample was chosen and surveyed.	<p><b>Conclusions:</b></p> <ul style="list-style-type: none"> <li>- While a decrease was noted in treatment items pertaining to pediatric dentistry, dentures, extractions and adult restorations, remaining areas in clinical dentistry remain unchanged or nearly so. The volume of patients has not suffered major changes. The overall perception of the 43% of subscribers who responded to the survey was that there were too many dentists on the supply side.</li> </ul> <p><b>Recommendations:</b></p> <ul style="list-style-type: none"> <li>- Stop overproduction of dentists by dental education establishments.</li> <li>- Incorporate the clinical community into the dental education system, and vice versa.</li> </ul>
Original research			
Survey of opinion			

**Table 5** Estimates of requisite demand to absorb current capacity (DeFriese and Barker DHHRP system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
Lewis and Brown, Experts' report Economic modelling	Supply of dental services/chairside hours, productivity Profile of needs/sociodemographic and insurance components Dental auxiliary personnel (with and without expanded functions)	To provide a dynamic comparison of the relative impact of 2 prepayment systems and 2 combinations of dental personnel on the demand for dental services (scenarios A, B, C and D).	<u>Conclusions:</u> Against a background of the 1971 ratio of 1 dentist for every 2,814 persons, this study indicates that (A) Dentist:population ratios of 1:1,222 to 1:1,424 are required to achieve desirable levels of utilization of dental care services in Canada in the future. (B) Anticipated increases in annual utilization and frequency of care resulting from a publicly financed dental prepayment program for the 0-18 year age group will require ratios of 1:1,100 to 1:1,291. (C) Target ratios of 1:1,822 to 1:2,042 for dentists (higher than A or B) are possible under the same utilization as in A when maximum use (with the 0-18 year age group) is made in private practice of dental therapists, who must be available in the ratio of 1:3,599 and 1:5,432 (total population), respectively, to counterbalance the decreased need for dentists.  (D) Utilization of therapists in "1500-hour" school clinics to work on the age group (0-18) in a publicly financed prepayment scheme having a 90% patient utilization experience requires ratios of therapists to total population of from 1:2,681 to 1:3,551 coupled with dentist supply ratios of 1:1,681 and 1:1,912, respectively; note that here patient utilization is higher than 3 and only slightly above 2.
Aziz and Leung, 1973 <sup>4</sup> Experts' report Charting of trends	Supply of dental services by dentists and by dentists and auxiliary personnel Financing of services/voluntary type and publicly financed Demand for dental services (USA and Canada)	Unclear. Seemed to use Lewis and Brown <sup>25</sup> criteria to determine supply of dental manpower, assuming various sets of frameworks and charting assumptions.	<u>Conclusions:</u> Unclear. It may be inferred from a subjective comparison of the 4 charts depicting the number of dentists and demand that the inclusion of publicly financed dental plans or the employment of auxiliary personnel in various capacities to provide services would reduce the discrepancy between the projected supply of dentists (1973-1981) and the required supply to meet the demand for dental services.
House and others, Experts' report Unclear	Unclear Changes in demographics Changes in disease trends Changes in modalities of payment Changes in attitudes Impact of higher levels of care/mass prevention Demand for dental services	Unclear. Using some charts to depict current patterns/levels of treatment, there is an extrapolation to larger needs projected to grow between 1982 and 2001. The foundation of these projections is vague.	<u>Conclusions:</u> - Demand will double between 1982 and 2001. Insurance coverage, treatment affordability and sustainability of trends are open to question. - Distribution of time in treatment will evolve but most will still be taken up by diagnosis, prevention and restoration procedures. - Profession should be aware of the financial implications of demand growth and participate actively in shaping events.

**Table 5** Estimates of requisite demand to absorb current capacity (DeFriese and Barker DHHRP system)<sup>3</sup>

<b>Author/Year</b> <b>Document Type</b> <b>Methods</b>	<b>HRP Factors</b>	<b>Study Summary (Design)</b>	<b>Conclusions/Recommendations</b>
Lewis, 1986 <sup>24</sup> Symposium proceedings Design of HHR models (production-function based and demand based) from surveys Contrast and review of selected publications	Unclear Survey information on demand and supply in terms of dental visits	To outline some of the most important facts and considerations in the models, 4 major segments of the document were outlined. (1) A summary of a 2-year survey consisting of questionnaires sent to various dental personnel, a 3-year questionnaire to households and a multiple regression analysis to make a projection of HRP for Ontario. A demand-based model was also designed using population projections of provincial demographics. (2) Medium-term evaluation of the Ontario Dental Manpower Study. (3) Other HR considerations. (4) Critique/contrast of Douglass & Gammon <sup>14</sup> study.	<u>Conclusions:</u> Overall picture unclear; numerous isolated conclusions. (1) Studies [a] Dentists' activity: general dentists one-third not busy enough; recent graduates half to two-thirds busy enough; lack of busyness may be dentist oversupply or perception. [b] Dental hygiene: level of employment doesn't reflect oversupply. [c] Insurance: insured have increased utilization. [d] Supply:demand projections: Overall there are excess dentists despite decreasing dentist:patient ratio, and policy decisions should be made soon to stimulate demand or curtail supply. The supply of dental hygienists is adequate now but there is a need to start curtailing for the future. (2) Medium-term [a] dentist projection accurate 6 years later. [b] Dental hygiene projection inaccurate 6 years later. (3) HR considerations [a] Demand continues to increase and is associated with increased income, increased access and availability of dental insurance. [b] Demand due to decreased caries may not be kept at its present levels due to increased periodontal needs. (4) Douglass and Gammon study [a] Unmet need not only new disease increments but also [b] Met and unmet need equals total potential market is not true. [c] Criteria for met need is actually potential capacity. [d] Lewis suggests that Douglass and Gammon data could be interpreted in a different manner; he is concerned with the idea of preserving enrollment.
Boyd & Diggins, 1987 <sup>9</sup> Experts' report Unclear Charting of trends, combination of surveys	Changes in diseases Demographic profiles in transition Dentist:population ratio Migration, attrition, enrollment trends for dentists Enrollment and curriculum changes in B.C. and elsewhere Demand for dental services	To achieve a more stable scenario for HRP in B.C., demand and supply data were evaluated together with sociodemographic and dental education considerations.	<u>Recommendations from main report:</u> Manpower changes (1) Funding for dental studies at the University of British Columbia should be maintained at the current level during the attempt to respond to the manpower issue through adjustments to enrollment. (2) There is a "critical mass" of faculty required to provide the range of teaching expertise and research interests needed for a viable dental institution. (3) Implement a modification in student mix with a decrease in undergraduate enrollment balanced by graduate and post-graduate enrollment. (4) Immediately decrease undergraduate enrollment. The first-year class would have 32 rather than 40 students. (5) Consider registration only for dentists who hold full practising licenses in B.C. to ensure uncompromised quality of care to patients. (6) Further epidemiological study must be continued to monitor provincial and national dental manpower levels based on population growth and demand for services. (7) A specific timetable for review of provincial manpower and curriculum should be established.  <u>Recommendations from minority report:</u> Since the data used for HR evaluations were poorly founded and there was a risk of bias in their interpretation, the minority report rejected the call for reducing enrollment.



**Table 5** Estimates of requisite demand to absorb current capacity (DeFriese and Barker DHHRP system)<sup>3</sup>

Author/Year	HRP Factors	Study Summary (Design)	Conclusions/Recommendations
Document Type			
Methods			
House, 1987 <sup>15</sup> Experts' report Unclear	Unclear Population growth Changing demographics Trends in oral health status Treatment demand	Based on partial and assumed scenarios with regard to treatment needs and demand, an appraisal was made of the time spent per treatment procedure. This scheme was based on current treatment patterns and modalities, and subsequently extrapolated to hypothetical scenarios in the future. Some questionable assumptions exist, such as the equation of "demand" to "need" in high-care users and then basing the overall projections on this group.	<u>Conclusions:</u> - Demand will not keep pace with population growth. - Demand will grow by less than 3% in the next 20 years, which is much lower than the expected trend in HR. - The modalities of utilization may alter projections due to changes in disease trends and demographics, as well as economic and social factors.
Brodeur and others, Original research Combination of independent surveys	Dentist supply (Quebec) Demand for services Population (Quebec)	To appraise the evolution of the supply:demand relationship in dental care for adults in Quebec (1971-1985), various sources of data were combined. These resources offered information on the number of dentists, the population at large and the demand for services.	<u>Conclusions:</u> - The dentist:population ratio increased markedly during the interval under study. - While the number of adults who visited a dental office once a year increased substantially, an increase in all age groups was identified for people visiting a dental office twice a year or even more often. - In spite of these trends showing higher utilization, dentists are more anxious about HR issues (even though the concern may be unwarranted). <u>Recommendations:</u> - Introduce studies to investigate supply and demand. - In the meantime, measures should be undertaken to reduce the number of applicants to dental schools and to increase the demand for services.
Brodeur and others, Original research Combination of surveys	Dentist supply (Quebec) Demand for services (Canada and USA) Population (Quebec)	To examine the supply and demand for dental care in Quebec between 1985 and 1988.	<u>Conclusions:</u> While the number of active dentists grew (although at a slower rate more recently), the demand for services has reached a plateau. Utilization rate in Quebec is similar to United States. <u>Suggestion:</u> Introduce additional education campaigns and dental insurance programs to improve utilization of services and dental health status.

**Table 6** Need-based, demand-weighted studies (DeFriese and Barker DHHRP system)<sup>3</sup>

<b>Author/Year</b> <b>Document Type</b> <b>Methods</b>	<b>DHHRP Factors</b>	<b>Study Summary (Design)</b>	<b>Conclusions/Recommendations</b>
Douglass & Gammon, 1985 <sup>14</sup> Original research Epidemiological profiles of caries, periodontal disease and edentulousness in Canada (where lacking, figures from the U.S. were used). Need-based model to estimate hours of treatment needed/hours effectively demanded.	Secular trends of oral health status (caries and periodontal disease) in United States (Projected) growth in the at-risk dentate population Met treatment need and unmet treatment need, leading to (projected) total potential market	To determine the implications for the dental profession of the epidemiological trends, a need-based model was developed. The model took into account the secular trends of oral health status (extrapolating from U.S. figures), the changes in population size and distribution and the estimates of met and unmet treatment needs (assuming that people with dental treatment needs would effectively demand services at least at the 1976 rates). Note: Root decay lacks reliable data to be included in the model but its impact is deemed to be considerable.	<u>Conclusions:</u> Number of hours for operative and periodontal treatment will steadily increase by 2001 by many millions of hours — at least twice the 1981 figures. The trend is driven by the increase in the number of dentate adults making up the older cohorts in 2001. <u>Recommendation:</u> Policy planners should be aware of the interaction between the epidemiological trends of dental diseases in adults and the demographic changes.
Stangel, 1992 <sup>33</sup> Original research Combination of surveys and charting of trends	Disease/needs profile Dental school enrollment Supply of dentists	To determine whether there is an increased need for dental services in the future or not, the 3 main HR components were charted and projections made into the future.	<u>Conclusions:</u> - There is no well-documented decline in the need for dentists. - Evidence suggests that there will be an increasing need for dental services in the future, insofar as (i) The changing patterns of dental disease that have been identified in younger age groups are offset by the large number of adults who are retaining teeth into older ages. (ii) The increasing demand will likely be due to demographic changes and increasing third-party payments, economic growth and dental IQ in older cohorts. - HRP should be based on data available on factors affecting need. Accurate understanding of these should be carefully sought and updated.