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Comparing Indicators of Access to Oral Health Care In Rural and Urban Populations

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Abstract

Access to health services in rural areas is an important social issue. Yet almost no comparisons of relative rates of provision of dental health services in rural and urban settings have been reported. This paper reviews extant comparisons and presents new information concerning prosthetic dental treatment. One part of a statewide survey of active North Carolina general dentists (n=959, response rate=47%) was designed to quantify provision of prosthetic services. Responses were analyzed according to dentists' self-report of practice city size using analysis of covariance with percent of insured patients in the practice as the covariate. Mean per-patient-visit rates for crowns, fixed partial dentures, removable partial dentures, and extractions as well as the distributions of treatment following tooth extraction differed by city size, with practitioners in the smallest cities reporting treatment distributions reflecting more frequent loss of teeth and less frequent replacement. These differences in patterns of prosthetic care echo the limited existing information describing oral health status, provider supply, and receipt of care, all of which suggests that differential levels of access to care do exist and lead to differences in oral health outcomes.

Current concern over deficiencies in access to appropriate health care services among rural populations (Office of Technology Assessment, 1990; Health Resources and Services Administration, 1992) has not been echoed in dentistry. The lack of attention to these issues is reflected in the paucity of information about them in the dental literature. Although there is no single measure of access to oral heath services (Capilouto, 1991), indicators of relative levels of access for population groups could include measures of oral health status, supply of providers, prevalence of barriers to receipt of care, and patterns of care provided. However, few comparisons of oral health status between rural and non-rural populations have been reported, and information describing rural/nonrural comparisons for other indicators of access is almost non-existent. This paper briefly reviews the available information on indicators of access to oral health care among rural populations, and then describes the results of a survey of dental practitioners in North Carolina that provides new information on one of these indicators, differences in the pattern of prosthetic care provided in rural and non-rural areas.

Summary of Available Indicators of Access to Oral Health Care for Rural Populations

Oral Health Status: Available national and regional epidemiological data indicate that oral health status of children, as defined by the number of decayed, missing, and filled (DMF) tooth surfaces, is generally poorer among rural children than among non-rural children. The 1986-87 national survey of dental caries in school children indicated that mean DMF surface values for children aged 5-17 in non-SMSA counties were approximately five percent higher than for children in SMSA counties, 3.18 versus 3.03 DMF surfaces (National Institute of Dental Research, 1989). Further, the proportion of disease that had not been treated, D/DMF surfaces, was 15% higher among non-SMSA counties. These analyses were not controlled for other patient characteristics.

Similarly, data from a 1987 state survey of schoolchildren in North Carolina strengthens the association of lower oral health status with rural populations by showing an inverse relationship between degree of urbanism and DMF surface scores (Rozier, Dudney, & Spratt, 1991). Urbanism was classified by county as low (<23.8%), moderate (23.8%-70.0%), and high (>70.0%) based on the proportion of county population living in "urban" areas, or in places with 2500 inhabitants outside urban

areas. Children in the least urbanized counties experienced 43% more DMF surfaces than children in the most urbanized counties, and children in moderately urbanized counties experienced 22% more. The proportion of disease that had been treated also reflected this inverse relationship with degree of urbanism, with 25%, 20%, and 19% of disease untreated respectively among children in least, moderately, and most urbanized counties. Analyses controlling for race showed that differences between least and most urbanized white children were greater, but least urbanized nonwhite children had the highest level of disease and the lowest proportion of treated disease, i.e. D/DMF surfaces.

For adults, oral health status traditionally has been measured by the DMF surface score and the rate of edentulism, i.e., complete loss of teeth, which is assumed to reflect experience with both caries and periodontal disease. No current national data describe differences in these measures among adult populations in rural and non-rural populations. Distributions from early national interview surveys indicated that the prevalence of edentulism was higher in rural areas in 1957 and 1971 (Weintraub & Burt, 1985), while a 1962 national clinical survey of adult caries experience indicated that non-SMSA residents had DMF tooth scores 8% lower than SMSA residents (Kelly, Nan Kirk, & Garst, 1967). Comparison of results from a 1976-77 North Carolina survey with those from a similar survey in 1960-63 showed that "while there was little urban/rural difference in caries experience in 1960-63, a wide gap has developed since that time, with residents of urban areas being in a favorable position and rural areas in an unfavorable position" (Hughes, Rozier, & Ramsey, 1982). A current North Carolina survey, in this instance a population-based five county epidemiological survey of 1,000 community-dwelling older adults, found that among the elderly population, rural (no criteria provided) non-white residents were 1.8 times more likely to require an extraction than urban non-white residents (Drake, Beck, & Graves, 1991). This difference was not observed in white residents.

Supply of Dentists: Historically, the supply of practitioners has always been less in rural areas as compared to all other areas (Douglass & Cole, 1979a). This relationship is evident in regional manpower data, where southern and central northwestern regional designations have consistently shown less favorable dentist to population ratios, approximately 20% fewer dentists per 100,000 population than the national average from the mid 1960s through the mid 1980s (Hebbeler, 1984).

Once again direct data describing current differences in supply of dentists in rural and non-rural areas are scanty. The most recent data available come from the Bureau of Health Profession's Area Resource File (Bureau of Health Professions, 1992), and represent 1988 distributions. The most pertinent comparison of relative supply is made at the level of primary care dentists, i.e., general dentists and pediatric dentists. The number of active primary care dentists per 100,000 population for non-MSA counties is 22% lower per 100,000 population than in MSA, a proportion similar to the 20% smaller supply that was cited in the 1970s. Another indicator of reduced supply in rural areas is the proportion of Dentist Shortage Areas in non-metropolitan areas, which was 73% as of mid-year 1992 (Division of Shortage Designation, 1992).

Prevalence of Barriers to Utilization: The most recent data describing utilization patterns among rural and non-rural populations come from the 1986 National Health Interview Survey (Jack & Bloom, 1988). The percent of the population over two years of age reporting at least one dental visit within the past year was 60% for MSA residents and 53% for non-MSA populations. The mean numbers of visits in the past year were 2.1 and 1.8 respectively for these two populations. A large number of determinants of utilization of oral health care has been identified over the past two decades (Douglass & Cole, 1979b; Gift, 1984; Haywood, Meetz, Shapiro, & Freeman, 1989). Those generally accepted as "barriers," i.e., factors that can act as deterrents to utilization of any oral health services, include lack of perceived need for treatment, lack of dental insurance, lack of a regular source of care, presence of fear and/or anxiety, and convenience and economic factors associated with the availability of services. The only recent data comparing the presence of any of these putative deterrents among rural and non-rural populations are presented in the 1986 National Health Interview Survey, where the proportion of the population with private dental insurance was 41% for MSA inhabitants and 29% for non-MSA inhabitants (Jack & Bloom, 1988).

Patterns of Care: No direct comparisons of patterns of care provided in rural and urban areas exist, and the only extant indirect information offers ambiguous indications of differences. A summary score of 23 dimensions of the process of care has been shown to differ between rural (town size <5,000) and urban practices nationally, but the difference, which favored urban practices, was not significant

when controlled for region of the country (Morris, Bentley, Vito, & Bomba, 1988). In a study of dentists' self-reported attitudes and behaviors concerning prevention, rural (non-SMSA New York counties) and urban (Manhattan) dentists were not different on a summary measure of preventive orientation, but the determinants of this orientation were substantially different for the two groups (Sadowsky & Kunzel, 1987).

This aspect of access to oral health care, the pattern of care provided to those persons who utilize dental services, is perhaps less well-documented than any other indicator of access to oral health services. Patterns of care surrounding the loss of teeth and their replacement are particularly significant because this type of dental care is characterized by a wide variety of treatment approaches that can have substantially different long-term implications for oral health status. Therefore, an exploratory study of differences in prosthetic care patterns among urban and rural dentists in North Carolina was undertaken.

Methods

One section of a questionnaire designed to explore North Carolina general dentists' attitudes and behaviors concerning restorative dentistry was devoted to questions concerning the provision of restorative and prosthetic treatment procedures. Dentists were asked to estimate the proportion of treatment time they spent performing restorative, fixed prosthetic and removable prosthetic procedures. Estimates of the number of prosthetic procedures of various types performed per week were requested, as were estimates of the distribution of procedures provided following extraction of a tooth. To permit calculation of rates from these data, dentists were asked to indicate the number of patients treated per week. Finally dentists were asked to indicate the population of the town or city in which they practiced.

All analyses were performed using city size as a classification variable. To permit identification of associations with extent of urbanism, three categories of city size were established, "rural" where the population was less than 10,000; "suburban" where the population was between 10,000 and 50,000, and "urban" where the population was greater than 50,000. For all rate calculations,

respondents' estimates of the proportion of patients in the practice who had dental insurance were used as the covariate in analyses of covariance to control for the effects of coverage on service provision patterns.

In January 1992, the questionnaire was sent to all active general dentists (n=2146) licensed by the North Carolina State Board of Dental Examiners. The questionnaire was accompanied by a cover letter from the Chair of the Department of Operative Dentistry requesting assistance with the project. Eight weeks later, a new letter and second copy of the questionnaire were sent to those who had not yet responded. All remaining non-respondents after the two mailings received a letter requesting them to complete three practice-related survey questions that were taken from the questionnaire and printed on a postcard. Responses to these questions and demographic characteristics available from the state board were compared for respondents and non-respondents. Respondents were not included in the analyses reported here if they identified themselves as being employed by a local, state, or federal government (7.7% of respondents), or treating patients less than 32 hours per week (22.8% of respondents).

Results

Of 2,146 questionnaires sent to licensed active general dentists, 38 were returned as undeliverable or returned by dentists no longer in active practice. Six weeks after the second mailing, 959 dentists (45.5%) had responded. Because returned postcards indicated that 4.7 percent of these survey non-respondents were not active in dentistry, a final adjusted response rate of 46.7% was calculated. Data from licensure files indicated that respondent and non-respondent groups were not different by sex, practice setting, employment status, number of other dentists in the practice, or metropolitan/non-metropolitan county designation. However, respondents were more likely to be white (96% versus 89%) and to have graduated more recently (1974 ± 10.6 yrs versus 1971 ± 12.8 yrs). Respondents worked more total hours per week (37.3 ± 6.9 versus 36.3 ± 8.6) and employed more dental team members (3.1 ± 1.9 versus 2.7 ±2.0). Respondents were more likely to be graduates of the state dental school (68% versus 54%), and controlling for dental school did not eliminate the other

differences. Non-respondents who returned the postcard reported similar patient care hours per week (33.8 ± 8.3 versus 33.3 ± 6.3), but indicated extracting fewer teeth per month (20.6 ± 32.0 versus 26.0 ± 32.2).

Among respondents, 31% practiced in rural towns, 30% in suburban cities, and 39% in urban cities. Basic rates of treatment for retaining damaged teeth (crowns) and for replacing missing teeth (bridges, partial dentures, implants) are shown in Table 1, together with the rate for extraction of teeth. There are significant differences among the practitioner by city size for the provision of bridges, crowns, and for extractions themselves. Practitioners in rural cities reported rates of provision of bridges and crowns approximately a third lower than practitioners in urban cities. In both instances, rates for practitioners in suburban cities fell between these extremes and were significantly different from them, demonstrating a relatively linear relationship between city size and treatment provision rates. Conversely, practitioners in rural cities reported rates of extraction almost double those of urban city practitioners, with dentists in suburban cities again reporting an intermediate rate.

Table 2 shows practitioners' estimates of the distributions of treatment provided in their practices following extraction of teeth. The largest differences are evident between rural and urban city practices in the proportion of extracted teeth replaced by fixed bridges, and the proportion for which no replacement is provided. Teeth extracted in rural city practices are twice as likely not to be replaced than to be replaced with a fixed bridge, whereas teeth extracted in urban city practices are one-and-a-half times more likely to be replaced with a bridge than to not be replaced. No difference in the proportion of patients receiving removable partial dentures was evident, while urban dentists reported providing complete dentures proportionally less frequently.

These differences in provision rates and distributions of post-extraction treatment are reflected in dentists' estimates of the time they spend providing restorative and prosthetic care (Table 3). Dentists in rural cities spent significantly smaller proportions of their treatment time in providing fixed prosthetic care. Dentists in urban cities reported spending somewhat less treatment time in removable prosthetic care, and time spent in providing restorative care did not differ among providers in rural and urban cities.

Discussion

These results suggest that patients visiting private dental practices in rural cities are likely to receive a different pattern of prosthetic treatment services---more extractions, less tooth replacement, and fewer fixed prosthodontic services---than patients visiting practices in more urban areas. In general, dental practices in suburban areas reflected a pattern that represented a midpoint between the large city and small city practices. These different patterns of care are important from the standpoint of evaluating access to dental care in rural areas because, as noted, they can have substantial implications for long-term oral health status.

It is axiomatic that the prevention of any tooth loss, a potentially debilitating event, is the most effective approach to maintaining high levels of oral health. Tooth loss decrements oral health status to such an extent that it has been singled out in two of the Healthy People 2000 objectives. Dentists consistently rate missing teeth as the most important condition in determining relative oral health status (Marcus, Koch, & Gershen, 1983). Differences in rates of extractions across city sizes in this study suggest that tooth loss is more frequent overall in rural city practices; tooth loss per 100 patient visits was almost twice as high among these practices than among urban city practices. The difference in the rate of provision of crowns may, in addition to signaling this same difference in patterns of care, contribute to the lower extraction rate in urban practices because a sizable minority of all crowns are placed to prevent tooth fracture, which can lead to tooth loss (Bader, Shugars, & Roberson, in press). This difference in tooth loss rates is perhaps the most dramatic single example of a less desirable pattern of care and reduced access to preventive services in rural areas.

Another example of differences in what is considered to be preferred treatment is the pattern of care following tooth loss. The data describing patterns of care following tooth loss suggest that lost teeth are less likely to be replaced among patients in rural practices. Further, when teeth are replaced, rural patients are less likely to received fixed bridges, which are almost universally considered to be the preferred treatment alternative.

Because cost is a substantial issue in treatment decisions related to prevention of tooth loss and replacement of lost teeth, the presence of dental insurance was partially controlled by using the practitioners' estimates for the proportion of their patients with insurance as covariates in the analyses. This analysis should not be interpreted as controlling the cost of care because most plans have copayment provisions for prosthetic treatment. That the differences in extractions and prosthetic service patterns were evident with dental insurance coverage partially controlled suggests that other factors are operating. Unfortunately, the survey from which the treatment patterns were determined was not intended to explore these factors, so our ability to examine other reasons for differences in prosthetic treatment patterns is limited using this data set. It is also possible that the results are biased to some extent because publicly-funded dental clinics, which are more prevalent in urban areas, and in which it is assumed that extraction rates are higher for financial reasons, were not included in the sample. However, because dentists were asked to respond to the survey in terms of their primary practice, care provided by large-city practitioners in rural secondary practice locations is also not represented.

The larger implication of these findings is that the differences in patterns of treatment provided by dental practices in rural, suburban, and urban cities may be indicators of differential levels of access to dental care. As shown by the review of available information, the issue of access to dental care among rural populations is distinguished chiefly by the lack of current quantitative information for most indicators of access. We are unable to state with certainty that differences exist for these indicators based on national data, let alone estimate the extent of the differences or speculate on probable causes. But these results from North Carolina reinforce the presumption that the relatively well-documented differences in caries experience and tooth loss among urban and rural child and adult populations in the state are associated with differences in access to dental care for urban and rural populations. Further, the results suggest that differences in access may contribute to substantially different oral health outcomes among patients receiving treatment related to tooth loss.

These results raise substantial questions about the causes of the different patterns of care that have been described. For example, it is not possible to determine from these results whether the

different patterns of prosthodontic care are a reflection of other barriers to access, or a barrier in and of themselves because rural dentists value and thus provide a different mix of treatment services. Nevertheless, the results do demonstrate a clear need to explore further the issue of access to dental care among rural populations. Unfortunately, that the results of the most recent national adult epidemiological survey of oral health status have not been reported by rural status (National Institute of Dental Research, 1987) may be an indication of the priority placed on this issue by the federal government as well as the dental profession. This inattention must be reversed if the issues are to be addressed.

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Table 1

Estimated Treatment Provision Rates# by City Size

Treatment	City Size <10,000 *(n=269)*	10-50,000 *(n=256)*	>50,000 *(n=337)*
Bridge	1.0*	1.4*	1.6*
Crown	7.5*	9.2*	11.3*
Partial Denture	1.5	1.6	1.3*
Implant	0.2	0.1	0.4*
Extraction	15.5*	11.4*	8.3*

procedures per 100 patient visits (not including hygiene visits)
* different than adjacent value(s), $p<0.05$

Table 2

Distribution of Post-Extraction Treatment Estimates, by City Size

	City Size		
Treatment	<10,000	10-50,000	>50,000
	(n=269)	*(n=256)*	*(n=337)*
Bridge	17%*	26%*	38%*
Partial Denture	24%	24%	23%
Full Denture	17%	15%	11%*
Implant	1%*	2%	2%
No Treatment	39%*	30%*	25%*

* different than adjacent value(s), $p<0.05$

Table 3

Estimates of Proportion of Total Treatment Time Spent in Three Areas, by City Size

	City Size		
Treatment Area	<10,000 *(n=269)*	10-50,000 *(n=256)*	>50,000 *(n=337)*
Percent time in fixed prosthetics	22%*	26%*	31%*
Percent time in removable prosthetics	12%	12%	10%*
Percent time in restorative dentistry	52%	53%	52%

* different than adjacent value(s), p<0.05