Dental Health Professional Shortage Areas Methodology: A Critical Review
Annotated Bibliography

(1994). "List of designated primary medical care health professional shortage areas (HPSAs); list of withdrawals from primary medical care HPSA designation--HHS. Notice." Federal Register **59**(14): 3412-507.

This notice provides two lists. The first is a list of all areas, population groups, or facilities designated as primary medical care health professional shortage areas (HPSAs) as of August 31, 1993. Second is a list of previously designated primary medical care HPSAs that have been found to no longer meet the HPSA criteria and therefore are being withdrawn from the HPSA list. HPSAs are designated or withdrawn by the Secretary of Health and Human Services (HHS) under the authority of section 332 of the Public Health Service Act

American Association of Public Health Dentists (1981). "Problems and potentials in dental manpower planning. The North Carolina research studies." J Public Health Dent **41**(1).

American Dental Association: Council on Dental Health and Health Planning (1980). Strategies for Dental Society Participation in shortage area designations and National Health Service Corps Assignments, American Dental Association.

Provides in-depth discussion of the shortage designation criteria in use in 1980, the process of applying for a NHSC placement, and the role that local dental societies can play in improving the accuracy of the data on which such decisions are made, facilitating local communities in their application process, as well as questioning designation decisions made on the basis of weak or inaccurate data.

American Dental Association, House of Delegates. (1984). Resolution 77H-1987, Chicago, American Dental Association.

American Dental Association (2002). *Access to Care*. ADA Website. Available at: http://www.ada.org/prof/govt/dentistryworks/access.html. Accessed: August 2002.

Arnjlot, H., D. Barmes, et al. (1985). Oral Health Care Systems: An International Collaborative Study. London, Quintessence Publishing.

Ultimately, the application of any preventive intervention is driven by a combination of individual behaviors, community interventions, and profession- al practice, This is one of the few studies have taken into account all three spheres of action in determining health outcomes in a community. Provides extensive discussion of theoretical considerations and methodological issues at stake in planning oral health intervention strategies

Aved, B. M. (1996). Strategies to Increase Access to Dental Services in Rural California, Preventive Dental Systems, Inc**:** 25.

This report presents a set of recommendations to increase access to dental services for residents of rural California, particularly low-income families and children. The recommendations were developed by a broad base of health care leaders convened from across the state.

Baird, J. T., Jr. and J. E. Kelly (1970). "Need for dental care among adults." Vital Health Stat 1 **11**(36): 1-22.

This report indicates that there is sufficient reason to believe that an omnibus evaluation of the need for dental care, although essentially judgmental, nonetheless provides a meaningful indication of the relative urgency for seeking care. The evaluation may then be studied in relation to various demographic and socioeconomic features. Such analysis is the subject of the findings subsequently presented in this report.

Bailit, H. L. (1988). "Changing patterns of oral health and implications for oral health manpower. Responsibility to the public." Int Dent J **38**(1): 56-60.

This paper examines organized dentistry's responsibility for informing the public about changing patterns of oral disease. The public is divided into two groups: governments and other organizations that are responsible for allocating funds for dental treatment, education and research, and the general population that is eligible to use dental services. Some governments in industrialized countries apparently believe that with the decline in caries, monies for dentistry can be reduced without affecting the oral health of the population. This assumption can be challenged, since oral disease levels in lower socioeconomic class groups and the elderly continue to be very high. Further, the goals of the dental care system should be raised to eliminate edentulousness. Dentistry needs to make the public aware that adequate care for the poor and elderly and eliminating edentulousness will require increased support for dentistry. At the patient level, regular users of care who are healthy should be informed that more frequent visits and complex services may have little effect on oral health. In contrast, infrequent users of dental care should be made aware that dentistry has the technology to prevent disease and the loss of teeth. One phase in the history of dentistry is coming to an end but another is beginning. In the new era the dental profession can make even greater contributions to the quality of life of individuals and society.

Bane F (1959). Dentists for a Growing America. Physicians for a Growing America: Report of the Surgeon General's Consultant Group on Medical Education. Washington DC, Government Printing Office.

Influential report documenting the maldistribution of dentists in the United States. The report uses a demand adjusted population-to-provider ratio, corrected for income, age, educational level and degree of urbanization.

Bascombe, D. E. (1992). "Notes on the supply and demand for dental hygienists." Probe **26**(4): 164-5.

Bawden, J. and G. DeFriese (1981). Planning for dental care on a statewide basis : the North Carolina dental manpower project. Chapel Hill, N.C., Dental Foundation of North Carolina.

Detailed examination of the North Carolina Dental Manpower Project. Includes sections on assessing disease prevalence, projecting treatment needs, predicting demand, measuring dental productivity. Includes vast data sources and grounded threory.

Beagrie, G. S. (1986). "Dental manpower. An F.D.I./W.H.O. viewpoint." J Can Dent Assoc **52**(1): 52-5.

Although other educational facilities are needed for developing the oral health manpower team, universities have the primary role in educating the dentist. The need for a curriculum based on fundamental research which is responsive to the needs of society is essential for the future development of the profession. Oral health manpower plans should be dependent upon the type of service designed for a country and an appropriate mix of manpower should be developed. By the collection, monitoring and interpretation of epidemiological data, universities have a major role to play in the forecasting of trends. Relevance of programs within universities in health matters must be made more apparent to the community, especially when financial restriction in both health services and higher education are being felt. A national planning program, centrally managed to include national associations, government, universities and interested parties, is essential if the relevance of oral health manpower is to be maintained.

Beagrie, G. S. (1988). "The responsibilities and role of universities in dental manpower." Int Dent J **38**(1): 51-5.

Although other educational facilities are needed for developing the oral health manpower team, universities have the primary role in educating the dentist. The need for a curriculum based on fundamental research which is responsive to the needs of society is essential for the future development of the profession. Oral health manpower plans should be dependent upon the type of service designed for a country and an appropriate mix of manpower should be developed. By the collection, monitoring and interpretation of epidemiological data, universities have a major role to

play in the forecasting of trends. Relevance of programmes within universities in health matters must be made more apparent to the community, especially when financial restriction in both health services and higher education are being felt. A national planning programme, centrally managed to include national associations, government, universities and interested parties, is essential if the relevance of oral health manpower is to be maintained.

Beazoglou, T., H. Bailit, et al. (2002). "The dental work force in Wisconsin. Ten-year projections." J Am Dent Assoc **133**(8): 1097-104.

BACKGROUND: The national dentist-to-population ratio is expected to decline during the next decade. The Wisconsin Dental Association undertook a study to determine the impact of this decline on the future supply of and demand for dental care in Wisconsin. METHODS: Using state and national data, the researchers estimated the number of dentists leaving and entering the state for the years 2001 through 2010. Then, using multivariate regression equations, the researchers estimated expected changes in dentists' productivity, the growth of the Wisconsin population and increases in utilization of dental services for the next 10 years. From these data, they determined the number of dentists needed in 2010 to maintain the current level of access. They assessed several strategies for increasing the number of dentists in the state. RESULTS: Wisconsin will have 297 fewer dentists in 2010 than it did in 2000. However, with increases in dentists' productivity of 1.8 percent per year, a slowly growing Wisconsin population (0.42 percent per year) and modest increases in utilization (0.82 percent per year), Wisconsin will need only 194 additional dentists to maintain current levels of access to care. The authors examined several options for increasing the number of dentists and their productivity, including increasing the number of Wisconsin (vs. out-of-state) students enrolled at Marquette University School of Dentistry, Milwaukee, employing more auxiliaries and using risk-based scheduling for recall patients. CONCLUSIONS: Wisconsin will have fewer dentists in 2010 than in 2000, but current levels of access can be maintained by implementing modest changes in the selection of dental students at Marquette, in the use of dental auxiliaries and in patient scheduling. CLINICAL IMPLICATIONS: With the national dentist-to-population ratio declining, each state should assess how its supply and demand for dental care will change in the next 10 years. If substantial supply-and-demand imbalances exist, options for correcting the imbalances need to be considered.

Beck JD, McGill, J. (1976). "Projecting shortages and surpluses of dentists from available data." J Public Health Dent **36**(3): 171-81.

The usefulness of manpower projections are reviewed and methodologies for projecting are reviewed. Estimates of current (1975) and projected (1990) surpluses and deficits of dentists are presented for Illinois. The model used to derive these estimates has the following characteristics. 1. Only generally available data are used. 2. Mortality rates of dentists, production and retention of new dentists, dental productivity by age, and immigration of dentists are all accounted for. 3. It is assumed that the distribution of new dentists in the future will be similar to the distribution of currently practicing dentists. 4. The assumptions regarding the demand variables of dental productivity and patient visits per person per year can be varied according to the specific situation.

Beck JD, Luebke, N. (1978). "An index of treatment needs for population groups: a pilot study." J Public Health Dent **38**(3): 212-222.

The objective of this pilot study was to examine the predictability of the relation between the status of dentition in a population and the amount of treatment provided. The regression equation generated by the authors to estimate treatment time from a modified DMFT was able to predict actual treatment time with an error of only 8.69 minutes per patient. While pilot in nature, these data speak to the feasibility of using hard epidemiological data to generate accurate personnel requirements.

Beck JD, W. J., Disney JA, Graves RC, Stamm JW, Kaste LM, Bohannan HM. (1992). "University of North Carolina Caries Risk Assessment Study: comparisons of high risk prediction, any risk prediction, and any risk etiologic models." Community Dent Oral Epidemiol **20**(6): 313-21.

The purpose of this analysis is to compare three different statistical models for predicting children likely to be at risk of developing dental caries over a 3-yr period. Data are based on 4117 children who participated in the University of North Carolina Caries Risk Assessment Study, a longitudinal study conducted in the Aiken, South Carolina, and Portland, Maine areas. The three models differed with respect to either the types of variables included or the definition of disease outcome. The two "Prediction" models included both risk factor variables thought to cause dental caries and indicator variables that are associated with dental caries, but are not thought to be causal for the disease. The "Etiologic" model included only etiologic factors as variables. A dichotomous outcome measure--none or any 3-yr increment, was used in the "Any Risk Etiologic model" and the "Any Risk Prediction Model". Another outcome, based on a gradient measure of disease, was used in the "High Risk Prediction Model". The variables that are significant in these models vary across grades and sites, but are more consistent among the Etiologic model than the Predictor models. However, among the three sets of models, the Any Risk Prediction Models have the highest sensitivity and positive predictive values, whereas the High Risk Prediction Models have the highest specificity and negative predictive values. Considerations in determining model preference are discussed.

Beck, J., J. Weintraub, et al. (1992). "University of North Carolina Caries Risk Assessment Study: comparisons of high risk prediction, any risk prediction, and any risk etiologic models." Community Dent Oral Epidemiol **20**(6): 313-21.

The purpose of this analysis is to compare three different statistical models for predicting children likely to be at risk of developing dental caries over a 3-yr period. Data are based on 4117 children who participated in the University of North Carolina Caries Risk Assessment Study, a longitudinal study conducted in the Aiken, South Carolina, and Portland, Maine areas. The three models differed with respect to either the types of variables included or the definition of disease outcome. The two "Prediction" models included both risk factor variables thought to cause dental caries and indicator variables that are associated with dental caries, but are not thought to be causal for the disease. The "Etiologic" model included only etiologic factors as variables. A dichotomous outcome measure--none or any 3-yr increment, was used in the "Any Risk Etiologic model" and the "Any Risk Prediction Model". Another outcome, based on a gradient measure of disease, was used in the "High Risk Prediction Model". The variables that are significant in these models vary across grades and sites, but are more consistent among the Etiologic model than the Predictor models. However, among the three sets of models, the Any Risk Prediction Models have the highest sensitivity and positive predictive values, whereas the High Risk Prediction Models have the highest specificity and negative predictive values. Considerations in determining model preference are discussed.

Bendall, D. and P. Asubonteng (1995). "The effect of dental insurance on the demand for dental services in the USA: a review." J Manag Med **9**(6): 55-68.

Examines the primary studies which have contributed to dental care research. By reviewing background information, lays a foundation for the review of the current empirical evidence, which examines the effect of dental insurance coverage on the oral health of the American population, as well as the utilization and demand for dental services. Raises questions and implications for future research and practice.

Birch, S. (1985). "Equity and efficiency in medical manpower planning: defining objectives and looking towards the future." Health Policy 1985;4(4):341-6 **4**(4): 341-6.

If medical manpower planning is to be successful in terms of providing the correct future manpower levels to produce the desired (efficient) health care services then the planners must recognise the ultimate objectives of the provision of health care services and the production relationship between

the services provided (inputs) and the effects on patient health status (outputs). Furthermore the planning of medical manpower should not be done in isolation under the implicit assumption that other important inputs will be available as required but should be part of an overall planning process for the future production of improvements in health status. Having determined the objectives for outputs the future levels of different types of manpower will depend on the identification of the efficient mix of inputs. In addition the values of other variables influencing the production relationship (e.g. trends in the consumption of certain goods) should be considered in the planning process since observed trends show that they do not remain constant over time.

Birch, S. and S. Chambers (1993). "To each according to need: a community-based approach to allocating health care resources." CMAJ **149**(5): 607-612.

To develop a method of allocating publicly funded health care resources among communities according to their relative levels of need for health care independent of their current patterns of use. DESIGN: For each health care program population mean levels of resource allocation were calculated and were adjusted for age and sex to produce a national age- and sex-adjusted share of program resources. Indices of relative need for health care (for most programs the standardized mortality ratio) were derived from existing data on aspects of illness and death and were then used to weight the age- and sex-adjusted shares for between-community differences in health risks and health care needs. SETTING: The populations of the 49 counties in Ontario were used as the communities among which resources were allocated. Health care expenditures in 1988-89 by the Ontario Ministry of Health were used as the "budget." MAIN RESULTS: Age- and sex-adjusted resource allocations weighted for between-community differences in health care needs differed from allocations based on population size, in certain cases by up to 100%. CONCLUSION: Existing data can be used to propose allocations of health care resources that relate to relative levels of need for care across communities.

Birch, S., J. Eyles, et al. (1996). "Proxies for healthcare need among populations: validation of alternatives--a study in Quebec." J Epidemiol Community Health **50**(5): 564-9.

Paper compares the use of a non-mortality based proxy for relative needs for healthcare among regional populations with a mortality based proxy for population relative needs and goes on to evaluate the additional value of a proxy based on a combination of non-mortality and mortality based proxies. The socioeconomic proxy developed in this study provides a closer correlation to the self assessed health of the populations under study than a mortality based proxy, and the combination measure was the most accurate of the three.

Born, D. (1975). Dental Manpower Planning and Distribution: A Survey of the Literature. Chicago Illinois, American Dental Association.

Discussion of the legislative and methodological histories of oral health personnel planning in the United States. History begins with the military planning during World War Two and concludes with the Loan Repayment and NHSC legislation of the 1970's. Discusses terms, methodologies, politics and policy implications.

Born, D. (1981). "Issues in forecasting graduate dental education manpower supply and requirements." J Dent Educ **45**(6): 362-73.

This paper explores the history of forecasting in dentistry and then focuses on several major forecasting techniques, briefly examining the basic assumptions, data requirements, and strengths and weaknesses of each. In discussing the issues involved in forecasting, the paper isolates three perspectives held by forecasters; health status, social need, and economic. Each approach defines the critical concept of "adequate supply" in a different way. Other issues addressed include: who should engage in forecasting; what methods should be employed; is it worth the effort to forecast

requirements for dental specialists; should forecasting be done for small areas; and what is the "political" reality of forecasting.

Byck, G. and J. Cooksey (2001). The Dental Requirements Model (DRM). Chicago, Illinois Center for Health Workforce Studies.

This report evaluates the usefulness of the Dental Requirements Model created by Vector Research Incorporated under contract from HRSA. The model estimates the FTE dentist requirements to provide care to children with coverage by the State Children's Health Insurance Program. The report finds that the DRM represents a useful tool, in a user friendly format, that can assist in state level planning efforts.

Byck, G., H. Russinof, et al. (2002). Wisconsin Dentist Workforce Report, 2001. Chicago, Illinois Regional Health Workforce Center.

This report summarizes the findings from a 2001 survey of licensed dentists in Wisconsin. The report describes the supply, distribution, and characteristics of Wisconsin dentists as well as their participation in Medicaid, volunteer work, and retirement plans.

Capilouto, E., M. L. Capilouto, et al. (1995). "A Review Of Methods Used To Project the Future Supply Of Dental Personnel and the Future Demand And Need for Dental Services." Dental Education **59**(1): 237-257.

The purpose of this paper is to critically examine different models for forecasting dental personnel requirements. The article focuses on supply-based, demand-based, and econometric modeling. The authors take specific examples of each model, and then conduct retrospective analyses to ascertain which was the most accurate model of the dental market. The conclusion, however, is that the "accuracy" of these models is difficult to assess in the absence of a clear statement of values. Dentists will account for adequacy in a different way than a public health (needs-based) approach. Thus, the yardstick for "accuracy" will remain a subject for debate among different interest groups.

Capilouto, E. and R. Ohsfeldt (1996). Health Workforce Modeling, Lessons From Dentistry. The US Health Workforce. M. Osterweis M, Mantasse H, Hopper CL. Washington, DC, Association of Academic Health Centers**:** 277-309.

Discusses various different techniques for forecasting dental health personnel requirements that have been and continue to be used. Authors discuss the pros and cons of demand based, need based, and supply based forecasting methods, and provide specific examples from American dental health policy to document their analysis.

Cavanaugh, G. D. (1983). "Dental manpower in Minnesota, U.S.A." J Ir Dent Assoc **29**(6): 92-3.

Discussion of dental personnel studies conducted in Minnesota during the late 1970's. Article discusses methodological considerations, values, and the role to be played by dentists in assessing personnel requirements.

CDC (2000). Data Sources: National Oral Health Surveillance System, Centers for Disease Control. **2002**. http://www.cdc.gov/nohss/dsdmain.htm

CDC, HRSA and NIH. (2000). Healthy People 2010: Oral Health. Washington, DC, Government Printing Office.

Chiu, G. Y., L. A. Aday, et al. (1981). "An examination of the association of "shortage" and "medical access" indicators." Health Policy Q **1**(2): 142-58.

This study examined six shortage area indicators and compared all to demand/utilization data to determine which studies most accurately predicted areas with low utilization and high need. It was found that the MUA indicator was the most cost efficient means of designating shortages.

Chung, K. and D. Striffler (1980). "Fundamental issues in the practice of dental public health." Fam Community Health **3**(3): 1-11.

This paper discusses the primary goals, methods, and values implied by a public dentistry perspective. The author pays particular attention to the need for community based preventive methodologies and of the central meaning of assuring equal access independent of financial means. The ultimate goal of this perspective is to prevent all oral disease in a given population.

Cohen, L. and J. Jago (1976). "Toward the formulation of sociodental indicators." International Journal of Health Services. **6**: 681-98.

The bases for the construction of sociodental indicators is discussed in the paper, considering several indexes of oral health status (dental caries, periodontal disease, malocclusion, oral hygiene, and other oral conditions) as well as measures of quality of services.

Cole, R. and L. Cohen (1971). "Dental Manpower: Estimating Resources and Requirements." Milbank Memorial Fund Quarterly **49**(3): 29-62.

Early, seminal article discussing demand, supply, and personnel requirements in the oral health arena. Article provides data on the dental workforce from 1950-1970, documents increasing demand for services as well as decrease in supply. Authors offer a number of analytical strategies for defining shortage as well as suggesting policy solutions to said shortages.

Collins, R., E. Broderick, et al. (1993). "Dental manpower planning in the Indian Health Service." J Public Health Dent **53**(2): 109-114.

As a public health agency, the Indian Health Service (IHS) must plan for the needs of the entire American Indian and Alaskan Native (AI/AN) population and distribute resources as equitably as possible. To facilitate this process, the IHS has developed a manpower planning model to provide for the distribution of dental providers based upon the dental needs of the AI/AN population and within the limits of annual appropriations of funds. This paper briefly describes the original IHS Dental Program manpower planning model and the development of modifications over time. The need-based approach to manpower planning developed by the IHS Dental Program has exhibited utility and flexibility over time. It allows a determination of clinic size (number of peratories) and dental staffing requirements, and may be generalizable to other public health programs if an accurate assessment of utilization rate and treatment need can be made for the defined population. Nonetheless, the availability of resources in public programs is subject to the compromises inherent in the political process; thus, the use of a manpower planning model alone may not be sufficient to ensure the equitable distribution of dental resources and dental providers.

Colombet, P, D Bourgeois, et al. (1996). "Needs, demands and manpower balance. Dentists/populations." Int Dent J **46**(6): 543-547.

Discussion of the need for a standardized instrument for assessing the dental personnel requirements for a given population. The proposed program is inspired by the work conducted by a joint working group of the FDI/WHO. A questionnaire has already been designed and tested in seven countries, designed and implemented by the WHO.

Connor, R., J. Kralewski, et al. (1994). "Measuring geographic access to health care in rural areas." Med Care Rev **51**(Fall(3)): 137-77.

Measuring geographic access to health care in rural areas is becoming increasingly important for decision making by local communities and for public policy. Lacking good access measures, judgments about the availability of rural health care services are often flawed and the resulting interventions misdirected. This article identifies alternative approaches to measuring geographic access to health care so that community leaders and other policymakers can make more informed

judgments about rural health services. It develops a framework to compare methods of measuring geographic access and uses this framework to compare studies with an emphasis on rural areas.

Cons, N., J. Beck, et al. (1983). "A low-cost method for conducting a statewide survey of oral health." J Public Health Dent **43**(4): 295-304.

Paper describes Iowa's 1982 oral health survey conducted at 1/20th the cost of oral health surveys undertaken by other states. Survey made heavy use of volunteers, and kept survey instruments simple to apply. Authors note that while there are serious threats to the validity to this survey -- inter-rater reliability was not adequately assured -- the importance of the data outweighs the methodological flaws. Because of the prohibitively high cost of oral epidemiological surveys, very few states have undertaken them. The authors posit that Iowa provides an example of feasible way of conducting an oral needs assessment on a statewide basis.

Corcoran, D. (1983). "Dental Manpower Requirements to 2020." Journal of the Irish Dental Association **Nov/Dec**: 94-96.

Projected manpower requirements were studied to the year 2020 - approximately the working life for a dentist qualifying today. The authors point out that it must be right to attempt a systematic analysis of possibilities and probabilities, rather than basing plans for dental education on instincts and impressions. The conclusion which emerges from these projections is that the number of dentists being trained is probably not excessive in relation to projected levels of need and demand. However, there are major uncertainties, notably in forecasting population size, future levels of treatment take-up, and the profession's capacity to provide treatment, particularly as more women enter.

Council on Graduate Medical Education (U.S.) and United States. Health Resources and Services Administration. Division of Medicine (1996). Council on Graduate Medical Education : eighth report : patient care physician, supply and requirements : testing COGME recommendations. Rockville, MD, U.S. Dept. of Health & Human Services Public Health Service Health Resources and Services Administration Bureau of Health Professions Division of Medicine.

Cretin, S., J. R. Freed, et al. (1983). "A predictive model of the need for dental services." J Dent Educ **47**(11): 715-27.

Projections of dental manpower requirements begin with a model of the need and demand for dental services. This paper proposes an approach to modeling the need for dental services that attempts to keep the number of parameters small and the flexibility of the model high by decomposing the problem.

Davis, G. (1974). "The Assessment of Periodontal Disease for Public Health Purposes." J. of Periodont. Res. **9**: 62-70.

Davis, K. (1974). Financing Medical Care: Implications for Access to Medical Care. Primary care: where medicine fails. Sun Valley Forum on National Health and S. Andreopoulos. New York,, Wiley**:** x, 212.

Davis, M. (2000). "Pediatric dentistry workforce issues: a task force white paper." Pediatr Den **22**(4): 331-5.

The number of current practitioners, academicians, and researchers in Pediatric Dentistry is clearly not adequate to meet the need and demand. The shortage in academia is dire. Simply put, not enough pediatric dentists are being trained. The rate-limiting factor is the number of training positions. The American Academy of Pediatric Dentistry established a "Task Force on Work Force Issues" approximately 18 months ago and charged that group to seek methods for creating more training positions. This paper reflects the Task Force deliberations, documents the shortage of pediatric dental specialists, and recommends tactics for amelioration.

DeFriese, G. and T. Konrad (1981). "Estimating dental manpower requirements on a statewide basis." J Public Health Dent **41**(1 Winter): 33-40.

The North Carolina Dental Manpower Study undertook to use epidemiological data on dental disease, data on practice productivity, and estimates of treatment needs to arrive at more useful measures of dental manpower requirements on a statewide and substate regional basis. As in all attempts to plan for health manpower, the North Carolina study relied upon a measure of subjective judgment pertaining to the treatment/ services required to deal with certain dental conditions. These judgments, however, were representative of the conventional standards of practice in North Carolina at the time of the study. Though certain important factors necessary to a complete assessment of dental manpower requirements were not directly measured in the study (e.g., consumer demand), estimates of the volume increase in dental-office practice-productivity were derived for the major categories of dental procedures and conditions. In North Carolina this technique is thought to represent a more meaningful approach to dental manpower planning than the conventional manpower-to-population ratio.

DeFriese, G. and B. Barker (1982). Assessing dental manpower requirements : alternative approaches for state and local planning. Cambridge, Mass, Ballinger Pub. Co.

In-depth analysis of the dental market, public dental health, and the use of different models for assessing oral health personnel requirements. Authors present both theoretical and practical examples of the models, and critically examine the utility/disutility of the models in their practical application.

DeFriese, G. and B. Barker (1983). "The status of dental manpower research." J Dent Educ **47**(11): 728-37.

A critical discussion of dental personnel requirements, the dental market, and the different ways in which policy makers attempt to model the dentistry market. The paper discusses the methodological difficulties posed by the study of the dental market, and the values that various summary measures imply. The authors argue for the importance of developing more extensive data sources on oral health needs and dentists' productivity, as well as the use of more sophisticated models out of which to develop policy recommendations.

DeFriese, G. (1986). "Dental health services research and policy analysis: looking out or looking in?" J Dent Educ **50**(11): 647-50.

DHEW (1980). Evaluation of health manpower shortage area criteria. Hyattsville, Md., Dept. of Health, Education, and Welfare, Public Health Service, Health Resources Administration, Bureau of Health Professions, Division of Health Professions Analysis.

Designation of Health Manpower Shortage Areas (HMSA's) plays a key role in federal programs to effect a redistribution of health manpower. Criteria for designating such areas were developed by the Department of Health, Education, and Welfare in accordance with guidelines provided in the Health Professions Educational Assistance Act of 1976. This report is the result of an evaluation of those criteria, conducted under contract with the Health Resources Administration

DHEW. (1977). Workshop on Health Manpower Shortage Areas (1976 : Orlando, Fla.). Orlando, FL., Moshman Associates, Inc.

Selected proceedings from 3 day DHEW sponsored workshop on Health Manpower Shortage Areas stimulated by the addition of Section 332 of the Public Health Service Act which called for the delinineation of new shortage criteria that would reference need, specify population groups that are underserved, and allow for the designation of facilities that have personnel shortages. The three day workshop included, but was not limited to, discussions and speakers on the historical development of HMSA criteria, methodology, data availability, and administrative difficulties/requirements.

DHEW, U. (1980). The Target income hypothesis and related issues in health manpower policy. Hyattsville, MD, Public Health Service, Bureau of Health Manpower, Division of Manpower Analysis and Division of Dentistry.

Dolkart, D. (1978). "Dental planning information: more than a body count." J Am Dent Assoc **96**(5): 776-80.

Paper discususses the results of the ADA's research and development of the Dental Planning Information System. The DPIS was the ADA's attempt to create a comprehensive model for accurately assessing both supply and demand for dental services. It is hoped that this system will allow for more focussed policy making aimed at improving the oral health of the poor. Unfortunately, this system is very cumbersome and requires a large amount of not-readily-available input data on which to base the analysis.

Douglass, C. W., D. Gillings, et al. (1983). "National trends in the prevalence and severity of the periodontal diseases." J Am Dent Assoc **107**(3): 403-12.

In summary, between the 1960 to 1962 national health survey and the 971 to 1974 national health survey, the mean periodontal index scores remained unchanged. However, the classification of adults into broad disease categories showed that those with no evidence of disease increased significantly. This improvement in the nation's experience with the periodontal diseases was restricted to those with gingivitis, and a concomitant improvement was observed in the nation's oral hygiene status; debris scores decreased substantially, whereas little change was observed in calculus scores. Hypotheses have been raised in this paper about the decline in the prevalence of gingivitis and its possible association with variables such as OHI-S scores, socioeconomic status, dental care utilization, cigarette smoking, fluorides, and antibiotics. Also noted between the two surveys was a slight decrease in the prevalence of periodontal pockets in persons younger than age 35, whereas in persons older than 35, there was either no change or a slight increase. During this same period, both total loss of teeth and number of missing teeth per person decreased for all ages. A hypothesis is proposed that links this slight increase in the more severe signs of periodontal disease in older adults to an increase in the number of teeth at risk to the disease. The modest change in the prevalence and severity of advanced periodontal disease may be an early sign of a trend that will become accentuated as a result of a distinct increase in the nation's older population coupled with the increased retention of the natural dentition. Thus, it would seem that a decline in edentulism and an increase in number of teeth per person may well contribute to circumstances that will lead to greater, not lesser, risk of advanced periodontal disease problems in the later decades of life. Although this hypothesis may or may not hold true for today's younger adults as they age, it seems to be the likely occurrence for the nation's older adults, at least for the next several decades. A third national survey, using the same indexes and more current periodontal disease measures, is needed to help to clarify the trends reported here.

Dunlop, D. (1980). "Health planning: what about demand ?" Soc Sci Med [Med Econ] **14**(1): I-III.

Eddie, S. and R. J. Elderton (1983). "Comparison of dental status determined in an epidemiological survey with prosthetic treatment received." Community Dent Oral Epidemiol **11**(5): 271-7.

The potential need for prosthetic treatment among 720 dentate Scottish subjects of the 1978 UK Adult Dental Health Survey, was assessed by applying treatment criteria to the epidemiological data. The need was compared with the prosthetic treatment that was received under the National Health Service within 1 and 3 yr. It was found that 220 people had a need for dentures. 12.7% of the people who attended a dentist with a prosthetic need received the predicted treatment within 1 yr and 21.3% within 3 yr. Considered at the community level, as would be the case when planning a service, only 10% of those with a predicted need received the predicted treatment within 3 yr. 5.1% of the whole sample received more than the predicted treatment. This included 25 of the 500 people for whom the criteria predicted no need for dentures. 25.3% of the sample received less treatment than predicted.

Taken overall, these findings indicate that the amount of prosthetic treatment demanded in the community was 28.6% of the amount predicted by the epidemiological survey. It would seem that prosthetic services in Scotland should be planned on this basis.

Eklund, S. (1999). "Changing treatment patterns." J Am Dent Assoc **130**(12): 1707-1712.
Patterns of clinical care are closely linked to the nature of diseases in the population. During the past decade, the nature of both dental caries and periodontitis has undergone a transformation that has implications for dental practice. Especially in younger cohorts, the overall need for extensive restorative and periodontal treatment is much reduced, compared with that of prior generations. CONCLUSIONS: Over the next several decades, there will be a slowly declining per-capita need for restorative and surgical care. The overall mix of services will continue to shift toward diagnostic and preventive services. PRACTICE IMPLICATIONS: At least in terms of today's conventional dental care, each provider in the future should be able to manage the oral health care needs of larger numbers of patients than is possible today.

Escovitz, A. and S. Birdwell (1996). "Determining specific health care needs of rural communities." J Health Care Poor Underserved **7(4):**(Nov(4)): 285-9.
The purpose of this exploratory study was to determine differences exist among rural counties with respect to perceived health needs. It is the author's belief that, though comprehensive approaches are useful, it important to bear in mind the variation among rural communities when it comes to implementing comprehensive programs applied statewide.

Eyles, J., S. Birch, et al. (1993). "A needs-based methodology for allocating health care resources in Ontario, Canada: development and an application." Soc Sci Med **33**(4): 489-500.
In an attempt to limit its health care expenditures, Ontario is, as one option, exploring the possibilities of a capitated system for service delivery payments as opposed to the present mixture of global budgets and fee-for-service. After reviewing the literatures on capitation (primarily American) and on resource allocation (primarily British), the paper sets out to establish a capitation rate, based on 'need' and not prior use, for a range of health services in the northern Ontarian community of Fort Frances-Rainy River. The difficulties and limitations of the needs-based approach are explored. The results reported show the setting of the local population characteristics against provincial average health care utilization data to generate expected use rates, which are then adjusted for need and other factors, particularly relative costs and scarcity. Finally these adjusted rates are applied to current provincial expenditures to derive a target share. This target is then expressed in relation to the planning population to derive the capitation rate.

Feil, E. C., H. G. Welch, et al. (1993). "Why estimates of physician supply and requirements disagree." Jama **269**(20): 2659-63.
OBJECTIVE--To review the major forecasts of physician supply and physician requirements. DATA SOURCES--English-language medical literature on physician manpower published between 1980 and 1990, identified from journal articles selected through searches of the MEDLINE and Health Planning and Administration databases using the search formulations physician supply, health manpower--physicians, and physician manpower. STUDY SELECTION--Sources were selected if they were repeatedly cited and provided quantitative projections. DATA EXTRACTION--Each study was reviewed for its quantitative projections and to identify its methodological assumptions. DATA SYNTHESIS--All forecasts point to a steadily increasing physician supply and, with one exception, suggest that supply will exceed requirements in the year 2000. The estimates of physician supply across studies varied primarily because of differing assumptions about entrance rates into the profession and the size and clinical work load of specific categories of physicians: researchers, teachers, administrators, residents, and women. The estimates of physician requirements were more volatile because of differences in the basic approach and assumptions about future growth and

market structure. CONCLUSIONS--Even though the measurement of entrance and exit rates from the profession is a generally accepted approach to forecasting supply, apparently minor disagreements on assumptions create large discrepancies between forecasts over time. There is no accepted approach to forecasting physician requirements.

Feldstein, P. and C. Roehrig (1980). "A national econometric forecasting model of the dental sector." Health Serv Res **15**(4): 415-32.

The Econometric Model of the the Dental Sector forecasts a broad range of dental sector variables, including dental care prices; the amount of care produced and consumed; employment of hygienists, dental assistants, and clericals; hours worked by dentists; dental incomes; and number of dentists. These forecasts are based upon values specified by the user for the various factors which help determine the supply an demand for dental care, such as the size of the population, per capita income, the proportion of the population covered by private dental insurance, the cost of hiring clericals and dental assistants, and relevant government policies. In a test of its reliability, the model forecast dental sector behavior quite accurately for the period 1971 through 1977.

Flexner, A., H. S. Pritchett, et al. (1910). Medical education in the United States and Canada; a report to the Carnegie Foundation for the Advancement of Teaching. New York City.

Friedman, E., E. J. McTernan, et al. (1985). "A historiography of a model statewide allied health manpower supply/demand study." Journal of Allied Health **14**(1): 129-39.

Noting the absence of unified data on the supply and demand of allied health practitioners in New York State, a study was conducted at the State University of New York at Stony Brook of 16 professional groups. The study consisted of a statewide census; a market survey of professional leaders, hospitals, long-term care facilities, and practicing professionals; and an analysis of educational programs available and minority enrollment in those programs. The results indicated that, in general, the supply and demand for the services of allied health professionals in New York State are in rough equilibrium, with some shortages in rural and inner-city locations. It was further noted that while the educational institutions are preparing adequate numbers of professionals to meet the employment demand, minority groups are significantly underrepresented in the enrollment figures.

Fryback, D. G., D. H. Gustafson, et al. (1978). "Local priorities for allocation of resources: comparison with the IMU." Inquiry **15**(3): 265-74.

Study compared shortage designations made on the basis of the IMU criteria with professional opinions of local physicians on the level of need and degree of personnel shortages. There was a large discrepancy found between the two, though there was a relationship documented.

Fryer, G. J., R. Call, et al. (1983). "The validity of indices for rural health manpower needs assessment." Eval Program Plann. **6**(2): 130-42.

Population-to-practitioner ratios have long been the primary index in the designation of health manpower shortage areas. This paper documents that application of the widely used population-to-dentist index results in understatement of the need for dental health manpower in rural areas. Through the analysis of utilization data collected from a statewide health screening program in Colorado, the practice of sole reliance on the population-to-dentist indices as an indicator of need was tested. Another measure, the area-(square miles) to-dentist ratio was formulated, examined, and found to be a more useful referent of the need for additional health manpower in rural areas. Utilization of dental services in sparsely settled rural counties of Colorado was unrelated to population-to-dentist ratios. A strong, statistically significant association of utilization with land area-to-dentist ratios was found. The findings of this analysis suggest a need for reevaluation of needs assessment methodologies used in the designation of health manpower shortage areas. Indices

more sensitive to consumer circumstance than to the number of health care providers available must be considered.

GAO (1994). Role of Title VII/VIII Programs in Improving Access to Care is Unclear. Washington, DC, United States General Accounting Office.

An appropriate supply and distribution of health professionals is vital to ensuring that all Americans have adequate access to health care. In fiscal year 1993, the Congress provided nearly $354 million for 42 health professions training programs that would further this goal. Thirty of these programs, established under Titles VII and VIII of the Public Health Service Act, are aimed at improving access to health care by (1) increasing the supply of primary care providers and other health professionals, (2) improving their representation in rural and medically underserved areas, and (3) improving minority representation in the health professions.

As it debates health care reform, the Congress is considering strategies such as those contained in Title VII and VIII to increase the number of primary care providers and improve access to care in underserved areas. The 1992 amendments reauthorizing Title VII and VIII require us to report on the effectiveness of these strategies and programs. Therefore, we focused our review on determining how: available data have shown that changes in the supply, distribution, and minority representation of health professionals have been effective in creating greater access to health care in rural and underserved areas, and evaluations have shown that these changes were attributable to Title VII and VIII programs.

RESULTS IN BRIEF

Over the past decade, the supply of nearly all health professions has increased faster than the population. For most health professions, however, data are not available to demonstrate whether this increased supply has translated into more access to care in rural and underserved areas. For the two professions with the most data available-primary care physicians and general dentists-supply has increased in many rural areas but not in those urban and rural areas where the greatest shortages exist. Our findings are similar for minority recruitment; although the number of minorities in the health professions is increasing, data are inconclusive to support HHS' premise that further increases will improve access to health care for underserved populations.

While almost $2 billion has been provided for 30 Title VII and VIII programs in the last 10 years, evaluations have not shown that these programs had a significant effect on those changes that have occurred in the supply, distribution, and minority representation of health professionals. Often evaluations have not addressed these issues, and those that did had difficulty establishing a cause-and-effect relationship. Such a relationship is difficult to establish because the programs have other objectives besides improving supply, distribution, and minority recruitment and because no common outcome goals or measurements has been established. Schools have used the broad discretion allowed under Title VII and VIII to address other objectives, such as changing curricula to respond to emerging local or national health issues. The Congress recently took action to target Title VII and VIII funding more specifically for primary care and underserved areas, but these actions are not likely to have much impact, at least in the short run.

GAO (1995). Health Care Shortage Areas: Designations not a useful tool for directing resources to the underserved. Washington DC, US General Accounting Office.

GAO report discussing the methodological problems inherent to the MUA/P and HPSA methodologies. Study concludes that an entirely new methodology is called for if health resources are to be accurately targeted at underserved populations.

GAO (2000). Oral Health: Factors Contributing to Low Use of Dental Services by Low-Income Populations. Washington, DC, US General Accounting Office**:** 41.

In-depth analysis of the access barriers faced by the poor who need dental care. Focus is on the lack of dentists willing to take Medicaid or low-income clients and the market-based reasons that such a

disparity in oral health access exists between wealthy and poor citizens. Article also describes a number of federal and state programs intended to address the disparity and critiques their sufficiency.

Ginley, T. J. (1983). "An approach to studying dental manpower." J Ir Dent Assoc **29**(6): 87, 89-91.

Gillies, J. C. (1986). "Dentist help thyself." J Can Dent Assoc **52**(1): 62-3.

Goldfarb, M. (1975). "Methodological Problems of Health Manpower planning Models." Medical Care Review **July, 1975**(32): 696-723.

Goodman, H. S. and R. J. Weyant (1990). "Dental Health Personnel Planning: A Review of the Literature." Journal of Public Health Dentistry **50**(1): 48-63.

The purpose of this literature review is to illustrate the use of dentist-to-population ratios, need-based models, and demand based models in the determination of appropriate supply of dental personnel. The need to plan for dental health personnel is rooted in the ethical imperative to use limited health resources appropriately. The government's role in dental health personnel planning is, in part, to ensure that adequate care is received by consumers in an efficient manner.

Grace, M. (2000). "Is need enough?" Br Dent J **2000**(10): 525.

Grembowski, D., P. Milgrom, et al. (1990). "Variation in dentist service rates in a homogeneous patient population." J Public Health Dent **50**(4): 235-43.

Previous studies in medicine and dentistry document wide variations in service rates across small areas, large regions, and providers. The practice patterns of providers and underlying differences in patient need are thought to be important sources of this variation. To control for variation in patient needs, we calculated service rates of 200 general dentists in Washington state based on a homogeneous, well-educated, upper-middle-class population of patients. Wide variations were found in the rate for many dental services. Dentists' practice beliefs and characteristics of the practice were sources of variation in the rates. The evidence is insufficient to determine whether undertreatment of overtreatment occurred among dentists with the lowest and highest expenditures per patient, respectively. However, the perceived oral health status of adult patients was lower in practices with the lowest total expenditures per patient than in practices with the highest total expenditures per patient, suggesting the undertreatment of adult patients in the lowest-expenditure practices may have occurred.

Gupta, G. C. and T. R. Konrad (1992). "Allied health education in rural health professional shortage areas of the United States." Journal of the American Medical Association **268**(9): 1127-30.

Harmon, R. (1993). "Oral health care for the underserved in the 1990s: HRSA perspective." Healthy Dentistry **53**(1): 46-49.

A description of the different oral health programs currently administered by HRSA. The article goes on to suggest future directions for oral public health and argues that currently there are not enough DHPSA's making use of available program benefits.

Health Services Research Group, University of Wisconsin, (1975). "Development of the Index of Medical Underservice." Health Services Research **10**: 168-80.

Report discussing the rationale and methodological issues considered in the construction of the IMU indicator used in the designation of Medically Underserved Areas/Populations.

Henderson, W. G. (1975). "Science and research...The identification of dental shortage and surplus areas in Iowa." Iowa Dent J **61**(3): 28-32.

Henderson, W. (1976). "Measuring Supply and Demand for Dentists in a Population." American Journal of Public Health **66**(January): 70-72.

Use of the population per-dentist ratio to detect surplus and shortage areas has several deficiencies. The ideal ratio is unknown, the assumption that dentists are equally productive is misleading, and the demand for services varies from one location to another. This paper tests the use of another test statistic, articulated in a paper by Mumma, against the population-to-provider ratio and against the dental busyness index. Mumma's index appears better suited to identifying shortage areas.

Hirsch, G. and W. Killingsworth (1975). "A new framework for projecting dental manpower requirements." Inquiry **12**(2): 126-42.

This paper is an attempt to model the impact of changes to the supply/productivity of dentists upon the oral health of the population. By looking at health -- rather than demand or need -- the authors hold that their model makes novel predictions and provides a different perspective on the goals policy makers should have in mind as they grapple with supply issues.

Holmes, G. (1967). "Dental manpower: shortage and distribution." Oral Hyg **57**(11): 27-35.

House, RK, GC Johnson, et al. (1983). "Manpower supply study scenarios for the future: dental manpower to 2001." J Can Dent Assoc **49**(2): 85-98.

House, RK. (1987). "Estimating future dental care requirements. The implications for dental manpower." J Can Dent Assoc **53**(2): 99-105.

Article discussing the oral health personnel requirements in Canada, from a report presented to the Canadian Dental Association. Discusses the effect and import of reduced caries prevalence, increased numbers of dentists, and the variation in utilization rates/disease prevalence in the Canadian Provinces. Discusses how these factors should impact policy decisions, personnel requirements.

HRSA (1995). Federally Designated Dental Health Professional Shortage Area Guidebook. Yonkers, NY, Charles M Mathis Associates.

The purpose of the guidebook is to further the NHSC's goal to increase the number of underserved communities eligible for NHSC assistance and to increase access to dental health professional services in those underserved areas. The guidebook separately addresses each type of dental HPSA, describing each step in the process and suggesting available resources.

HRSA (1997). "List of designated primary medical care, mental health, and dental health professional shortage areas--HRSA." Fed Regist **May 30;62**(104): 29396-537.

This notice provides lists of all areas, population groups, and facilities designated as primary medical care, mental health, and dental health professional shortage areas (HPSAs) as of March 31, 1997. HPSAs are designated or withdrawn by the Secretary of Health and Human Services (HHS) under the authority of section 322 of the Public Health Service (PHS) Act.

HRSA (2001). Primary Care Service Area Project, Health Services and Resources Administration. **2002**.

The goal of the PCSA project is to provide information about primary care resources and populations within small, standardized areas that reflect patients' utilization patterns. The definition of PCSA boundaries and description of these areas will be contained within a database linked to a geographic information system (GIS) to allow federal, state, and academic users easy access.

Ingargiola, P. (2000). Understanding the Dental Delivery System and How it Differs from the Medical System. Denver, CO, Anthem Foundation**:** 7.

This paper is an attempt to distinguish the dental market from the primary care market, and in so doing highlight distinctions that are important from a policy-making perspective. The article then focuses on how best to integrate oral health into existing primary care systems.

Jeffers, J. R., M. F. Bognanno, et al. (1971). "On the demand versus need for medical services and the concept of "shortage"." Am J Public Health **61**(1): 46-63.

The purposes of this article is to differentiate between two concepts, need and demand, and to provide two interpretations of the concept of shortage as it applies to the provision of health services.

Jeffers, J. R., M. F. Bognanno, et al. (1974). "Medical services--demand versus need and the concept of shortage: rejoinder." Am J Public Health **64**(1): 58-60.

A quick clarification of a number of topic areas in their 1974 article by the same name. They clarify a number of points related to what assumptions were made in the writing of the last article as well as why these assumptions were made.

Jones, W. J., J. A. Johnson , et al. (1996). "Allied health workforce shortages: the systemic barriers to response." Journal of Allied Health **25**(3): 219-232.

Klooster, J. (1980). "Dental manpower: an overview. It's a numbers game--but which numbers?" J Calif Dent Assoc **8**(2): 33-41.

Knapp, K. K. and K. Hardwick (2000). "The availability and distribution of dentists in rural ZIP codes and primary care health professional shortage areas (PC-HPSA) ZIP codes: comparison with primary care providers." J Public Health Dent **60**(1): 43-8.

OBJECTIVE: This paper maps dentists, primary care physicians, physician assistants, nurse practitioners, and nurse midwives in rural areas and rural areas meeting criteria as underserved for primary health care. METHODS: Computer-based mapping was used to localize health care provider groups by five-digit ZIP code. For each rural and each rural primary care health professional shortage area (PC-HPSA) ZIP code, the number of providers in each group was determined. The different combinations of providers were determined. RESULTS: All providers in rural areas were present at levels substantially lower than national averages, particularly in PC-HPSA areas. Dentists were approximately equal in number to primary care physicians in rural areas and the largest group in PC-HPSAs. Approximately 75 percent of rural residents lived in ZIP code areas with dentists available. Over 5.8 million rural residents and over 50 percent of rural PC-HPSA residents had no providers available in their ZIP code areas. CONCLUSIONS: Rural areas continue to have a short supply of primary care providers and dentists. Dentists were present in many areas where primary care provider presence was absent or very low. These data, including those relating to provider co-presence, can be used to develop strategies to overcome health care access problems due to provider shortages.

Kohrs, F. P. and A. G. Mainous (1995). "The Relationship of Health Professional Shortage Areas to Health Status: Implications for Health Manpower Policy." Archives of Family Medicine **v4**(n8): pp. 681-685.

OBJECTIVE: To compare the health status of adult residents of health professional shortage areas (HPSAs) with adult residents of non-HPSAs. DESIGN: A random-digit dialing telephone survey. Respondents were subsequently classified by their county of residence asresiding in an HPSA or non-HPSA. PARTICIPANTS: A sample of 470 adults (18 years or older) living in Kentucky. MAIN OUTCOME MEASURES: Health status was measured by the Medical Outcomes Study 20-Item Short-Form Health Survey's six subscales. RESULTS: Controlling for demographic variables in the multiple regression analysis, there were significant differences between HPSAs and non-HPSAs for the social, mental health, and pain subscales. An interaction between age and HPSAs in relation to health status was observed for the physical, social, mental health, health perception, and pain

subscales. After stratification by age (18 to 44 years, 45 to 64 years, or 65 years or older), HPSA-designated areas were associated with poorer health status in all but the youngest age strata. Elders in HPSAs had the poorest health status. CONCLUSIONS: Health professional shortage areas are associated with poorer health status in the older segments of the adult population. Future policy may need to focus on increasing access not only to primary care services but also to specific types of services that may promote better health status of elderly residents of HPSAs.

Kushman, J., R. Scheffler, et al. (1977). Non-Solo Dental Practice: Incentives and Returns to Scale. Davis, Department of Agriculture Economics, University of California at Davis.

Lee, R. (1977). History and objectives of shortage area designation. Proceedings of the Workshop on Health Manpower Shortage Areas, Orlando, FL, US Government Printing Office.

Selected proceedings from 3 day DHEW sponsored workshop on Health Manpower Shortage Areas stimulated by the addition of Section 332 of the Public Health Service Act which called for the delineation of new shortage criteria that would reference need, specify population groups that are underserved, and allow for the designation of facilities that have personnel shortages. The three day workshop included, but was not limited to, discussions and speakers on the historical development of HMSA criteria, methodology, data availability, and administrative difficulties/requirements.

Lee, R. (1979). "Designation of health manpower shortage areas for use by public health service programs." Public Health Rep **94**(1): 48-59.

Article discusses the history of shortage criteria and the shortcomings of various measures. It describes changes required by different congressional acts and the development of new criteria pursuant to those requirements. Article goes on to describe how changes to the shortage criteria have affected the programs for which the criteria serve a qualifying function.

Lee, R. C. (1991). "Current Approaches to Shortage Area Designation." The Journal of Rural Health **7**(4 - Supplemental): 437-459.

This paper reviews the various indicators and criteria that are in use to identify rural and urban areas with shortages of primary care physicians, dentists, psychiatrists, or nurses; areas with medically underserved populations; high migrant impact areas; and areas of greatest need/shortage, leading to lists of designated shortage or underserved areas eligible for various federal and state programs; and to lists of areas with priority for resource placement. Presenting these shortage and underservice criteria at a workshop dealing with adequacy was not meant to suggest an equivalency between the concepts of "shortage," "underservice," and "adequacy," but the shortage and underservice criteria can be thought of as a floor on the definition of adequacy, and may contain elements of that definition. Refinements or revisions to the various criteria could probably better identify the needs in rural areas, or the kind of staffing mix needed in various types of areas, or improve priority setting among designated areas; but the existing criteria remain a good first screen to identify those areas with health services-related needs that require further attention.

Lewis, D. W. (1986). "Dental manpower supply and demand projections and changing demography and dental disease." J Can Dent Assoc **52**(1): 33-40.

The extensive Ontario Dental Manpower study completed in 1981 was based on a supply and demand approach. Projections through 1996 of both dental visits to be demanded and supplied under various policy, population projection, dental practice and student enrollment options were developed. The busyness of dentists and its important validating correlates, dental hygienists employment status and the public's dental utilization are reviewed. Using 1981 dental enrollment and population projections it was estimated that there would be an excess of dental visits supplied over those demanded of about 1.5 million visits in 1981 to 4.3 million visits in 1996. As one million visits is approximately equivalent to 300 dentists' practices, dental enrollment reductions were suggested. In

1983 and 1984 enrollment at the two Ontario dental faculties was curtailed by about 21 percent for a number of reasons, one of which may have been manpower oversupply. Because or the probable excess supply situation, it was further suggested that dental hygienists enrollment of the future might also need to be reduced; however despite increased in lack of dentists busyness from 32 percent in 1978 to 46 percent in 1984, the dental community now feels more hygienists, not fewer, should be trained. This an other matters, including the very important manpower implication that population age and dental disease shifts have for dental manpower policy, are also discussed. The paper ends with a critical evaluation of certain aspect of an important recent paper on future Canadian dental treatment needs by Dogulass and Gammon. Their concept of future effective demand or met need is challenged. The compounding effect of demographic and epidemiological changes leading to greater personal and tooth survival is a most important considerations relative to future manpower planning. The need to examine carefully the most appropriate mix of dental personnel required in the future and for programs to enhance economic and geographic access to care by the elderly is emphasized.

Lyons, T. (1993). "Shortage of qualified dental technicians." Trends Tech Contemp Dent Lab **10**(6): 58-60.

Mayer, M. (1999). "Using Medicaid Claims to Contruct Dental Service Market Areas." HSR: Health Services Research **34**(5): 1047-1062.

OBJECTIVES: To use Medicaid claims data to construct patient origin-based market areas for dental services and compare constructed market areas with those based on the practice county. DATA SOURCE: North Carolina Medicaid claims, eligibility, and provider files, the Cooperative Health Information Systems' dentist licensure files, and the Log Into North Carolina data. STUDY DESIGN: A visit-level file was created from the Medicaid claims data and aggregated by provider practice county and patient county of residence. Using the aggregated file and an algorithm based on the Elzinga-Hogarty approach, patient travel patterns were used to construct mutually exclusive patient origin market areas. DATA ANALYSIS: Market area characteristics were compared across definitions using Pearson correlation coefficients. In addition, estimations of provider participation were performed using market area characteristics as control variables. The (beta) coefficients associated with market area characteristics were compared across market area definitions. PRINCIPLE FINDINGS: Medicaid claims data, when combined with provider licensure files, can be used to construct market areas based on patient origin data. However, measures of market areas characteristics are correlated highly between the two types of market areas studied. Furthermore, (beta) coefficients on market areas variables in models of provider participation are similar in sign, significance, and magnitude across market definitions. CONCLUSIONS: Compared with market areas constructed using patient origin data, county-based market areas adequately proxy for dental markets. Using the county as the market area also avoids the time and computational costs associated with using a patient origin-based approach and facilitates the use of widely available data.

McDermott, R. E. (1986). "Demand and supply of dental services: an economic perspective." J Can Dent Assoc **52**(12): 993-6.

The demand and supply of dental services are discussed from an economic viewpoint in this article. Factors that affect demand and supply of goods and services in the business world are presented and equated with analogous factors influencing the demand and supply of services in the dental service industry. Under present day conditions, it might be advantageous to the dental profession to base manpower planning and dental fees on the demand for dental services, rather than on perceived needs for these services and increases in the cost of living index.

McFarland, G. (1983). "Oklahoma dental manpower: the 1,2,3's." J Okla Dent Assoc **73**(3): 7-14.

Mertz, B., C. Manuel-Barkin, et al. (2000). Improving Oral Health Care Systems in California: A Report of the California Dental Access Project. San Francisco, CA, Center for the Health Professions.

The California Dental Access Project was developed to review and analyze the complex issues that must be considered and addressed to improve access to oral health care services for underserved populations in California. The project consisted of an extensive review of the literature, a survey of over 100 safety net dental programs, and an assessment by an expert advisory committee. Recommendations are framed as action steps to 1) foster partnerships and collaborative efforts, 2) use resources more efficiently, and 3) institute evidence-based models.

Mertz, E. and K. Grumbach (2001). "Identifying communities with low dentist supply in California." J Public Health Dent 2001 **61**(3): 172-7.

This study estimates the supply and geographic distribution of dentists in California and examines the community characteristics associated with supply of dentists. METHODS: The number of practicing dentists was estimated from American Dental Association data on licensed dentists in California. Each dentist's address was geocoded and matched to a Medical Service Study Area (MSSA). Dentist-to-population ratios were computed, and the association between dentist supply and community characteristics was analyzed in regression models. RESULTS: Approximately 20 percent of California communities may have a shortage of dentists. Two-thirds of dental shortage communities are rural. Communities with a lower supply of dentists have higher percentages of minorities, children, and low-income persons. Minority dentists were more likely to practice in minority communities. CONCLUSIONS: Geographic maldistribution of dentists may contribute to poor access to dental care in many communities, especially in rural, low-income, and minority communities. Minority dentists are more likely to practice in minority communities, but are a small portion of the dental workforce.

Mertz, E. and E. O'Neil (2002). "The growing challenge of providing oral health care services to all Americans." Health Aff (Millwood) **21**(5): 65-77.

By many measures, the practice of dentistry has improved for the dentist over the past decade. Hours of work are down, and compensation is increasing. However, there is a growing disconnect between the dominant pattern of practice of the profession and the oral health needs of the nation. To address these needs, the profession will need to take some radical steps toward redefinition, or the responsibility for many for these needs and special populations may shift to other providers and other institutions.

Meskin, L. and L. Martens (1970). "Commentary on dental manpower; the dentist--population ratio." J Public Health Dent **30**(2): 95-8.

Early article examining the utility of the provider to population ratio. The paper concentrates on improving the accuracy of the numerator of the statistic by using survey data to more reliably predict provider productivity. The authors conclude that though the DDS/population statistic is flawed and imprecise, it is still a potentially useful guide for policy makers.

Miller, G. (1997). County Medical Services Program: Dental Access Issue Paper. Sacramento, California Department of Health Services, County Medical Services Program**:** 3.

Is access to dental care a problem for County Medical Services Program (CMSP) beneficiaries? If so, what can CMSP do to mitigate the dental access problem?

Mitry, D. (1973). Productivity Measures of the Dental delivery of dental care services. Bethesda, MD, US dept of Health, Education, and Welfare. Public Health Services, Division of Dentistry, Manpower development branch.

Mulvey, P., W. Foley, et al. (1978). "An analytical method for regional dental manpower training." Am J Health Plann **3**(3): 56-64.

This paper presents an analytical method for dental manpower planning for use by Health Systems Agencies. The planning methods discard geopolitical boundaries in favor of Dental Service Areas (DSA). A method for defining DSAs by aggregating Minor Civil Divisions based on current population mobility and current distribution of dentists is presented. The Dental Manpower Balance Model (DMBM) is presented to calculate shortages (or surpluses) of dentists. This model uses sociodemographic data to calculate the demand for dental services and age adjusted productivity measures to calculate the effective supply of dentists. A case study for the HSA region in Northeastern New York is presented. The case study demonstrates that, although the planning methods are quite simple, they are more flexible and produce more sensitive results than the normative ratio method of manpower planning.

Mumma, R. (1974). "Report of the Manpower and Education Committees." Journal of Public Health Dentistry **34**(winter): 52-5.

Nash, D. D. (1993). "Values and Health Care Reform." Journal of Public Health Dentistry **53**(2): 67-9.

Editorial discussing the ethical implications of relying on the private market to deliver dental services.

Niessen, L. and C. Douglass (1985). "Application of a needs-based model for planning geriatric dental services for the Veterans Administration." Spec Care Dentist **5**(2): 78-83.

Describes the cohort effects of an aging population on dental health demand, argues for the necessity of a needs based approach to rationing care so as to adequately provide for the needs of the aged. Describes the system of needs based, resources allocation currently used by the veterans administration, and provides data indicating that such as system might be operationalizable on a statewide basis.

Nuckles, D. B., J. D. Adams, et al. (1993). "Dental needs of geriatric patients: a radiographic study." Dentistry **13**(2): 26-30.

Nuckton, C. F. and J. E. Kushman (1976). The index of medical underservice : historical background and theoretical foundations, with computations for northern California. Davis, University of California Cooperative Extension-Agricultural Experiment Station Giannini Foundation of Agricultural Economics.

Nuttal, N. (1983). "Capability of a national Epidemiological Survey to predict general dental service treatment." Community Dentistry and Oral Epidemiology **11**(5): 296-301.

The aim of this investigation was to examine the relationship between the dental status of tooth surfaces, as recorded during the 1978 Adult Dental Health Survey, and the treatment dental attenders subsequently received. A year after the survey, almost twice as many surfaces had been filled than were predicted on the basis of the survey. After 3 yr, this had risen to a 3.5-fold difference. Despite this, 59% of the restorative need identified by the survey criteria remained unmet by the end of the 1st yr; 46% was unmet by the end of the 3rd yr. A surface that received a filling for the first time was three times more likely to have been identified as in need of filling during the survey than a surface which was refilled. These findings cast doubt upon the usefulness of the epidemiological survey as a tool for predicting restorative treatment, and show that maintenance of previous fillings was particularly poorly forecast by the survey data.

Odrich, J. (1985). "Dental manpower planning: can we ever get it right?" J Public Health Policy **6**(4): 539-52.

Increased efficiency in health care and a more realistic assessment of medical and dental manpower deployment continue to be high priorities. This paper examines the role of different measures of supply, demand, and need within current and prospective public dental policy; ultimately advocating for a clear statement of the values and limitations of policies based on a given statistic.

Pamenter, D. V. (1986). "Dental manpower. An Atlantic perspective." J Can Dent Assoc **52**(1): 64-5.

Pathman, D. E., MD, MPH; Konrad, Thomas R., PhD; Ricketts III, Thomas C., PhD, MPH (1994). "The National Health Service Corps Experience for Rural Physicians in the Late 1980s." JAMA **272**(17): 1341 - 1348.

Objective: To learn from physicians in the National Health Service Corps (referred to as NHSC or the Corps) scholarship program about their experiences in rural health professional shortage areas (HPSAs), to contrast their experiences with those of other physicians working in rural HPSAs, and to learn how HNSC physicians' retention is associated with the quality of their experiences. Design: Cohort study. Participants: Two groups of primary care physicians who moved to rural HPSAs nationwide from 1987 through 1990 were surveyed in 1991: group 1 consisted of all 675 physicians in the NHSC scholarship program, and group 2 consisted of a stratified random sample of 1000 non-Corps physicians. Response rates were 73.7% and 69.1%, respectively. Analyses used comparable subsets of 417 NHSC and 206 non-NHSC respondents. Results: Among NHSC physicians, 51% initially anticipated working in underserved areas longer than 10 years, although only 14% expected to remain more than 5 years in their assigned practices. Three quarters of the Corps group felt there were few acceptable practice sites available to them, one third likely would have preferred urban sites, and two thirds were matched in states where they had not lived or trained earlier. Corps physicians felt their spouses' and childrens' needs were less well satisfied in their communities than non-Corps physicians. Corps physicians reported lower satisfaction in their work and personal lives and demonstrated poorer retention. Group differences in satisfaction and retention remained after controlling for various features of physicians and sites where they worked. Among NHSC physicians, retention was dramatically lower for those less well matched to their communities and those less satisfied. Conclusions: The needs and preferences of NHSC physicians and families are not well accommodated. Low morale and poor retention are endemic among MHSC physicians. The NHSC is challenged by twin goals of meeting the immediate needs of underserved communities and providing personally and professionally satisfying environments where physicians can pursue long-term careers.

Pickles, T. H. (1970). "The relationship of caries prevalence data and diagnosed treatment needs in a child population." Med Care **8**(6): 463-73.

Prescott, P. (1991). "Forecasting requirements for health care personnel." Nursing Economics **9**(1): 18-24.

Accurate forecasting of requirements for health care personnel is an important part of avoiding significant imbalances that create costly inefficiencies in health care markets. Manpower shortages threaten access, quality, and costs of health care. This article reviews five general approaches previously used to determine manpower requirements. Suggestions are made for the analytic components of a comprehensive model for identifying significant imbalances in supply or demand for health care workers.

Renson, C. (1989). "Global changes in caries prevalence and dental manpower requirements: 3. The effects on manpower needs." Dent Update **16**(9): 386-9.

A Joint Working Group of the WHO and FDI was formed in 1981 to investigate the dramatic decrease in caries in children and young people that had been observed in a number of industrialized countries in the 1970s. The results of this investigation are reported in this series of three articles. Parts 1 and 2 described the assembly and analysis of all available data on the decrease, and identified

the widespread availability of fluoride toothpaste as the most probable cause. Inevitably in developed countries with declining caries incidence there will be a decreased need for dental services, and hence a change in the need for dental personnel. This third article will examine the likely effects on staffing needs and outline a suggested methodology for manpower planning. The lack of adequate data makes prediction a precarious procedure, and this review indicates the urgent need for regular dental health monitoring and better manpower planning in all countries.

Rosenbaum, J., K. Speicher, et al. (1975). "A method for assessing dental manpower need is tested in a low income area of Philadelphia." Public Health Report **90**: 257-61.

This paper makes use of a demand based test statistic as a means for assessing dental supply adequacy. The author uses dental visits and demographic data to form a demand estimate, and compared this to a busyness statistic that serves as a proxy for supply.

Ross, C. (1988). "Manpower planning for oral health." Int Dent J **38**(1): 45-48.

The challenges to the dental profession include the unemployed dentists, the radical changes to the numbers of dental schools and their intake of new students; and the imbalance which exists on a global scale between oral health personnel and service need and demand. Workforce planning needs clearly defined goals that relate to the nature of disease, the shift from treatment to prevention and consumer expectations. A wide variety of information is required to facilitate communication and co-operation with elements of the political system, the educational system, professional bodies, health service agencies and consumers. It is essential that national planning and monitoring groups be established with membership from dental associations, educational institutions and government. In workforce planning there must be the ability to accept change, to be creative, to be positive, and to be decisive.

Rozier, R., W. McFall, et al. (1983). "Policy implications of the epidemiology of dental diseases for the prevention and control of periodontal disease: the North Carolina studies." J Public Health Dent **43**(2): 120-7.

The North Carolina Dental Manpower Study indicated that periodontal disease was widespread and little was being done to control the disease. We have continued to address issues identified by the Dental Manpower Study in order to better understand the high prevalence of periodontal disease. Drawing from the theoretical basis of behavioral science and the clinical and epidemiological knowledge of periodontal disease, we have planned a strategy for testing the feasibility for controlling periodontal disease through dental health services. Only when attention to periodontal disease pervades the thinking and behavior of all segments of the dental care system--professional education, professional certification and regulation, financing mechanisms, consumers, and dental research--will factors be totally conducive to controlling this problem.

Sanger, R. and P. Reggiardo (1999). "Workforce issues in pediatric dentistry: recommendations of a recent conference." J Calif Dent Assoc **27**(Nov:11): 852-6.

A recent conference of the California Society of Pediatric Dentists discussed issues surrounding the shortage of pediatric dentists in the state. Several contributing factors were identified and recommendations made regarding ways of working with the dental schools to help increase the number of practitioners. This article frames the problem regarding servicing the state's children and discusses some recommended actions.

Scarrott, D. (2000). "The structure of the dental workforce in the 21st century." Prim Dent Care **7**(Jan (1)): 15-7.

Graham Try (page 9) has suggested that the UK is heading towards dentist shortage. This paper picks up the story from there, speculating on how a shortage of dentists might stimulate changes in working methods. The market place will look for workforce configurations which make business

sense at practice level and which deliver services in a form which patients find helpful and convenient. Although some dental procedures can be carried out by people with less training than dentists, this may not contribute to economic efficiency and could make the customer service experience less appealing. Changes in the structure of the workforce may therefore be less radical than has sometimes been suggested. Much depends on how decision-making and regulatory processes evolve. It seems likely that local and practice level decision-making will grow at the expense of central planning.

Schonfeld, W. H. (1981). "Estimating dental treatment needs from epidemiological data." J Public Health Dent **41**(1): 25-32.

This article clarifies the rationale for identifying treatment needs and the importance of wedding estimates of potential demand to epidemiological data. The article goes on to explicate four steps toward identifying treatment needs of a population: 1) Assessment of the dental health status of the population; 2) Translation of dental conditions into needs for services; 3) Estimation of the time required to provide the needed services; 4) Conversion of required time into personnel requirements.

Schonfeld, W. H. and D. Hicks (1981). Estimating the need for dental care and dental manpower. Planning for dental care on a statewide basis: The North Carolina dental manpower project. G. DeFriese and J. Bawden. Chapel Hill, Dental Foundation of North Carolina**:** 115-67.

Provides theoretical underpinning for the North Carolina Dental Manpower Project. Discusses Schonfeld's algorithm for conducting a needs-based personnel assessment, provides concrete examples of how best to conduct a needs-based assessment and discusses the methodological problems implied thereby

Schwartz, A. (1986). "Manpower strategies. Possible solutions." J Can Dent Assoc **52**(1): 66-7.

Shanley, D. B. and M. H. Hobdell (1983). "Estimating oral health manpower requirements." J Ir Dent Assoc **29**(6): 81-3.

This paper is intended as a contribution to discussions on the future of oral health care services in Ireland. It does not attempt to answer the question 'How many dentists should we train?' Rather it suggests how the answer to such a question might be arrived at in the context of planning oral health care services. The answer sought should be practical, capable of implementation and part of a general strategy towards better health care in the community.

Sheiham, A. (1981). Planning for Manpower Requirements in Dental Public Health. Dental Public Health. Slack GL. Bristol, UK, Wright Publishing**:** 148-179.

Focuses on how to make effective need-based estimates of public health dental workforce requirements. Discusses requisite data sources, methodological issues and various examples of test statistics.

Shugars, D. A. and J. D. Bader (1992). "Appropriateness of care. Appropriateness of restorative treatment recommendations: a case for practice-based outcomes research." J Am Coll Dent **59**(2): 7-13.

Silberman, P., D. Wicker, et al. (2000). "Assuring access to dental care for low-income families in North Carolina. The NC Institute of Medicine Task Force Study." N C Med J **61**(3): 135.

Following publication of the Task Force's recommendations for improving dental care access among low-income populations, North Carolina has taken several steps forward. The Division of Medical Assistance and the NC Dental Society are forming an advisory committee (comprising Medicaid patients, providers, and representatives from all elements of organized dentistry in the state) to review dental coverage and reimbursement rates. Using existing state funds, the NC Office of Research, Demonstrations and Rural Health Development has recruited 15 additional dentists and 1

dental hygienist to practice in community facilities serving low-income and uninsured patients. In 1999, the NC General Assembly revised the NC Dental Practice Act. Now, under the general direction of a licensed public health dentist, specially trained public health dental hygienists can perform oral health screenings and preventive and educational services outside the public school setting. The NC Institute of Medicine has begun exploring how to use dental hygienists to expand preventive dental services to underserved populations in federally-funded community or migrant health centers, state-funded health clinics, and the not-for-profit clinics that serve predominantly Medicaid, low-income or uninsured populations.

Silver, J. G. (1986). "Strategies and possible solutions." J Can Dent Assoc **52**(1): 59-60.

Sinkford, J. (1985). "A look at dental manpower and related issues." J Md State Dent Assoc **28**(1): 17-9.

Slagle, W. and J. Crawford (1995). "Assessing dental manpower needs in Tennessee." J Tenn Dent Assoc **75**(4): 36-39.

Using a formula developed by the State of Kentucky and the best data available for the State of Tennessee, it is estimated that this state currently has a slight oversupply of dentists, but that by the turn of the century this will have become a shortage. There is no reason to doubt these estimates except that for confidence in them we will need state-specific data on the supply of dental manpower, the need for dental care, and the demand for dental care. Following the recommendations of the Institute of Medicine and others, the College of Dentistry has initiated the Dental Manpower Project to develop and maintain a database that will allow Tennessee to forecast and monitor trends in the supply of dental personnel and factors affecting need and demand. Hopefully, such an activity will help us avoid mistakes like those made 25 to 30 years ago that resulted in the education of too many dentists nationwide (and in this state) and an unfortunate breach between practitioners and dental education.

Sloan, F. A. (1977). "Access to medical care and the local supply of physicians." Med Care **15**(4): 338-46.

This paper focuses on one aspect of access to physicians' services, the time patients spend obtaining physicians' service. Patient time is divided into travel and waiting time components. Communities in which the patient's total time commitment tends to be the highest are generally the most populous cities. Pairwise comparisons between central cities and non-central cities in the 22 largest Standard Metropolitan Statistical Areas (SMSAs) reveal that patient is higher in central cities in the vast majority of cases. Although the area physician-population ratio tends to have the anticipated negative impact on patient time, the ratio explains very little of the total intercommunity variation in the latter variable. Implications for physician manpower policy are discussed.

Solomon, E. (1997). "Results of the Texas Dental Association's dental hygiene needs survey." Tex Dent J. **114**(July(7)): 17-22.

Spencer, A. (1980). "The estimation of need for dental care." Public Health Dent **40**(4): 311-27.

This paper presents a background discussion of the estimation of normative need for dental care. Definitions are given which differentiate normative need for dental care from perceived need, demand, or utilization. Four different approaches to obtaining estimates of normative need for dental care are outlined. They are the translation of data from surveys of dental status, surveys of need for dental care, analyses of service or treatment records, and best judgment of dental practitioners. Present limitations within the four aproaches to estimating need to include factors such as objectivity, directness, completeness, precision, and extent of population coverage. Applications of estimates of need for dental care are identified in the areas of evaluation, setting of priorities, and planning of dental health programs. Current developments in the area of health services, including the concepts of an adequate minimum standard for personal health services, quality assurance, and

rationing by need, are seen as providing some impetus for greater interest in need for dental care. Future directions in the estimation of dental needs will depend upon the validation of the approaches outlined, as well as general factors including costs of collecting data on dental status and need for dental care in population.

Spencer, A. (1982). "Dental manpower: a transitional matrix analysis of study." Aust Dent J **27**(4): 248-53.
The projected supply of dentists in Australia up to 1991 was analysed using a transitional matrix model. The analysis illustrated the importance of selection of baseline data on the stock of dentists and the sensitivity of the projections of supply to assumptions on recruitment of Australian graduates and to migration of foreign dentists into Australia. The analysis also provided data on the changing age distribution of Australian dentists and the rates of wastage from the dental manpower stock. Directions for further development of a transitional matrix model for the study of dental manpower are discussed.

Spencer, A. (1985). "The role of epidemiological surveys in planning dental services: are they a useful tool?" Community Dent Health **2**(4): 277-83.
The Paper Critically Examines the role of oral epidemiological surveys in planning dental services. These surveys play a major role in feedback and review; establishing goals; setting objectives; identification, evaluation and choice between alternative programs. Paper critically examines the usefullness of epidemiological data for policy analysis, suggests improvements to current models for their use.

Stambler, H. (1977). An Overview of the Workshop - Its purpose, content and structure. The Workshop on Health Manpower Shortage Areas, Orlando, FL, US Government Printing Office.

Stangel, I. (1992). "Factors affecting the future need for dental manpower in Canada and Quebec." J Can Dent Assoc. **58**(12): 1005, 1008-10, 1014.
During the past decade, dental faculties in North America have reduced class sizes due to a perceived oversupply of dentists. Several schools have been closed outright, and others have been threatened with closure. These actions may have a negative impact on the future supply of dentists. The current beliefs with regards to the oversupply of dentists have inadequately accounted for the dramatic demographic and epidemiologic changes that are occurring in North America. Major changes in population distribution and disease trends point to an increased need for adult dental services in the future. Therefore, models for dental manpower needs should integrate these data to avoid a potential shortage of dental health care personnel in the future.

Striffler, D. (1983). Dental Treatment: Need, Demand, and Utilization. Dentistry, Dental Practice, and the Community. Y. W. Striffler DF, Burt BA. Philadelphia, PA, WB Saunders and CO.**:** 293-339.
This article discusses the different frames from which one may view the question of what constitutes adequate, effective, and efficient dental treatment. The article discusses the particularities of the dental market, how the market should be evaluated, different data sources, and on factors of particular significance to the future direction for dental personnel assessment.

Striffler, D. F. (1984). "Dentist oversupply (?), dentistry, and dental public health." J Public Health Dent **44**(3): 98-9.
A concise editorial critiquing the argument that there is a "dental shortage." Striffler argues that while some populations receive more than adequate dental services, those in the public sector are still woefully underserved. Author calls for more capitated programs or even for a national oral health plan.

Striffler, D. F., W. O. Young, et al. (1983). Dentistry, dental practice, & the community. Philadelphia, Saunders.

Thomas, C. S., T. M. Henderson, et al. (1994). A Review of State Legislation Related to Increasing the Training, Supply, Recruitment & Retention of Generalist Physicians (1985-1991), The Intergovernmental Health Policy Project at The George Washington University.

The role of state government in supporting the education and training of health professionals is well established. States have been involved in financing medical education for close to 50 years. There is a long tradition of support for loan and scholarship programs for medical students and physicians in training. State concerns about the maldistribution of physicians and the unmet needs of many rural and inner city areas are also long-standing. Many states have followed the federal government's lead by establishing a health service corps loan program or similar loan and scholarship programs to create a cadre of physicians who will practice in underserved areas for a specified period of time. In addition, states have invested in area health education centers, a program initiated by the federal government in 1971 to provide expanded regional educational networks, particularly in underserved areas. These various programs have not solved the health workforce problems of rural and inner city communities. Physician shortages persist and, in some areas, have worsened. Consequently, states have been reexamining both the problems and potential solutions associated with attracting physicians to practice in underserved areas. As a result, states are modifying various forms of educational support and financial incentives for students and residents in the hope that these changes will make a difference. More focused, coordinated programs are also being developed in state government to address a broader range of issues affecting workforce access and service delivery problems in underserved areas. New emphasis is being placed on the student selection process and development of community-based education. In addition, attention is being directed to improving the practice environment, and area which until recently was largely neglected.

Tiede, J., Born DO (1975). "The dental manpower shortage area study in Minnesota." Northwest Dent **54**(4): 174-8.

In the fall of 1974 the Minnesota Dental Association, with assistance from the Dental Information Service Center, completed the initial analysis of the data collected under the MDA shortage Area Study. The MDA study was conceived as a result of the problems encountered in 1972 by the leadership of Minnesota dentistry and by representatives of the Department of Health, Education and Welfare. The present article is intended to summarize the findings of the study and to extend this information to the profession at large.

Tiede, J., Born DO (1975). "Professional opinions in the identification of dental manpower shortage areas." J Am Dent Assoc **91**(July(1)): 139-46.

A study was initiated by the Minnesota Dental Association to identify criteria that dental practitioners use in defining a dental manpower shortage area and to determine the perceived effectiveness and acceptability of solutions to the manpower shortage problem. This report from the association presents the study findings. The five factors, in order of importance, that should be considered in a definition of a manpower shortage area are the public's "dental IQ," the ratio of dentists to population, the availability of dental appointment times, the age and productivity of practicing dentists in the area, and the distance patients must travel to the dentist. Minnesota dentists perceived dental placement techniques to be more effective and acceptable than financial incentives or the use of auxiliary personnel in solving the dental manpower shortage problem

Trier, K. (1996). "Demand: shortage of dental hygiene services: an estimate of need." J Indiana Dent Assoc **75**(2): 6-8, 10, 12.

United States. Dept. of Health and Human Services. (1994). Healthy People 2000 : national health promotion and disease prevention objectives. Washington, D.C., The Dept.

United States. Dept. of Health and Human Services. (2000). Healthy people 2010 : understanding and improving health. Washington, DC, U.S. Dept. of Health and Human Services : For sale by the U.S. G.P.O. Supt. of Docs.

United States. Dept. of Health and Human Services. (2000). Oral Health In America: A Report of the Surgeon General. Rockville, MD, US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.

Waldman, H. (1983). "Fine tuning change: planning for dental manpower needs." N Y J Dent **53**(1): 15-7.

Waldman, H. (1984). "Would you believe a shortage of dentists?" N Y State Dent J. **50**(9): 572, 574, 576.

Wan, T. (1975). "A Prediction of Dental Services Utilization." Inquiry **12**(June): 143-56.

White, K., Henderson, et al. (1976). Epidemiology as a fundamental Science. New York, Oxford University Press.

WHO (1997). Oral Health Surveys: Basic Methods. Geneva, World Health Organization.

WHO (2000). The World Health Report 2000: Improving Systems. Geneva, World Health Organization.

Willcocks, A. and N. Richards (1977). Dental Manpower and Dentistry as an Institution. Social sciences and dentistry, a critical bibliography. N. Richards and L. Cohen. THe Hague, International Federation of Dentistry**:** 120-149.

Wright, G., D. Paschane, et al. (2001). Distribution of the Dental Workforce in Washington State: Patterns and Consequences. Seattle, WWAMI Center for Health Workforce Studies.