

The military oral health care system as a model for eliminating disparities in oral health

Jeffrey J. Hyman, DDS, PhD; Britt C. Reid, DDS, PhD; Susan W. Mongeau, DDS, MPH; Andrew K. York, DMD, MPH

Healthy People (HP) 2010 is a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats. It is an initiative of the Office of Disease Prevention and Health Promotion of the U.S. Department of Health and Human Services. The goals of the HP 2010 report¹ included reducing disparities in health and improving life expectancy and the quality of life of the U.S. population. The report, which was published in 2000, established objectives for achieving improved oral health in the United States within this decade.¹ These include objectives 21-2, "Reduce the proportion of children, adolescents, and adults with untreated dental decay"; 21-3, "Increase the proportion of adults who have never had a permanent tooth extracted because of dental caries or periodontal disease"; and 21-10, "Increase the proportion of children and adults who use the oral health care system each year." It is unlikely that the HP 2010 objectives can be achieved without reducing racial and ethnic disparities in oral health.²⁻⁵

Despite some limitations,⁶⁻⁸ studying oral health outcomes among different racial groups has been useful for identifying the unequal distribution of disease. A

ABSTRACT

Background. Healthy People (HP) 2010 is a national health promotion and disease prevention initiative of the U.S. Department of Health and Human Services. The HP 2010 report highlighted a range of racial/ethnic disparities in dental health. A substantial portion of these disparities appear to be explained by differences in access to care. Members of the U.S. military have universal access to care that also has a compulsory component. The authors conducted a study to investigate the extent to which disparities in progress toward achievement of HP 2010 objectives were lower among the military population and to compare the oral health of the military population with that of the civilian population.

Methods. The participants in this study were non-Hispanic white and non-Hispanic black males aged 18 to 44 years. They were drawn from the Tri-Service Comprehensive Oral Health Survey (10,869 including 899 recruits who participated in the TSCOHS Recruit Study) and the Third National Health and Nutrition Examination Survey (4,779).

Results. We found no disparities between black and white adults in untreated caries and recent dental visit rates in the military population. Disparities in missing teeth were much lower among military personnel than among civilians.

Conclusions. A universal access-to-care system that incorporated an aspect of compulsory treatment displayed little to no racial disparity in relevant oral health outcomes. This demonstrates that it is possible for large, diverse populations to have much lower levels of disparities in oral health even when universal access to care is not provided until the patient is 18 or 19 years of age.

Key Words. Race; access to care; oral health; military health care.

JADA 2006;137:372-8.

Dr. Hyman is an epidemiologist, Office of Science Policy and Analysis, National Institute of Dental and Craniofacial Research, 45 Center Drive, Room 4AS-37K, MSC 4601, Bethesda, Md. 20892, e-mail "jh393y@nih.gov". Address reprint requests to Dr. Hyman.

Dr. Reid is an assistant professor, Department of Health Promotion and Policy, University of Maryland School of Dentistry, Baltimore, Md.

Dr. Mongeau is a colonel, Dental Corps, U.S. Air Force; dental public health consultant to the Air Force Surgeon General; and chief, Tri-Service Center for Oral Health Studies, Uniformed Services University of the Health Sciences, Bethesda, Md.

Dr. York is a captain, Dental Corps, U.S. Navy, and director, Tri-Service Center for Oral Health Studies, Uniformed Services University of the Health Sciences, Bethesda, Md.

substantial portion of the observed racial disparities in oral health appears to be explained by socioeconomic status acting through its effects on access to care.⁴⁻¹² Poor access to care has been identified as a key contributor to disparities in caries experience in childhood, adolescence and young adulthood.¹² Thus, having a usual source of care appears to be a robust predictor of dental care utilization.¹³

If lack of access to care is a critical barrier to good oral health, does it follow that removal of this barrier would reduce disparities? Two studies examined the benefits of providing full access to care and found that it did not eliminate disparities.^{14,15} In one of these, the authors cautioned that simply providing universal access may not be sufficient to prevent disparities in oral health status.¹⁵

Members of the U.S. military have both universal access to care and a usual source of care. In addition, they are required to have regular examinations and to maintain a certain level of oral health. Thus, the military population provides an opportunity to explore the impact of these factors on reducing disparities in oral health status.

We undertook a study that focused on racial disparities in untreated caries, use of dental services and loss of teeth by comparing the oral health of African-American and white members of the military care system with black and white people in the civilian population.

MATERIALS AND METHODS

We drew the participants in this study from the Tri-Service Comprehensive Oral Health Survey (TSCOHS) and the Third National Health and Nutrition Examination Survey (NHANES III). The design of the NHANES III and TSCOHS have been described previously.^{16,17}

Sample designs. *NHANES III.* NHANES III was a nationally representative survey that was conducted by the National Center for Health Statistics between 1988 and 1994. The survey targeted the U.S. civilian, noninstitutionalized population and used a stratified-multistage-probability sampling design.¹⁸ NHANES III was approved by the institutional review board of the National Center for Health Statistics. For our

study, we included NHANES III participants if they were aged 18 through 44 years at the time of their interview, were male, and were either non-Hispanic white or non-Hispanic black.

TSCOHS. The TSCOHS was a 26-site, cross-sectional survey that captured the oral health status and dental treatment needs of U.S. Army, Navy, Marine Corps and Air Force personnel. It was conducted by the Tri-Service Center for Oral Health Studies, Bethesda, Md., from April 1994 through January 1995. A two-stage, stratified, randomly selected target sample of 15,924 yielded 13,050 respondents (an 82 percent response rate).¹⁷ This sample represented the 1994 military population of 1,699,662.

Our study. Our study population consisted of the 9,970 TSCOHS participants who were white or black, male and aged 18 to 44 years. We excluded Hispanics because they were not directly comparable with the corresponding NHANES III category of Mexican-Americans. We also excluded women because their sample size in the TSCOHS was too small to enable us to calculate stable estimates. In this study, the term “military” refers to those on active duty in the U.S. military except for the 899 participants in the TSCOHS Recruit Study, who compose the military sample for the 18- to 19-year age group.

We drew the recruits from the 2,711 participants in the TSCOHS Recruit Study. They represented the 101,072 people who were military recruits during the six-month data collection period. We sampled recruits using a single-stage, stratified, systematic random sample. Because of the low numbers of female recruits and older recruits, we limited our study population to the 899 recruits who were white or black, male and between the ages of 18 and 19 years. During the course of the TSCOHS, recruits had received the same examination as had members of the active-duty population.

The recruits had not received a military dental examination or treatment before entering military service other than a check of their mouths by a physician at their entrance medical qualification physical examinations. Recruits also participated in this survey before receiving any dental care at their recruit bases.¹⁹

Members of the U.S. military have both universal access to care and a usual source of care. In addition, they are required to have regular examinations and to maintain a certain level of oral health.

TABLE 1

Healthy People 2010* oral health objectives addressed in this study.	
OBJECTIVE	TARGET (%)
21-2. Reduce the proportion of children, adolescents, and adults with untreated dental decay. 21-2d. Reduce the proportion of adults with untreated dental decay.	56
21-3. Increase the proportion of adults who have never had a permanent tooth extracted because of dental caries or periodontal disease.	42
21-10. Increase the proportion of children and adults who use the oral health care system each year.	56
* Healthy People 2010 is a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats. It is an initiative of the Office of Disease Prevention and Health Promotion of the U.S. Department of Health and Human Services. ¹	

TABLE 2

Age distribution of the military and civilian study populations.				
AGE (YEARS)	NHANES III* (CIVILIAN)		TSCOHS† (MILITARY)	
	Number	Percentage	Number	Percentage
18-19	332	6.9	899‡	8.3
20-24	950	19.9	2,943	27.1
25-29	875	18.3	2,561	23.6
30-34	931	19.5	2,151	19.8
35-39	888	18.6	1,572	14.5
40-44	803	16.8	743	6.8
TOTAL	4,779	100.0	10,869	100.0
* NHANES III: Third National Health and Nutrition Examination Survey. † TSCOHS: Tri-Service Comprehensive Oral Health Survey. ‡ In the military population, 18- to 19-year-olds are recruits.				

DATA COLLECTION

Twenty-six TSCOHS examiners received a three-day course and calibration before data collection began. They evaluated and calculated interexaminer and intraexaminer reliability for each component of the examination, including decayed, missing and filled (DMF) indexes. They also calculated κ statistics and intraclass correlation coefficients.¹⁷ “Gold-standard” examiners conducted replicate examinations at each study site midway through the data collection period. The 26 examiners conducted all data collection using new mirrors, explorers and Periodontal Screening

and Recording (American Dental Association, Chicago) probes. Examiners used radiographs to assess oral treatment needs. However, NHANES III personnel determined DMF indexes without the use of radiographs.

The NHANES III oral health examinations were conducted by trained and calibrated dental examiners. The National Center for Health Statistics conducted replicate examinations throughout the data collection period to assess intraexaminer reliability. NIDCR measured interexaminer reliability by comparing examination results with those of a reference examiner. Calibrated examiners conducted the coronal caries examination with a mirror and explorer. No radiographs

were used. Two examiners conducted approximately 85 percent of the examinations. We calculated intraexaminer reliability regarding numbers of decayed surfaces (DS), filled surfaces (FS) and decayed or filled surfaces (DFS) for these examiners.⁵

DATA ANALYSIS

We analyzed the TSCOHS data using SUDAAN statistical software, Version 6 (RTI International, Research Triangle Park, N.C.) to account for the complex sampling scheme.

We used STATA, Version 7.0 (Stata Corporation, College Station, Texas), for all NHANES III calculations and analyses. Analyses included sample weights appropriate for the survey’s complex sampling design.

RESULTS

Table 1 lists the specific Healthy People 2010 Oral Health Objectives for which comparable data had been collected in the NHANES III and TSCOHS studies and that we addressed in this study.

Table 2 presents the sample size and age distributions of the NHANES III, TSCOHS military

and TSCOHS recruit study populations. The TSCOHS military population was more than twice the size of the NHANES III sample and had a somewhat younger age distribution. However, the NHANES III sample size was larger in the 40- to 44-year age group.

Figure 1 displays the percentage of each population that had had a dental visit within the preceding 12 months, stratified by age group. This corresponds to HP 2010 Objective 21-10. In the military population, about 80 to 90 percent of each age group had had a visit within the previous year. There were no differences across racial groups. In the civilian population, a higher percentage of whites than blacks in all age ranges had had a dental care visit within the preceding year. Both groups had much lower percentages of people with visits than the corresponding military group and were under the HP 2010 target of 56 percent for all age ranges except for 18- to 19-year-old whites. A lower percentage of military recruits than of their age-matched civilian counterparts had had a dental visit within the preceding year. The results for the recruits represent their experiences before entry into the military.

The percentage of dentate people with one or more untreated DS is shown in Figure 2. This addresses HP 2010 Objective 21-2: a maximum of 15 percent of adults aged 35 to 44 years having untreated dental decay. A much higher percentage of military recruits than of their civilian counterparts had untreated decay. The percentage with untreated decay was lower in successively older age groups in the military population and generally was higher in older age groups in the civilian populations. The disparities in untreated decay in the military population were smaller than those in the civilian population but were not completely eliminated.

Figure 3 displays mean number of DS and addresses HP 2010 Objective 21-2. The mean number of DS was much higher for the black civilians than for white civilians. The white and black military populations were similar in their mean number of DS. Overall, their mean number of DS was much lower than that of civilian populations of the same age group for people aged 20 years and older. Recruits in both racial groups had a much higher mean number of DS than did members of civilian populations in the same age range and of the same race.

Figure 4 displays the percentage of each population that had not lost any permanent teeth

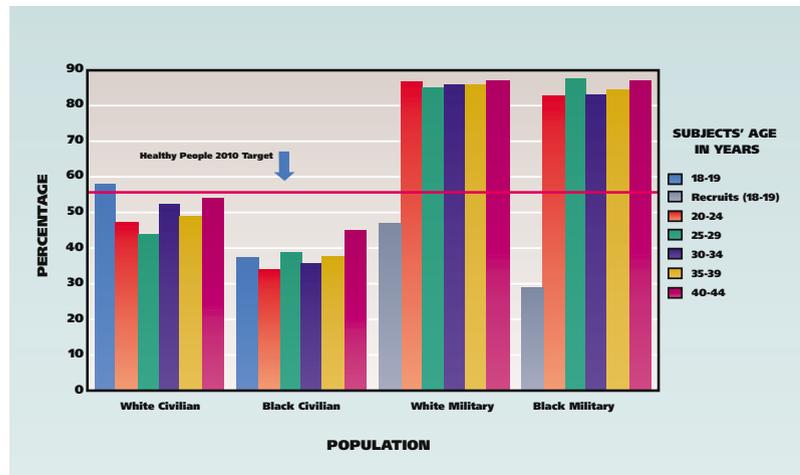


Figure 1. Percentage of people with a dental visit within the past year, by military status, age and race. In the military population, 18- to 19-year-olds were recruits. They had not received any military dental treatment before being examined in the Tri-Service Comprehensive Oral Health Survey. Their results represent their condition on entry into the military. This figure addresses Healthy People (HP) 2010 Objective 21-10, "Increase the proportion of children and adults who use the oral health care system each year." The HP 2010 target is 56 percent.

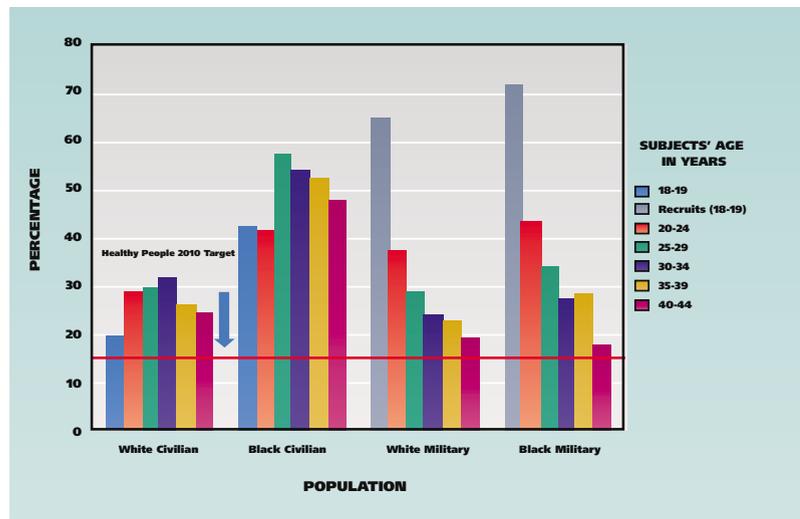


Figure 2. Percentage of dentate people with one or more untreated decayed surfaces, by military status, age and race. In the military population, 18- to 19-year-olds were recruits. They had not received any military dental treatment before being examined in the Tri-Service Comprehensive Oral Health Survey. Their results represent their condition on entry into the military. This figure addresses Healthy People (HP) 2010 Objective 21-2, "Reduce the proportion of children, adolescents, and adults with untreated dental decay." The HP 2010 target is for a maximum of 15 percent of adults aged 35 to 44 years to have untreated dental decay.

because of disease (excluding third molars), by age group. This corresponds to HP 2010 Objective 21-3. The percentage of people with no missing teeth was lower among older age groups and was highest for the white military group, followed by white civilians, black military personnel and

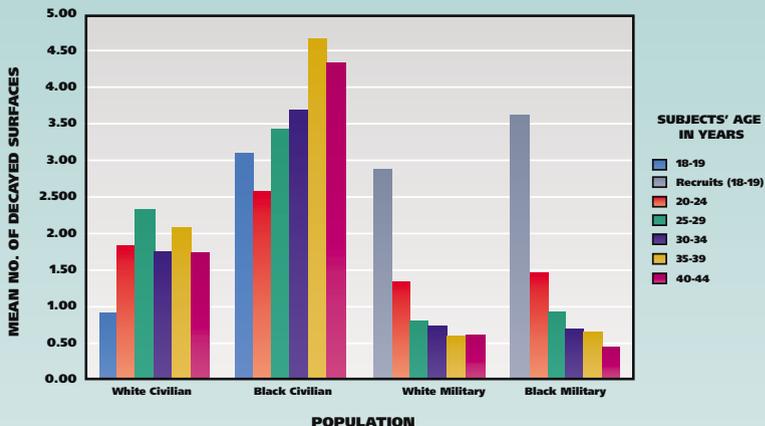


Figure 3. Mean number of decayed surfaces, by military status, age and race.

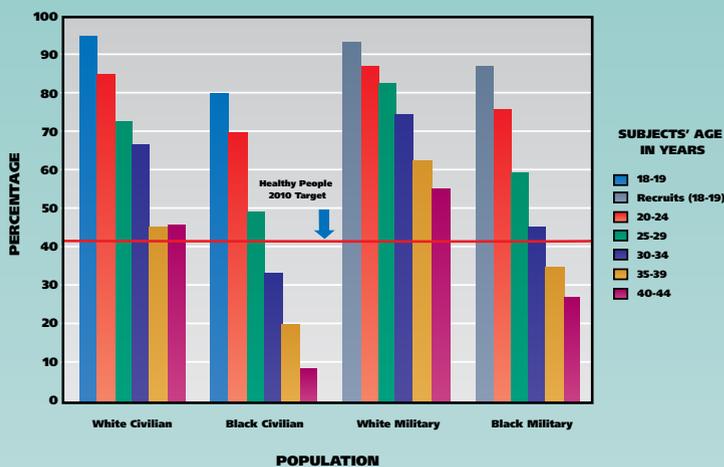


Figure 4. Percentage of the population that had not lost any permanent teeth owing to dental disease (excluding third molars), by military status, age and race.

black civilians. Racial disparities in missing teeth were lower in the military population but were not entirely absent.

DISCUSSION

We found that the disparities between black and white adults in untreated caries and recent dental visit rates in the NHANES III data were largely eliminated among military personnel. The black-white disparities in missing teeth among military personnel were lower than those among their civilian counterparts.

We also found that untreated caries was much less common among military personnel than

among their civilian counterparts.

These results were achieved despite the fact that the white and black recruit populations both had a much higher mean number of DS than did their civilian counterparts. A higher percentage of the recruit groups also had one or more untreated DS. The percentage of recruits who had had a dental visit within the past year was lower than the percentage for the comparable civilian population. Since the recruits did not receive any military oral health treatment before they were surveyed, this suggests that overall, their oral health was worse than that of the civilian population. We speculate that their mean socioeconomic status was lower than that of their civilian counterparts. However, civilian income data were not collected in the TSCOHS, so we cannot make a comparison.

Racial disparities in the oral health objectives that are subject to rapid remediation (such as visit rates and untreated caries) displayed the greatest reductions in the military care environment. The racial disparities of military recruits in objectives involving missing teeth would not be expected to disappear in the military setting because they are cumulative measures of disease.

Disease processes that have caused accumulated damage until the typical age of entry into the military (18 or 19 years) cannot be reversed through access to care and usual source-of-care interventions. However, there is a reduction in disparities in missing teeth among older age groups, suggesting that, over time, the military care system tends to achieve parity in these indicators.

An earlier report indicated that approximately 86 percent of military personnel had had a dental visit within the preceding year, compared with less than one-half of a similar cohort of employed civilian people. This high utilization did not vary across racial groups.²⁰ Conversely, in another study, military recruits were found to have the same or lower dental care utilization rates in the year before they entered the military as those of a similar cohort of employed civilian adults.²¹ In combination, these results suggest that those entering the military move from low to high utilization of dental care compared with their civilian counterparts, and that racial disparities in utilization are eliminated after entry into military service.

Utilization rates and having a usual source of care are process measures, not health outcomes.

Nevertheless, it is encouraging that the military dental care setting appears to address these factors. A more relevant issue is whether universal access and high utilization rates lead to a reduction of racial disparities in untreated dental caries, especially given the failure of studies of British children¹⁴ and Canadian children¹⁵ to eliminate disparities in caries experience through universal access to care.

Neither the British nor the Canadian study indicated that simply providing universal access and a usual source of care would eliminate oral health disparities. However, we found clear indications that these disparities were smaller in the military population. This could be due to a fundamental difference between the military and civilian oral health care systems. In the military system, an annual dental visit and receipt of a minimal standard of care are strongly encouraged and, in some cases, compulsory.

Some compulsory dental care exists in the U.S. civilian setting. For example, many school systems require, at a minimum, confirmation that a school-aged child has had a recent dental visit before he or she may be enrolled. However, a system providing universal access to dental care to children that incorporates compulsory treatment is not feasible in the United States.

Compulsory care is not the only feature of the military system that could be playing a role in oral health outcomes. Military command support for changes in attitudes, behaviors and expectations through health educational efforts also may have contributed to the results recorded among military personnel.

The limitations of this study include differences in survey methodologies between the NHANES III and TSCOHS. These prevented us from including periodontal disease status in our study. However, there were no systematic differences by racial group within the NHANES III and TSCOHS so that comparisons of black-white disease prevalence should be unbiased. The cross-sectional nature of both the TSCOHS and NHANES III data limits the ability to address cohort effects and establish temporal relationships.

The strengths of our study include the large sample sizes, multistage sampling, calibrated

examiners and systematic data collection, all of which allow for stable, accurate and externally generalizable outcome estimates. The caries examinations of the military and civilian participants in this study used the same methodologies, which facilitates comparisons.

The finding that disparities in the percentage of people with untreated caries were smaller in the military population but were not completely eliminated in most age ranges is a source of concern and affects our expectations for civilian programs. One might expect that a system that includes universal access to care, an element of compulsion, employer support and health educational efforts would result in the total elimination of disparities. The reasons that this result has not been achieved are unknown. A slightly smaller percentage of black military personnel had had a dental visit within the preceding year, and this may play a role. Other as-yet-unidentified factors also may affect the use of oral health care services. Clearly, this is an area that requires further investigation.

CONCLUSIONS

We found that the disparities between black and white adults in untreated caries and recent dental visits that are seen in the U.S. civilian population were absent among military personnel. Racial disparities in missing teeth persisted among military personnel, though they were much smaller than those seen in their civilian counterparts. The absence of racial disparities in oral health among adults occurred in a system that provided universal access and a usual source of care, as well as employer support, and that was to some extent compulsory. This demonstrates that it is possible for large, diverse populations to have much lower levels of disparity in oral health even when universal access to care is not provided until age 18 or 19. ■

We found that the disparities between black and white adults in untreated caries and recent dental visits that are seen in the U.S. civilian population were absent among military personnel.

1. U.S. Department of Health and Human Services. Healthy People 2010: With understanding and improving health and objectives for improving health. 2nd ed. Washington: U.S. Government Printing Office; 2000.

2. Chapter 4: The magnitude of the problem (Figures 4.5 and 4.6). In: Public Health Service, Office of the Surgeon General, National Institute of Dental and Craniofacial Research. Oral health in America: A report of the surgeon general. Rockville, Md.: National Institute of Dental and Craniofacial Research; 2000.

3. Kaste LM, Selwitz RH, Oldakowski RJ, Brunelle JA, Winn DM, Brown LJ. Coronal caries in the primary and permanent dentition of

- children and adolescents 1-17 years of age: United States, 1988-1991. *J Dent Res* 1996;75(special number):631-41.
4. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988-1994. *JADA* 1998;129:1229-38.
 5. Winn DM, Brunelle JA, Selwitz RH, et al. Coronal and root caries in the dentition of adults in the United States, 1988-1991. *J Dent Res* 1996;75(special number):642-51.
 6. Andersen RM, Mullner RM, Cornelius LJ. Black-white differences in health status: methods or substance? *Milbank Q* 1987;65(supplement 1):72-99.
 7. Berkman LF, Macintyre S. The measurement of social class in health studies: old measures and new formulations. *IARC Sci Publ* 1997(138):51-64.
 8. Bhopal R, Donaldson L. White, European, Western, Caucasian, or what? Inappropriate labeling in research on race, ethnicity, and health. *Am J Public Health* 1998;88:1303-7.
 9. Drury TF, Garcia I, Adesanya M. Socioeconomic disparities in adult oral health in the United States. *Ann NY Acad Sci* 1999;896:322-4.
 10. Reisine ST, Psoter W. Socioeconomic status and selected behavioral determinants as risk factors for dental caries. *J Dent Educ* 2001;65:1009-16.
 11. Davidson PL, Andersen RM. Determinants of dental care utilization for diverse ethnic and age groups. *Adv Dent Res* 1997;11:254-62.
 12. Edelstein BL. Disparities in oral health and access to care: findings of national surveys. *Ambul Pediatr* 2002;2(2 supplement):141-7.
 13. Davidson PL, Cunningham WE, Nakazono TT, Andersen RM. Evaluating the effect of usual source of dental care on access to dental services: comparisons among diverse populations. *Med Care Res Rev* 1999;56(1):74-93.
 14. Moynihan PJ, Holt RD. The national diet and nutrition survey of 1.5 to 4.5 year old children: summary of the findings of the dental survey. *Br Dent J* 1996;181:328-32.
 15. Ismail AI, Sohn W. The impact of universal access to dental care on disparities in caries experience in children. *JADA* 2001;132:295-303.
 16. Drury TF, Winn DM, Snowden CB, Kingman A, Kleinman DV, Lewis B. An overview of the oral health component of the 1988-1991 National Health and Nutrition Examination Survey (NHANES III-Phase 1). *J Dent Res* 1996;75(special number):620-30.
 17. York AK, Poindexter FR, Chisick MC. 1994 Tri-Service Comprehensive Oral Health Survey: Active duty report. Washington: Office of the Assistant Secretary for Health Affairs; June 1995. National Defense Research Institute report PR-9503.
 18. Ezzati TM, Massey JT, Waksberg J, Chu A, Maurer KR. Sample design: Third National Health and Nutrition Examination Survey. *Vital Health Stat* 2 1992;Sept(113):1-35.
 19. York AK, Poindexter FR, Chisick MC. 1994 Tri-Service Comprehensive Oral Health Survey: Recruit report. Washington: Office of the Assistant Secretary for Health Affairs. June 1995. National Defense Research Institute report PR-9502.
 20. Chisick MC, Poindexter FR, York AK. Comparing annual dental utilization rates of active duty U.S. military personnel and their employed civilian cohorts. *Mil Med* 1998;163(3):148-50.
 21. Chisick MC, Poindexter FR, York AK. Comparing dental utilization of United States of America military recruits with their employed civilian cohorts. *Clin Oral Investig* 1997;1(4):195-8.