Hispanic subgroups. More than 20 different countries of varied cultural, socioeconomic, and political backgrounds are currently included in this category of the U.S. population. Narrowing the gap in oral health between Hispanic and non-Hispanic groups will require improved data on health status, barriers to access, and disease factors underlying differences in oral health in these populations.

Asians, Native Hawaiians, and Other Pacific Islanders

National data for the oral health of Asian, Native Hawaiian, and other Pacific Islander (ANHPI) groups that can be generalized to the U.S. population are not available. Instead the profile of disease and health in this category is only available through studies of specific states and locales. Among all ethnic groups in California in 1993 and 1994, Asian and Pacific Islander American (APIA) children in Head Start had the highest prevalence of early childhood caries—20 percent compared to 14 percent for all Head Start children (Pollick et al. 1997). These data are comparable to other survey findings of 16 to 20 percent and 29 percent early childhood caries among APIA children in Hawaii and California, respectively (Greer unpublished, Louie et al. 1990).

A California study of 6- to 8-year-olds found disparities in the oral health status of APIA children in the state when compared to all children nationally. Among the California APIA children, 7.1 percent had untreated dental caries, with a significant portion of this group requiring urgent dental treatment. By comparison, NHANES III data indicate that in 1988-94, 29 percent of children in the United States aged 6 to 8 years had untreated dental decay.

There is variation in oral health status among subgroups of ANHPI children. In a recent survey in Hawaii, the prevalence of early childhood caries among APIA children was 16 percent, ranging from a low of 8 percent among Japanese children to a high of 25 percent among Filipino children. The prevalence of untreated dental caries in 6- to 8-year-old APIA children was 39 percent, which ranged from a low of 16 percent among Japanese children to 40 percent among Native Hawaiians, 48 percent among Southeast Asians, and 62 percent among non-Native Hawaiian Pacific Islanders (Greer 1999).

Oral cancer incidence and mortality rates for APIAs are lower than those for white non-Hispanics and African Americans. However, nasopharyngeal cancer incidence and mortality rates among Chinese and Vietnamese populations are many times higher than other groups (Miller et al. 1996), and therefore pose a unique health problem for these subgroups.

Until recent years, vital statistics and other health-related data were virtually nonexistent for the APIA population. Data for this group generally appeared in the "other" category of national surveys, and thus were not helpful in determining specific population-based oral or general health needs. Little national focus has been given to defining and measuring the oral health problems and related health care needs of the APIA population. These needs are now highlighted in the 2010 Healthy People Oral Health Objectives. A few statewide oral health data exist for some APIA child populations, but no ethnic subgroupings can be assessed. Again, this category of the U.S. population is extremely heterogeneous. It is estimated that 76 percent is from one of five ethnic origins and that 74 percent in 1990 were foreign born. More than 63 percent live in four states: California, New York, Hawaii, and Texas. Consequently, determining the reasons for variations in oral health will require additional data.

American Indian/Alaska Native Populations

Data on the oral health of American Indians and Alaska Natives (AI/AN) are available through studies conducted by the Indian Health Service (IHS) (Niendorfs 1994). The AI/AN people constitute about 1 percent of the U.S. population, or an estimated 2.5 million people in 2000. Little is known or can be easily determined about the general or oral health status of the 1 million AI/AN people not served by the IHS system. For this reason, with the exception of overall death rates obtained from census data, the statistics described in this section will be limited to the 1.5 million AI/AN served by the IHS. By and large, this group represents AI/AN people living on or near reservations.

Preliminary analyses of the IHS-wide Oral Health Status Survey of over 13,000 dental patients in 1999 revealed that some conditions have worsened and some improved since an earlier survey conducted in 1991 (IHS 1994, 2000). Across the IHS service population there was a statistically significant increase in caries among adults over 55 as measured by the decayed, missing, and filled teeth index. The decayed and filled tooth rate increased from 7.5 to 8.8 teeth, with no change in the average number of missing teeth for this age group.

Among AI/AN children across the IHS, there was a significant decline in caries in the permanent dentition and a significant increase in caries in the primary dentition. Among children aged 2 to 5 years, the increase in decayed and filled primary teeth surfaces went from 8.6 to 11.4. In general, AI/AN populations have much greater rates of dental caries and

periodontal disease in all age groups than the general U.S. population. AI/AN children aged 2 to 4 years have 5 times the rate of dental decay compared to all children, and 6- to 8-year-old AI/AN children have about twice the rate of dental caries experience. Rates for untreated decay in these age groups are 2 to 3 times higher than in the same age groups in the general U.S. population. Periodontal disease in AI/AN adults is 2.5 times greater than in the general U.S. population. High prevalence rates of diabetes among AI/AN populations are a significant contributing factor to this periodontal disease (IHS 2000).

Substantial unmet dental needs and quality of life issues have also been identified in IHS surveys, which included studies of representative AI/AN communities with regard to the effect of oral conditions on well-being and quality of life (Chen et al. 1997). (See Chapter 6 for a general discussion.) One third of schoolchildren report missing school because of dental pain. Twenty-five percent of schoolchildren avoid laughing or smiling, and 20 percent avoid meeting other people because of the way their teeth look. As a consequence of dental pain, almost a quarter of the adults are unable to chew hard foods, almost 20 percent report difficulty sleeping, and 15 percent limit their work and leisure activities. Three quarters of the elderly experience dental symptoms, and half perceive their dental health as poor or very poor and are unable to chew hard food. Almost half the adults avoid laughing, smiling, and conversation with others because of the way their teeth look.

Again, the available data allow for obtaining a picture only of the AI/AN population residing on reservations where services, including dental services, have been provided by the IHS or contracted to tribes or urban AI/AN organizations. In 1989, American Indians, residing in the current reservation states had a median household income of $19,897. Almost one third (31.6 percent) of AI/ANs lived below the poverty level. For some groups, diabetes and high rates of tobacco and alcohol use are prevalent and contribute to poor oral health.

Women's Health

Analysis of data from NHANES III indicates that women have benefited from the trend in general improvements in oral health that has been enjoyed by the U.S. population overall. Many, but not all, statistical indicators show women to have improved their oral health status as compared to men (NHANES III, Redford 1993). Adult females are less likely than males at each age group to have severe periodontal disease as measured by periodontal loss of attachment of 6 mm or more for any tooth. Both black and white females (6.0 and 6.0 per 100,000) have a substantially lower incidence rate of oral and pharyngeal cancers compared to black and white males, respectively (20.8 and 14.9 per 100,000). A higher prevalence of females than males have oral-facial pain, including pain from oral sores, jaw joints, face/cheek, and burning mouth syndrome. However, there are large areas for which information for either sex, even at the descriptive level, is only partial or nonexistent. Data gaps regarding craniofacial injuries, soft tissue pathologies, and salivary gland dysfunctions are notable examples.

Most oral diseases and conditions are complex and represent the product of interactions between genetic, socioeconomic, behavioral, environmental, and general health influences (Chapters 3 and 5). Multiple factors may act synergistically to place subgroups of women at higher levels of risk for oral diseases. For example, the comparative longevity of women, compromised physical status over time, and the combined effects of multiple chronic conditions often with multiple medications, can result in increased risk of oral disease (Redford 1993). Many women live in poverty, are not insured, and are the sole head of their household. For these women, obtaining needed oral health care may be difficult. In addition, gender-role expectations of women may also affect their interaction with dental care providers and could affect treatment recommendations as well (Redford 1993).

During the past decade, women's health has emerged as a significant issue in the nation's health agenda. The scientific community is beginning to respond to this concern by studying and reporting the effects of sex and gender differences on health and disease management. Although most of the effort has focused upon women, comparisons with men's health have begun to elucidate sex- and gender-specific differences.

Research has demonstrated sex and gender differences in the response to kappa opioid analgesics for the control of postoperative pain (Gear et al. 1996). These findings have heightened conjecture about differences in the female and male nervous systems in response to pain stimuli. There are studies in mice that suggest that there are sex-specific responses to pain and analgesics (Mogil et al. 1996, 1997). Taken together, these findings could help explain why women report certain painful conditions more than men; for example, temporomandibular joint disorders, trigeminal neuralgia, migraine headaches, and burning mouth syndrome (USDHHS 1999).

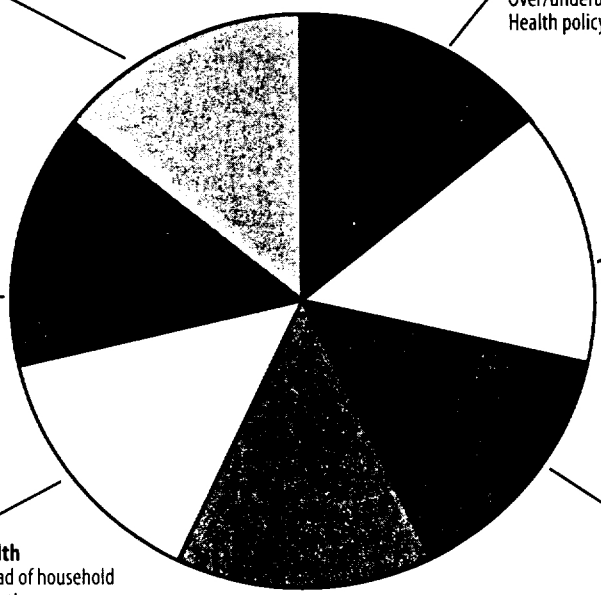
Recent research has also demonstrated sex and gender differences in taste perception. Women are more likely than men to be "supertasters" of a bitter compound known as 6-n-propylthyiouracil (PROP) (Bartoshuk et al. 1994). PROP supertasters experience more intense tastes (particularly for bitter and sweet), a greater sensation of oral burning in response to alcohol, and more intense sensations from fats in food (Bartoshuk et al. 1994, 1996, Tepper and Nurse 1997). PROP supertasters also have more fungiform papillae on their tongues than medium PROP tasters or those who cannot taste PROP at all.

The Agenda for Research on Women's Health for the 21st Century noted that the ability to interpret oral health in the context of sex and gender was limited by large gaps in knowledge. For example, pertinent oral health data, even at the descriptive level, are partial or nonexistent for many conditions and diseases for either sex. In addition, limited knowledge of etiologic factors, natural history of diseases, behavioral and environmental differences—to name a few—decreases the utility of those data that are available. For example, women are reported to be more inclined to self-care, to visit the dentist more often, and to be more likely to report symptoms such as pain. However, the effects of these behaviors on their oral health status cannot be determined fully. Figure 4.24 suggests content areas in the study of women's oral health.

Individuals with Disabilities

No national studies have been conducted to determine the prevalence of oral and craniofacial diseases among the various populations with disabilities. Several local and regional reports, however, provide some relevant data in this regard. For example, some smaller-scale studies show that the population with mental retardation or other developmental disabilities has significantly higher rates of poor oral hygiene

FIGURE 4.24
Content areas in the study of women's health



Oral Influences on Systemic Health
Evidence for links between oral infection and diabetes

Women and the Health Care System
Treatment decision making
Over/underutilization of professional services
Health policy

Diseases More Common in Women Than Men
TMD, oral-facial pain, Sjögren's syndrome, salivary gland dysfunction, burning mouth, alterations in taste, pregnancy-associated oral changes

Systemic Influences on Oral Health
Longevity
Multiple chronic conditions
Medication usage
Cognitive impairments
Physical confinement
Compromised functional status
Postmenopausal bone loss
HIV
Diabetes

Oral Diseases Affecting the Most Women
Caries
Periodontal diseases

Societal Influences on Women's Health
Caregiving
Poverty
Underinsurance
Access to care
Status as single head of household
Gender role expectations
Concern for aesthetics
Craniofacial trauma

Gender Influences on Health Risk
Dental care utilization
Self-care
Eating disorders
Unprotected sexual activity

Source: Adapted from Chesney and Ozer 1995 and reprinted in USDHHS 1999.

and needs for periodontal disease treatment than the general population, due, in part, to limitations in individual understanding of and physical ability to perform personal prevention practices or to obtain needed services. There is a wide range of caries rates among people with disabilities, but overall their rates are higher than those of people without disabilities. Much of the variation stems from where people reside (e.g., in large institutions where services are available versus in the community where services must be secured from community practitioners). Almost two thirds of community-based residential facilities report that inadequate access to dental care is a significant issue (Beck and Hunter 1985, White et al. 1995, Waldman et al. 1998, Dwyer, Northern Wisconsin Center for the Developmentally Disabled unpublished data, 1996). Parents consistently report dental care as one of the top needed services for their children with disabilities regardless of age (Haveman et al. 1997). Local studies of independent living centers reported that 24 to 30 percent of adults with cerebral palsy, 14 percent with spinal cord injuries, 30 percent with head injuries, and 17 percent who were deaf had dental problems (Arnett 1994). Results from 1999 oral assessments of U.S. Special Olympics athletes (all ages), based on an extremely conservative assessment protocol (without the use of x-rays, mirrors, or explorers), and carried out by the Special Olympics Special Smiles Program in 20 states, indicate that 12.9 percent of the athletes reported some form of oral pain, 39 percent demonstrated signs of gingival infection, and nearly 25 percent had untreated decay (Special Olympics, Inc., unpublished data). Note that this is a population that tends to be from higher-income families.

The oral health problems of individuals with disabilities are complex. These problems may be due to underlying congenital anomalies as well as to inability to receive the personal and professional health care needed to maintain oral health. There are more than 54 million individuals defined as disabled under the Americans with Disabilities Act, including almost a million children under age 6 and 4.5 million children between 6 and 16 years of age. A greater percentage of males than females and of African Americans than Hispanics and whites have disabilities (Federal Interagency Forum 1997, Waldman et al. 1999). Children with disabilities have chronic physical, developmental, behavioral, and emotional limitations, including mental retardation, autism, attention deficit hyperactivity disorders, and cerebral palsy. Also, children from families with incomes below the poverty level are about one third more likely than children in nonpoor families to have an existing special health care need. Similarly, children from less educated households exhibit a higher likelihood of a special health care need. Children in single-parent families are about 40 percent more likely than children from two-parent households to have special health care needs (Newacheck et al. 1998). Deinstitutionalization has resulted in highlighting the problem these individuals have regarding access to dental care as they move from childhood to adulthood. Availability of dental providers trained to serve special needs populations and limited third-party support for the delivery of complex services (see Chapter 9) further complicate the issues entailed in addressing the needs of this population.

Given the wide variability among groups with disabilities, this review of oral health status and needs is quite limited. More in-depth assessment and analysis of the determinants of oral health status, access to care, and the role of oral health in the overall quality of life and life expectancy of individuals with disabilities are needed (see Chapter 10).

UTILIZATION OF PROFESSIONAL CARE: WHAT DO WE KNOW ABOUT THE RELATIONSHIP OF ORAL HEALTH AND USE OF DENTAL SERVICES?

With few exceptions, maintenance of oral health through a lifetime requires timely receipt of advice for self-care, preventive therapies, early detection and treatment of problems, and restoration of function. Chapter 7 describes community-based and professional interventions that have played a significant role in the improvement of oral health achieved over the past 50 years; their full promise has not, however, been realized. Chapter 8 describes current and emerging strategies for personal and provider approaches to maintain and restore oral health, with tooth-conserving approaches being employed more and more frequently. As noted earlier, almost everyone experiences oral diseases and conditions over the course of a lifetime, and, unlike the common cold, most diseases do not resolve over time. Consequently, receipt of dental services complements self-care as a critical factor in achieving and maintaining good oral health.

Although certain counseling and screening services provided by physicians are recommended (U.S. Preventive Services Task Force 1996), data to indicate how many persons receive such services or oral-health-related recommendations from their physician are very limited. There are also no data on physician-based services for oral and craniofacial conditions. The data that *are* available describe utilization

of dental visits. Unfortunately, most of these data are cross-sectional, describing the experience of the population in any given year, but providing little detail about how patterns of care over time contribute to oral health. Nevertheless, utilization of care is used as a surrogate measure of an individual's or a population's capacity to maintain or improve health status. An understanding of utilization of dental visits and differences in such visits among age, racial/ethnic, sex, and income groups is important in identifying opportunities for improvement in oral health that would follow from timely receipt of professional care.

Characteristics of groups with different levels of dental care utilization suggest barriers to care as well as factors that predispose or enable access to dental care. Explanations for variation in utilization are alluded to in the following section, and are discussed in further detail in Chapter 10. More studies are needed to understand the dimensions of disease and the role of professional care and use of services. Also, for oral health in particular, the contributions of all health professions and the interdisciplinary nature of care need to be emphasized.

Dental Care Utilization

Visiting a health care provider at least once per year and the number of visits made within the past year are used as indicators of an individual's ability to access professional services. Dental care utilization statistics are traditionally based on an individual's reporting "at least one dental visit in the past year," although there are variations with shorter recall intervals and different forms of the question. Depending on the question and survey method, annual dental care use estimates vary. The 1996 Medical Expenditures Panel Survey (MEPS) estimates that 43 percent of the U.S. population 2 years and older had at least one dental visit that year (MEPS 2000). Responding to a variation of a question that had been asked in many previous surveys, some 65.1 percent of the U.S. population 2 years and older reported in 1997 that they had visited a dentist in the preceding year (NCHS 1997b), up from 55.0 percent in 1983 (Bloom et al. 1992). The average number of visits per person remains at about two per year. Further research is needed to understand reasons for variations in estimates from different survey approaches, but differences among persons with different characteristics are quite similar regardless of survey method.

Data from the 1997 National Health Interview Survey, reprinted in Healthy People 2010, indicate that the highest percentage reporting at least one

TABLE 4.3
Percentage of persons 25 years of age and older with a dental visit within the preceding year, by selected patient characteristics, selected years

	1983[a]	1989[a]	1990	1991	1993
Total[b,c]	53.9	58.9	62.3	58.2	60.8
Age					
25 to 34 years	59.0	60.9	65.1	59.1	60.3
35 to 44 years	60.3	65.9	69.1	64.8	66.9
45 to 64 years	54.1	59.9	62.8	59.2	62.0
65 years and older	39.3	45.8	49.6	47.2	51.7
65 to 74 years	43.8	50.0	53.5	51.1	56.3
75 years and older	31.8	39.0	43.4	41.3	44.9
Sex[c]					
Male	51.7	56.2	58.8	55.5	58.2
Female	55.9	61.4	65.6	60.8	63.4
Poverty status[c,d]					
Below poverty	30.4	33.3	38.2	33.0	35.9
At or above poverty	55.8	62.1	65.4	61.9	64.3
Race and Hispanic origin[c]					
White, non-Hispanic	56.6	61.8	64.9	61.5	64.0
Black, non-Hispanic	39.1	43.3	49.1	44.3	47.3
Hispanic[e]	42.1	48.9	53.8	43.1	46.2
Education[c]					
Less than 12 years	35.1	36.9	41.2	35.2	38.0
12 years	54.8	58.2	61.3	56.7	58.7
13 years or more	70.9	73.9	75.7	72.2	73.8
Education, race, and Hispanic origin[c]					
Fewer than 12 years					
White, non-Hispanic	36.1	39.1	41.8	38.1	41.2
Black, non-Hispanic	31.7	32.0	37.9	33.0	33.1
Hispanic[e]	33.8	36.5	42.7	28.9	33.0
12 years					
White, non-Hispanic	56.6	59.8	62.8	58.8	60.4
Black, non-Hispanic	40.5	44.8	51.1	43.1	48.2
Hispanic[e]	48.7	56.5	59.9	49.5	54.6
13 years or more					
White, non-Hispanic	72.6	75.8	77.3	74.2	75.8
Black, non-Hispanic	54.4	57.2	64.4	61.7	61.3
Hispanic[e]	58.4	66.2	67.9	61.2	61.8

[a] Data for 1983 and 1989 are not strictly comparable with data for later years. Data for 1983 and 1989 are based on responses to the question "About how long has it been since you last went to a dentist?" Starting in 1990, data are based on the question "During the past 12 months, how many visits did you make to a dentist?"

[b] Includes all other races not shown separately and unknown poverty status and education level.

[c] Age adjusted.

[d] Poverty status is based on family income and family size using Bureau of the Census poverty thresholds.

[e] Persons of Hispanic origin may be of any race.

Notes: Data are based on household interviews of a sample of the civilian noninstitutionalized population. Denominators exclude persons with unknown dental data. Estimates for 1983 and 1989 are based on data for all members of the sample household. Beginning in 1990, estimates are based on one adult member per sample household. Estimates for 1993 are based on responses during the last half of the year only.

Source: Data from NCHS 1989.

dental visit was third-grade children (82 percent). Those aged 25 years and older with less than a high school education had the lowest rates (41 percent) for annual dental visits as compared to those with at least some college education (74 percent) (USDHHS 2000).

Variation by Sex, Race/Ethnicity, Income, and Insurance

Dental care utilization varies with sex and race/ethnicity for individuals 25 and older (NCHS 1997a). Females had slightly higher rates of utilization (67 percent) than males (63 percent). Hispanic individuals had the lowest utilization (53 percent), and non-Hispanic whites had the highest rates (68 percent). Table 4.3 provides an overview of utilization from 1983 through 1993. A higher percentage of females reported a dental visit than males in each survey year. Fewer non-Hispanic blacks and Hispanics reported a dental visit than non-Hispanic whites in each survey year. Income and education are also key variables in utilization. In 1993, almost twice as many individuals 25 and older living at or above the poverty line had a dental visit than did those living below the poverty line in 1993 (64.3 versus 35.9 percent). Similarly, almost twice as many individuals with 13 years or more of education had a visit than did those with fewer than 12 years of education (73.8 versus 38.0 percent) in that same year.

Data from the 1989 National Health Interview Survey showed that the overall age-adjusted number of visits for blacks was 1.2 visits compared to 2.2 visits for whites (Bloom et al. 1992).

Table 4.4 shows the percentage distributions of the interval since their most recent dental visit for people aged 2 and older in selected demographic and socioeconomic categories. Individuals who have never visited a dentist ranged from a high of 13.1 percent of Mexican Americans to 5.8 percent of blacks and 4.4 percent of whites. Eleven percent of the population had not had a dental visit in 5 years or more. Individuals with fewer than 9 years of education represented the highest proportion, 30.6 percent, of those reporting no dental visit in 5 years

TABLE 4.4
Age-adjusted percentage distribution of persons 2 years and older by interval since last dental visit, by selected characteristics, 1989

	Interval Since Last Dental Visit					
	All Intervals	Less Than 1 Year	1 Year to Less Than 2 Years	2 Years to Less Than 5 Years	5 Years or More	Never
All ages	100.0	57.3	9.5	12.3	11.0	4.6
Sex						
Male	100.0	54.7	9.6	13.4	12.1	4.9
Female	100.0	59.9	9.4	11.2	10.1	4.4
Race						
White	100.0	59.5	9.1	11.6	10.5	4.4
Black	100.0	43.2	12.3	16.9	15.1	5.8
Other	100.0	51.6	9.7	14.0	10.8	6.7
Hispanic origin						
Non-Hispanic	100.0	58.5	9.4	12.0	10.8	4.1
Hispanic	100.0	46.0	10.5	14.6	13.0	9.7
Mexican American	100.0	40.5	8.9	15.3	15.8	13.1
Other Hispanic	100.0	53.2	12.3	13.7	9.9	5.1
Place of residence						
MSA[a]	100.0	58.4	9.4	11.9	10.1	4.5
Central city	100.0	54.9	10.1	12.9	10.9	5.1
Not central city	100.0	60.6	9.0	11.3	9.6	4.2
Not MSA[a]	100.0	53.6	9.7	13.6	14.1	5.1
Geographic region						
Northeast	100.0	60.7	10.4	10.7	9.0	3.5
Midwest	100.0	61.5	8.3	11.3	10.7	3.5
South	100.0	52.2	10.3	13.9	13.6	5.9
West	100.0	57.8	8.6	12.3	9.1	4.9
Education level						
Less than 9 years	100.0	30.6	9.9	18.4	30.6	5.9
9 to 11 years	100.0	39.0	10.7	20.3	23.5	1.3
12 years	100.0	54.6	10.6	15.0	14.4	0.5
13 years or more	100.0	70.2	8.5	10.3	6.9	0.2
Family income						
Less than $10,000	100.0	42.2	10.9	16.3	20.1	7.0
$10,000 to $19,999	100.0	43.9	11.8	17.4	16.1	6.6
$20,000 to $34,999	100.0	58.2	10.5	3.2	10.4	4.6
$35,000 or more	100.0	72.5	7.8	8.5	5.5	2.9
Dental insurance coverage						
With private dental insurance	100.0	70.4	8.7	9.2	6.6	3.3
Without private dental insurance	100.0	50.8	10.7	15.4	14.2	6.0

[a] MSA = metropolitan statistical area.
Source: Bloom et al. 1992.

or more, compared with 6.9 percent of those with 13 years or more of education. A larger proportion of individuals without private dental insurance had not had a dental visit in 5 years or more compared with those with private dental insurance (14.2 versus 6.6 percent). Hispanic individuals have the lowest rate of dental insurance coverage—29.0 percent, compared with 32.4 percent for non-Hispanic blacks and 41.8 percent for non-Hispanic whites (U.S. Bureau of the Census 1997).

Professional care is necessary for several critical dental disease prevention measures, such as the application of dental sealants. Unfortunately, dental sealants are 3 times less likely to be found on the teeth of Mexican American and African American children than among white children aged 5 to 17 (Selwitz et al. 1996). Asian and Pacific Islander American children in California also demonstrated a low rate of sealant use (Pollick et al. 1997).

Variation by Oral Health Status

Utilization of dental care is associated with self-reported health status, as shown in Table 4.5. Of those who reported "excellent" or "very good" health, 61.4 percent had had a dental visit within the past year, compared with about 45.1 percent of those reporting "fair" or "poor" health. Functional limitations are also related to dental service utilization. Of those who reported no physical limitations in activities, 58.5 percent reported a dental visit within the past year, compared to 46.6 percent of those who were unable to carry out their usual activities (Table 4.5) (Bloom et al. 1992).

Whether a person had natural teeth was strongly associated with dental care utilization (Table 4.5). Dentate persons were more than 4 times more likely to report a dental visit within the past year than edentulous people: 65.5 versus 14.3 percent. Over half (55.2 percent) of those who were edentulous reported that they had not had a dental visit in 5 years or more.

Recent analyses of data from NHANES III show that adults 18 and older who reported a dental visit in the past 12 months were nearly 9 times more likely to be dentate and 4.4 times more likely to have a complete dentition than adults who did not report visiting a dentist within the preceding 12 months. Dentate adults who reported a dental visit in the past 12 months were 3.1 times less likely to have untreated coronal decay and 1.5 times less likely to have gingivitis than dentate adults who did not report a recent dental visit (T. Drury, NIDCR, personal communication, 1999).

A study comparing individuals who had had a dental visit in the past 12 months with those who had not reported that dentate adults who had a recent visit were less likely to have untreated coronal and root caries, pulpal pathology, and retained tooth roots. They also were more likely to rate the general condition of their teeth and gums as excellent or very good (Drury and Redford 2000).

Examination of NHANES III data by low socioeconomic status (SES) provides an additional perspective. In a recent analysis, SES was measured by a composite index based on educational attainment and the ratio of annual family income to the poverty threshold. Among all adults, people with lower SES scores were nearly 9 times more likely to be edentulous than those with higher SES scores. Among the dentate, those with lower SES scores were 6 times more likely to have coronal decay and nearly 4 times less likely to have visited a dentist in the past 12 months (Drury et al. 1999).

TABLE 4.5
Age-adjusted percentage distribution of persons 2 years and older by interval since last dental visit, by selected health characteristics, 1989

	Interval Since Last Dental Visit					
	All Intervals	Less Than 1 Year	1 Year to 2 Years	2 Years to Less Than 5 Years	5 Years or More	Never
Assessed health status						
Excellent or very good	100.0	61.4	9.3	11.2	9.0	4.3
Good	100.0	51.9	10.1	13.9	12.6	5.8
Fair or poor	100.0	45.1	10.0	16.6	17.4	5.9
Limitation of activity						
Unable to carry on usual activity	100.0	46.6	9.8	15.6	16.6	5.1
Limited in amount or kind of major activity	100.0	52.3	9.8	14.0	14.4	4.7
Limited, but not in major activity	100.0	59.1	8.3	12.8	11.7	4.2
Not limited in activity	100.0	58.5	9.5	12.0	10.1	4.6
Dentition status						
Dentate	100.0	65.5	9.6	12.8	10.1	0.5
Edentulous	100.0	14.3	6.4	19.8	55.2	0.4

Source: Bloom et al. 1992.

Reasons for Nonutilization

Reasons for nonutilization of dental services are complex. Principal reasons cited by respondents of all ages (Bloom et al. 1992) are given in Table 4.6. Slightly less than half of those reporting no dental visit in the past year (46.8 percent) said that they perceived having no dental problem. This perception was the predominant response of individuals in all demographic categories, except for those 65 and older, who gave having no teeth as the predominant reason. Younger individuals were more likely than older to cite "no dental problem." Blacks were more likely to report "no problems" (58.5 percent) as a reason for no dental visit, compared to 44.3 percent of whites (Bloom et al. 1992).

Having no teeth (14.3 percent) was the next most frequently reported reason for no dental visit. About half of the people 65 and older in the 1989 survey gave this as their reason for no dental visit—39.2 percent of blacks compared to 51.2 percent of whites.

The third most frequently cited reason was the cost of care, mentioned by 13.7 percent of respondents. Whites (14.3 percent) were more likely than blacks (11.4 percent) to cite cost. Other surveys have reported substantially higher percentages of individuals indicating cost as a barrier, particularly those in underserved or low-income areas (Bloom et al. 1992). The age group most sensitive to the cost of care was 18- to 34-year-olds, 19.1 percent of whom gave cost as the reason for no dental visit. Finally, a small proportion of respondents (4.3 percent) reported fear as a personal barrier to receipt of care.

Unmet Needs

Unmet health needs can be assessed in many ways. Because oral diseases are common and do not resolve over time in the absence of intervention, the lack of dental visits is used as an indicator of unmet health needs. In addition, the National Access to Care Survey documented the extent of dental care that individuals wanted but could not obtain ("wants") in the total population and among various population subgroups (Mueller et al. 1998). About 8.5 percent of the U.S. population wanted, but did not obtain, dental care in 1994 (Table 4.7). In contrast, only 5.6 percent reported unmet medical or surgical care wants. Adult women aged 19 to 64 reported the greatest level of dental care wants; elderly people 65 and older had the lowest level. Blacks, people in fair or poor health or with one or more chronic conditions, and people living in the South reported higher levels of dental care wants than comparable groups. About 16.4 percent of those in households whose family income was less than 150 percent of the poverty level reported dental care wants. More than 22 percent of the uninsured reported dental care wants. Insured children with special health care needs were 4 times more likely to report unmet need for dental care (23.9 percent versus 6.1 percent) if they were uninsured than if they were insured, according to a recent analysis of data from the National Health Interview Survey (Newacheck et al. 2000).

Outcomes of Appropriate Levels of Access and Utilization: An Example

The effects on health of a system of care with assured access and positive expectations of care-seeking and utilization behavior have been demonstrated by the U.S. Department of Defense. There are currently over 1.4 million men and women on active duty in the U.S. military. The population is predominantly male (86 percent). The racial distribution is 68 percent white, 20 percent black, 7 percent Hispanic, 3 percent Asian, and 2 percent other groups. Slightly over 30 percent of active duty personnel are between the ages of 20 and 24, and 91 percent are younger than 40. In 1997, 59 percent were married. Seventy-six percent had a high school degree, and 19 percent were college graduates.

Free dental care, one of the benefits provided to active duty military personnel, eliminates one of the significant barriers that has been identified as limiting access to care for many in the civilian population. In addition, military personnel are required to receive a dental examination annually, even if the individual perceives that he or she has "no problem." Dental care is available to most military personnel at their duty station, eliminating the need to travel long distances. A comparison of the oral health and utilization of dental care of the military and civilian populations illustrates the impact of elimination of these barriers to care on oral health, even for persons from demographic groups that are traditionally underserved.

In 1994 the Tri-Service Comprehensive Oral Health Survey examined and administered questionnaires to 13,050 active duty military personnel using a complex, weighted survey design to examine the oral health status, dental treatment needs, dental utilization, and perceived need for care in this population (York et al. 1995). The study found that nearly all (99.2 percent) active duty military personnel had seen a dentist within the past 2 years. Eighty percent of active duty personnel received a dental examination within the past year, 60 percent had a dental

TABLE 4.6

Percentage of persons with no dental visit in past year by reason reported, by selected characteristics, 1989

	All with No Visits in Past Year	Fear	Cost	Access Problem	No Dental Problem	No Teeth	Not Important	Other Reason
Age								
All ages	100.0	4.3	13.7	1.7	46.8	14.3	2.3	8.7
2 to 17 years	100.0	1.3	15.0	1.5	56.8	0.2	1.9	11.9
18 to 34 years	100.0	5.9	19.1	2.4	52.4	0.7	3.2	9.5
35 to 64 years	100.0	5.8	12.8	1.5	43.3	17.8	2.2	8.4
65 years and older	100.0	2.2	4.1	1.1	31.2	49.7	1.1	3.9
Sex								
Male								
All ages	100.0	4.0	13.0	1.5	49.1	12.1	2.6	9.3
2 to 17 years	100.0	1.2	14.9	1.3	56.2	*0.2	2.0	12.1
18 to 34 years	100.0	5.5	17.5	2.0	54.8	0.6	3.4	9.7
35 to 64 years	100.0	5.4	11.2	1.5	45.4	16.1	2.8	9.5
65 years and older	100.0	1.7	4.0	1.0	33.6	48.6	1.3	3.5
Female								
All ages	100.0	4.6	14.3	1.8	44.4	16.6	1.9	8.1
2 to 17 years	100.0	1.5	15.2	1.6	57.4	*0.2	1.8	11.6
18 to 34 years	100.0	6.5	21.0	2.9	49.5	0.8	3.0	9.3
35 to 64 years	100.0	6.2	14.4	1.5	41.1	19.5	1.6	7.3
65 years and older	100.0	2.5	4.2	1.2	22.5	50.6	0.9	4.1
Race								
White								
All ages	100.0	4.4	14.3	1.8	44.3	15.7	2.4	9.4
2 to 17 years	100.0	1.3	16.4	1.7	54.0	0.2	2.0	13.3
18 to 34 years	100.0	6.2	20.7	2.6	49.6	0.7	3.4	10.6
35 to 64 years	100.0	5.8	13.0	1.6	41.3	19.0	2.4	9.1
65 years and older	100.0	2.1	3.7	1.1	30.5	51.2	1.1	3.9
Black								
All ages	100.0	4.0	11.4	1.0	58.5	8.8	1.5	5.1
2 to 17 years	100.0	1.3	10.7	*0.7	68.3	*0.2	1.2	6.6
18 to 34 years	100.0	4.9	13.3	1.5	63.8	*0.7	2.5	4.6
35 to 64 years	100.0	6.0	11.7	0.9	52.8	13.0	1.1	4.9
65 years and older	100.0	3.0	7.0	*1.0	36.6	39.2	*0.9	3.4
Other								
All ages	100.0	3.7	10.8	1.6	52.1	6.1	2.2	9.2
2 to 17 years	100.0	*1.7	11.4	*0.3	49.8	*0.0	*2.4	12.6
18 to 34 years	100.0	4.6	11.7	*2.5	59.4	*0.3	*2.2	8.8
35 to 64 years	100.0	4.6	10.8	*1.9	51.0	8.2	*2.6	7.7
65 years and older	100.0	*2.8	*4.2	*0.7	31.4	44.9	*0.7	*5.9
Hispanic origin								
Non-Hispanic								
All ages	100.0	4.3	13.0	1.7	45.7	15.6	2.2	9.1
2 to 17 years	100.0	1.3	14.4	1.3	56.2	0.2	1.9	12.8
18 to 34 years	100.0	6.0	18.9	2.5	51.6	0.7	3.2	10.1
35 to 64 years	100.0	5.8	12.0	1.5	42.5	18.8	2.2	8.7
65 years and older	100.0	2.1	4.0	1.1	30.9	50.4	1.1	3.9
Hispanic, total								
All ages	100.0	4.0	19.1	1.8	56.1	3.5	2.6	5.9
2 to 17 years	100.0	1.6	18.4	2.4	59.5	*0.1	2.2	7.3
18 to 34 years	100.0	5.2	20.1	1.5	57.9	*0.2	3.3	5.6
35 to 64 years	100.0	5.3	20.7	1.6	52.2	6.5	2.3	5.2
65 years and older	100.0	*4.6	8.2	*1.4	40.7	31.9	*1.6	*3.4

	All with No Visits in Past Year	Fear	Cost	Access Problem	No Dental Problem	No Teeth	Not Important	Other Reason
Hispanic, Mexican American								
All ages	100.0	3.6	20.7	1.7	56.2	2.4	2.3	5.3
2 to 17 years	100.0	*1.4	19.4	2.6	60.7	*0.1	2.2	5.5
18 to 34 years	100.0	4.7	21.0	*0.9	57.5	*0.1	2.8	4.8
35 to 64 years	100.0	5.2	24.3	*1.4	50.1	4.5	*1.7	6.4
65 years and older	100.0	*4.3	*11.1	*1.4	38.7	30.5	*1.8	*1.8
Hispanic, other								
All ages	100.0	4.7	16.3	2.0	55.9	5.3	3.1	7.0
2 to 17 years	100.0	*1.8	16.3	*1.9	56.9	*0.2	*2.0	11.3
18 to 34 years	100.0	6.2	18.5	*2.4	58.7	*0.4	4.4	7.0
35 to 64 years	100.0	5.5	16.3	*1.8	54.9	8.9	*3.1	3.8
65 years and older	100.0	*4.9	*5.7	*1.4	42.8	33.2	*1.4	*4.9
Place of residence								
MSA, total[a]								
All ages	100.0	4.4	13.4	1.8	46.6	12.8	2.4	9.0
2 to 17 years	100.0	1.3	14.1	1.4	55.7	0.3	2.0	12.1
18 to 34 years	100.0	5.7	18.5	2.6	51.6	0.5	3.3	9.6
35 to 64 years	100.0	6.1	12.6	1.6	43.1	16.0	2.4	8.7
65 years and older	100.0	2.3	4.2	1.1	31.4	47.6	1.2	4.0
MSA, central city[a]								
All ages	100.0	4.4	14.0	1.7	48.0	11.9	2.6	7.8
2 to 17 years	100.0	1.6	14.6	1.4	56.5	*0.2	2.0	10.0
18 to 34 years	100.0	5.3	17.9	2.5	54.2	0.4	3.6	8.4
35 to 64 years	100.0	6.4	14.1	1.3	43.9	14.8	2.5	7.3
65 years and older	100.0	2.5	4.7	1.3	31.5	46.3	1.7	4.2
MSA, not central city[a]								
All ages	100.0	4.3	13.0	1.8	45.5	13.5	2.3	9.9
2 to 17 years	100.0	1.2	13.7	1.4	55.1	*0.4	2.0	13.7
18 to 34 years	100.0	6.0	19.0	2.6	49.5	0.6	3.1	10.6
35 to 64 years	100.0	5.8	11.6	1.7	42.6	16.8	2.4	9.6
65 years and older	100.0	2.1	3.9	1.0	31.3	48.5	0.8	4.0
Not MSA[a]								
All ages	100.0	4.1	14.4	1.4	47.7	18.8	1.7	8.0
2 to 17 years	100.0	1.3	18.0	1.6	60.0	*0.1	1.5	11.2
18 to 34 years	100.0	6.9	21.1	1.7	55.4	1.2	2.7	9.1
35 to 64 years	100.0	4.9	13.1	1.2	43.8	23.1	1.6	7.7
65 years and older	100.0	2.0	3.9	1.0	30.7	55.2	0.9	3.5
Family income[b]								
Less than $10,000								
All ages	100.0	3.8	19.7	1.7	42.8	22.5	1.4	6.4
2 to 17 years	100.0	*1.1	19.4	2.6	60.0	*0.3	1.9	9.6
18 to 34 years	100.0	5.7	28.8	2.4	51.7	*0.9	1.9	7.2
35 to 64 years	100.0	6.3	25.2	*1.1	35.5	25.1	1.4	5.4
65 years and older	100.0	2.0	6.6	*0.9	27.4	57.4	*0.7	3.9
$10,000 to $19,999								
All ages	100.0	4.0	18.8	1.5	47.0	17.4	1.7	6.5
2 to 17 years	100.0	1.4	21.9	1.4	58.8	*0.1	1.3	7.9
18 to 34 years	100.0	6.1	27.8	1.8	53.2	*0.5	2.4	7.9
35 to 64 years	100.0	4.7	19.2	1.5	43.6	21.7	1.6	5.7
65 years and older	100.0	3.0	3.4	1.2	31.4	51.9	1.3	4.3
$20,000 to $34,999								
All ages	100.0	4.8	13.7	1.7	51.3	11.5	2.3	11.1
2 to 17 years	100.0	1.6	14.4	0.9	59.7	*0.1	1.7	13.8
18 to 34 years	100.0	6.4	18.1	2.8	54.7	0.8	3.3	12.3
35 to 64 years	100.0	6.4	12.5	1.4	46.2	18.5	2.0	10.2
65 years and older	100.0	1.8	2.4	*1.3	38.5	47.7	*1.5	4.7

(continues)

TABLE 4.6 continued

	All with No Visits in Past Year	Fear	Cost	Access Problem	No Dental Problem	No Teeth	Not Important	Other Reason
$35,000 or more								
All ages	100.0	5.9	6.8	2.6	52.3	8.1	4.1	14.1
2 to 17 years	100.0	1.1	5.8	2.0	56.8	*0.6	3.1	20.2
18 to 34 years	100.0	7.0	9.2	3.6	55.4	*0.6	5.4	13.4
35 to 64 years	100.0	7.8	6.0	2.3	49.7	13.2	4.0	12.9
65 years and older	100.0	*2.8	3.8	*1.6	37.9	41.6	*2.0	4.4
Dental insurance coverage								
With dental insurance								
All ages	100.0	6.2	7.2	2.5	53.2	10.1	3.4	15.2
2 to 17 years	100.0	1.2	7.8	1.2	61.4	*0.3	2.4	18.8
18 to 34 years	100.0	8.5	9.5	4.1	55.5	0.8	5.1	16.3
35 to 64 years	100.0	8.0	6.0	2.2	48.8	17.4	3.1	13.7
65 years and older	100.0	2.5	*1.6	*1.1	39.3	44.7	*1.0	5.7
Without dental insurance								
All ages	100.0	4.0	18.5	1.5	48.7	17.2	2.0	7.0
2 to 17 years	100.0	1.6	20.5	1.7	60.1	*0.2	1.9	9.9
18 to 34 years	100.0	5.5	26.7	1.9	56.3	0.7	2.7	7.6
35 to 64 years	100.0	5.4	18.9	1.3	45.1	19.9	2.1	6.8
65 years and older	100.0	2.3	4.9	1.2	31.9	52.5	1.2	3.9
Insurance status unknown								
All ages	100.0	1.6	3.9	0.7	23.8	9.3	0.8	2.9
2 to 17 years	100.0	*0.6	4.7	*1.0	25.7	*0.1	*0.6	3.6
18 to 34 years	100.0	2.3	5.1	*0.9	28.2	*0.3	1.1	3.5
35 to 64 years	100.0	1.5	3.4	*0.3	20.8	9.2	*0.7	2.0
65 years and older	100.0	*1.4	*1.6	*0.6	19.8	36.8	*0.6	2.6
Limitation of activity								
Unable to carry on usual activity								
All ages	100.0	4.4	15.4	1.7	33.2	31.9	1.1	6.2
2 to 17 years	100.0	*6.0	*27.6	*0.0	36.6	*0.0	*1.5	*20.1
18 to 34 years	100.0	7.4	25.3	*1.9	47.1	*1.9	*1.9	6.1
35 to 64 years	100.0	5.4	18.3	*1.2	34.5	28.9	*1.1	6.6
65 years and older	100.0	*1.7	6.6	2.4	26.0	49.9	*0.7	4.6
Limited in amount or kind of major activity								
All ages	100.0	4.4	15.2	1.9	34.5	29.7	1.7	7.5
2 to 17 years	100.0	*1.7	18.9	*2.5	58.0	*0.3	*2.0	9.1
18 to 34 years	100.0	6.9	30.2	*3.9	44.3	*0.8	*1.8	10.4
35 to 64 years	100.0	6.1	17.6	1.7	31.2	27.1	2.2	9.3
65 years and older	100.0	2.4	5.1	*1.2	26.3	54.3	*1.1	3.9
Limited, but not in major activity								
All ages	100.0	4.4	12.4	0.9	34.3	35.8	1.5	6.3
2 to 17 years	100.0	*1.7	28.0	*2.2	53.0	*0.0	*1.7	*10.8
18 to 34 years	100.0	8.0	29.2	*1.9	50.5	*1.4	*1.7	10.3
35 to 64 years	100.0	6.3	17.5	*0.8	35.3	24.0	*2.0	8.0
65 years and older	100.0	2.6	3.9	*0.6	28.2	54.4	*1.2	3.9
Not limited in activity								
All ages	100.0	4.3	13.5	1.7	49.6	10.4	2.4	9.2
2 to 17 years	100.0	1.3	14.7	1.4	56.9	0.2	1.9	11.9
18 to 34 years	100.0	5.8	18.2	2.4	52.9	0.6	3.3	9.6
35 to 64 years	100.0	5.8	11.3	1.5	46.1	15.1	2.4	8.6
65 years and older	100.0	2.1	3.4	0.9	34.3	47.3	1.2	3.7

[a] MSA = metropolitan statistical area.

[b] Persons with unknown income not shown separately.

Note: Data are based on household interviews of the civilian noninstitutionalized population.

* = Figure does not meet the standard of reliability or precision (more than 30 percent relative standard error and numerator of percent or rate).

Source: Bloom et al. 1992.

TABLE 4.7
Estimated number and percentage of people with unmet health care wants, by selected characteristics, 1994

	Number of People (in millions)	Dental Care (percentage)	Medical or Surgical Care (percentage)
All people	259.2	8.5	5.6
Age and sex			
Children, 1 to 18 years	73.5	5.9[a]	2.9[a]
Adult men, 19 to 64 years	75.3	9.5	5.8
Adult women, 19 to 64 years	79.3	12.1[a]	9.3[a]
Elderly people, 65 years and older	31.1	3.6[a]	2.4[a]
Race/ethnicity			
White	191.4	7.4	4.6
Black	32.2	15.0[a]	10.2[a]
Hispanic	23.9	8.2	6.2
Other	11.7	9.9	8.6
Health status			
Fair or poor	24.6	16.1[a]	11.2[a]
Good or excellent	233.5	7.7	5.0
Number of chronic conditions			
None	158.6	7.3	4.6
One or more	100.6	10.4	7.1
Geographical region			
Northeast	47.8	6.9	5.8
Midwest	65.8	6.9	4.5
South	92.6	11.2[a]	6.1
West	53.1	7.4	5.9
Rural/urban status			
Metropolitan statistical areas	208.2	8.6	5.6
Nonmetropolitan statistical areas	50.5	8.1	5.9
Education level of head of household			
High school or less	117.5	9.4	6.8
Some post-high school	141.2	7.9	4.7
Family income status			
Less than 150 percent of the poverty level	55.7	16.4[a]	9.1[a]
150 percent of the poverty level or more	174.3	6.3[a]	4.5
Health insurance status			
Private	166.6	5.9[a]	4.1
Medicare	36.0	5.6[a]	3.1[a]
Medicaid	22.2	12.2	8.0
Uninsured	32.5	22.6[a]	14.9[a]
Type of private health insurance			
Health maintenance organization/ independent practice association	45.1	5.5[a]	5.0
Preferred provider organization	30.7	4.6[a]	4.1
Fee-for-service	73.5	5.3[a]	3.1[a]

[a] The estimate differs from the percentage for the "all people" demographic at the 1 percent confidence level based on a two-tailed *t*-test of the difference in weighted estimates.
Note: The standard error of each percentage is less than 30 percent of the percentage estimate.
Source: Mueller et al. 1998. Access to dental care in the United States. JADA 1998 April; 129(4):429-37. Copyright 1998 by *Journal of the American Dental Association*. Reprinted by permission of ADA Publishing Co. Inc. (2000).

prophylaxis, and 29 percent had at least one tooth filled.

Edentulism is virtually nonexistent in the active duty military population. Also, active duty military personnel have a significantly lower proportion of their decayed, missing, and filled surfaces that are untreated; this is primarily due to dramatic improvements in the oral health of active duty blacks when compared to their civilian counterparts. Active duty whites also have somewhat better oral health than white civilians of a similar age.

The relative proportion of unfilled surfaces as a component of decayed and filled tooth surfaces in the military and civilian populations is illustrated in Figure 4.25.

ORAL HEALTH STATUS IN CHANGING TIMES

The burden of oral diseases and conditions in the United States is extensive and affects persons throughout their life span. Birth defects such as cleft lip/palate, dental caries, and facial trauma are common in the young. Periodontal diseases, autoimmune disorders, and other chronic disabling conditions are seen in adults, while complete tooth loss and oral cavity and pharyngeal cancers are seen more often in older Americans. Because the most common oral disease, dental caries, is so widespread in the population, nearly every American has experienced oral disease.

The effects of oral diseases and conditions on quality of life and well-being are discussed in Chapter 6. In sum, conditions such as cleft lip and palate and oral cancer not only involve costly and difficult surgeries and treatments, they also alter facial appearance and impair oral functioning. Pain disorders and pain as a consequence of dental disease are prevalent in certain groups and can affect daily living.

The available trend data reveal improvements in dental health for most Americans; however, despite improvements in dental status, disparities remain. Diseases disproportionately affect some sex, income, and racial/ethnic groups, and the magnitude of the differences is striking. All the reasons for these disparities are not clear. Some of the most common dental diseases, such as dental caries, are preventable (prevention of oral diseases and conditions is presented in Chapters 8 and 9). It appears, however, that not all individuals are benefiting from interventions that involve professional care, as represented by the data on dental visits. At the same time, as presented in Chapter 7, about 40 percent of the public does not receive the benefits of community water fluoridation. The emerging data on the effects of socioeconomic status on oral health are beginning to explain some, but not all, racial/ethnic differences. For other diseases, health disparities appear not to be related to professional services; a better understanding of the reasons for these differences is needed.

This review of available data on oral diseases and conditions also reveals the lack or limitation of national or state data on oral diseases for many population subgroups and for many conditions that affect the craniofacial structures. Information on the variables needed to explain health status differences, such as detailed utilization and expenditure data and data on services rendered, is limited as well. Data on specific services—self-care, services provided by professionals, and services that are community-based—are needed to understand the dimensions of oral health. (Some of these services are described in Chapters 7 and 8.) Although some data on expenditures for care and health care personnel are available to (Chapter 9) complement the statistics needed to assess oral health in the United States, almost all these data come from cross-sectional surveys that do not allow for analysis of the outcomes of disease and related care.

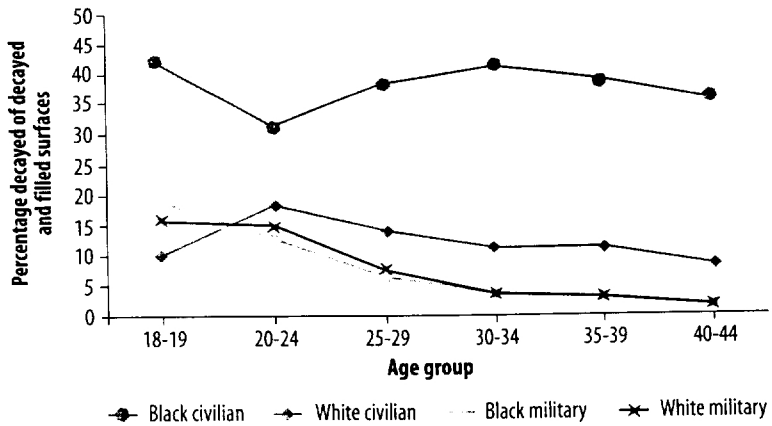
Available state data reveal variations within and among states in patterns of oral health and disease among population groups. Having state-specific and local data that augment national data is critical in identifying high-risk populations and areas and in addressing health disparities. These data also are vital in program evaluation, planning, and policy decisions. Yet state and local data are almost nonexistent. In recent years, the need for state and local data has intensified as more programs are funded by local authorities and responsibilities are shifted from national to state-based levels.

The nation's health information system is undergoing constant change to meet the current and future needs for health information. Consequently, many factors influence how and what data are collected and analyzed. These factors include emerging technologies, legislation about how data are to be collected, and confidentiality and privacy concerns.

The need for epidemiologic and surveillance data change as the understanding of specific diseases and conditions evolves and as society's goals and priorities change. The increasing focus on the long-term benefits of disease prevention and health promotion and the need to close the gap on disparities also affects how and what data are collected. For example, major initiatives such as the Department of Health and Human Services's Healthy People 2010 have provided a framework for data collection and analysis tied to specific objectives and have helped identify needs for new health data systems. The Healthy People initiative now includes objectives for the nation's health status as well as for preventive interventions and objectives that would improve infrastructure and capacity building to provide the necessary services and monitoring.

This overview of the magnitude of oral diseases and conditions in America raises many questions still to be researched. If certain oral diseases are preventable, why do we have populations with extensive and untreated disease? Once socioeconomic factors are controlled, why do we see differences in services received? Why

FIGURE 4.25
The percentage of unfilled decayed surfaces is higher for civilian males than for males in the U.S. military



Source: York et al. 1995.

are some conditions more prevalent in certain populations than in others? How will the rapidly changing and projected demographics of America contribute to future trends in oral and craniofacial health and disease? These and many other questions require more research, new databases, and an active and trained group of researchers.

FINDINGS

- Over the past five decades, major improvements in oral health have been seen nationally for most Americans.
- Despite improvements in oral health status, profound disparities remain in some population groups as classified by sex, income, age, and race/ethnicity. For some diseases and conditions, the magnitude of the differences in oral health status among population groups is striking.
- Oral diseases and conditions affect people throughout their life span. Nearly every American has experienced the most common oral disease, dental caries.
- Conditions that severely affect the face and facial expression, such as birth defects, craniofacial injuries, and neoplastic diseases, are more common in the very young and in the elderly.
- Oral-facial pain can greatly reduce quality of life and restrict major functions. Pain is a common symptom for many of the conditions affecting oral-facial structures.
- National and state data for many oral and craniofacial diseases and conditions and for population groups are limited or nonexistent. Available state data reveal variations within and among states in patterns of health and disease among population groups.
- Research is needed to develop better measures of disease and health, to explain the differences among population groups, and to develop interventions targeted at eliminating disparities.

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PART THREE

What Is the Relationship Between Oral Health and General Health and Well-being?

The next two chapters establish that oral health is essential to general health and well-being. Chapter 5 examines multiple linkages between oral and general health. The mouth and the face reflect signs and symptoms of health and disease that can serve as an adjunct for diagnosis for some conditions. Diagnostic tests using oral cells and fluids—especially saliva—are available to detect drug abuse, hormonal changes, and specific diseases; and more are being developed. The mouth is also a portal of entry for pathogens and toxins, which can affect the mouth and, if not cleared by the many defense mechanisms that have evolved to protect the oral cavity, may spread to the rest of the body. Recent epidemiologic and experimental animal research provides evidence of possible associations between oral infections—particularly periodontal disease—and diabetes, cardiovascular disease, and adverse pregnancy outcomes, and this evidence is reviewed. The review highlights the need for an aggressive research agenda to better delineate the specific nature of these associations and the underlying mechanisms of action.

Chapter 6 looks at the impact of oral health problems on the quality of life and includes examples of the kinds of questionnaires used to measure oral-health-related quality of life. Oral health is highly valued by society and individuals, and the chapter begins with a brief description of the reflections of those values in myth and folklore concerning facial appearance and the meaning of teeth. It then explores dimensions beyond the biological and the physical to examine how oral diseases and disorders can interfere with the functions of daily living, including participation in work or school, and what is known about their psychosocial impacts and economic costs. The deleterious effects of facial disfigurement and tooth loss may be magnified in a society such as ours that celebrates youth and beauty. Self-reported impacts of oral conditions on social functions include limitations in communication, social interactions, and intimacy. Research on the oral-health-related quality of life is needed to permit further exploration of the dimensions of oral health and well-being.

CHAPTER 5

Linkages with General Health

The mouth and face are highly accessible parts of the body, sensitive to and able to reflect changes occurring internally. The mouth is the major portal of entry to the body and is equipped with formidable mechanisms for sensing the environment and defending against toxins or invading pathogens. In the event that the integrity of the oral tissues is compromised, the mouth can become a source of disease or pathological processes affecting other parts of the body. It can also become a source of contagion by means of contaminated fluids or materials passed to others. This chapter explores what the mouth and face can reveal about general health, describes the role the mouth plays as a portal of entry for infection, and concludes with studies that are associating oral infections with serious systemic diseases and conditions.

THE MOUTH AND FACE AS A MIRROR OF HEALTH AND DISEASE

A physical examination of the mouth and face can reveal signs of disease, drug use, domestic physical abuse, harmful habits or addictions such as smoking, and general health status. Imaging (e.g., x-ray, MRI, SPECT) of the oral and craniofacial structures may provide early signs of skeletal changes such as those occurring with osteoporosis and musculoskeletal disorders, and may also reveal salivary, congenital, neoplastic, and developmental disorders. Oral cells and fluids, especially saliva, can be tested for a wide range of substances, and oral-based diagnostics are increasingly being developed and used as a means to assess health and disease without the limitations and difficulties of obtaining blood and urine.

Physical Signs and Symptoms of Disease and Risk Factors

A number of signs and symptoms of disease, lifestyle behaviors, and exposure to toxins can be detected in or around the craniofacial complex. Pathogens entering the mouth may proliferate locally with oral and pharyngeal signs and symptoms; other pathogens may enter the bloodstream directly or through lymphatic channels and cause generalized disease. Oral signs suspected to be indications of systemic illness may be confirmed by the presence of rash, fever, headache, malaise, enlarged lymph nodes, or lesions elsewhere on the body.

Swollen parotid glands are a cardinal sign of infection with the mumps virus and can also be seen in individuals with Sjögren's syndrome and HIV. The salivary glands are also frequently involved in tuberculosis and histoplasmosis infections. Oral signs of infectious mononucleosis, caused by Epstein-Barr virus, include sore throat, gingival bleeding, and multiple pinpoint-sized hemorrhagic spots (pettechiae) on the oral mucosa. The oral signs and symptoms associated with some viral, bacterial, and fungal infections are listed in Table 5.1. There can be a large overlap in the clinical appearance of oral manifestations of various diseases with different etiologies, and the clinical diagnosis often involves ancillary procedures, which may include laboratory tests, diagnostic imaging, and biopsy.

Oral tissues may also reflect immune deficiency. For example, nearly all HIV-infected individuals develop oral lesions at some time during their illness (Greenberg 1996, Greenspan and Greenspan 1996, Phelan 1997). Other immunosuppressed individuals may have the same lesions (Glick and Garfunkel 1992). However, the presentation and the extent, severity, and management of some of these lesions may reflect nuances due to variation in the underlying

TABLE 5.1
Diseases and conditions causing lesions of the oral mucosa

Condition	Usual Location	Clinical Features	Course
Viral Diseases			
Primary acute herpetic gingivostomatitis (herpes simplex virus type 1, rarely type 2)	Lip and oral mucosa	Labial vesicles that rupture and crust, and intraoral vesicles that quickly ulcerate; extremely painful; acute gingivitis, fever, malaise, foul odor, and cervical lymphadenopathy; occurs primarily in infants, children, and young adults	Heals spontaneously in 10 to 14 days unless secondarily infected
Recurrent herpes labialis	Mucocutaneous junction of lip, perioral skin	Eruption of groups of vesicles that may coalesce, then rupture and crust; painful to pressure or spicy foods	Lasts about 1 week, but condition may be prolonged if secondary infection occurs
Recurrent intraoral herpes simplex	Palate and gingiva	Small vesicles that rupture and coalesce; painful	Heal spontaneously in about 1 week
Chickenpox (varicella-zoster virus)	Gingiva and oral mucosa	Skin lesions may be accompanied by small vesicles on oral mucosa that rupture to form shallow ulcers; may coalesce to form large bullous lesions that ulcerate; mucosa may have generalized erythema	Lesions heal spontaneously within 2 weeks
Herpes zoster (reactivation of varicella-zoster virus)	Cheek, tongue, gingiva, or palate	Unilateral vesicular eruption and ulceration in linear pattern following sensory distribution of trigeminal nerve or one of its branches	Gradual healing without scarring; postherpetic neuralgia is common
Infectious mononucleosis (Epstein-Barr virus)	Oral mucosa	Fatigue, sore throat, malaise, low-grade fever, and enlarged cervical lymph nodes; numerous small ulcers usually appear several days before lymphadenopathy; gingival bleeding and multiple petechiae at junction of hard and soft palates	Oral lesions disappear during convalescence
Warts (papillomavirus)	Anywhere on skin and oral mucosa	Single or multiple papillary lesions, with thick, white keratinized surfaces containing many pointed projections; cauliflower lesions covered with normal-colored mucosa or multiple pink or pale bumps (focal epithelial hyperplasia)	Lesions grow rapidly and spread
Herpangina (coxsackievirus A; also possibly coxsackievirus B and echovirus)	Oral mucosa, pharynx, tongue	Sudden onset of fever, sore throat, and oropharyngeal vesicles, usually in children under 4 years, during summer months; diffuse pharyngeal congestion and vesicles (1 to 2 mm), grayish-white surrounded by red areola; vesicles enlarge and ulcerate	Incubation period 2 to 9 days; fever for 1 to 4 days; recovery uneventful
Hand, foot, and mouth disease (type A coxsackieviruses)	Oral mucosa, pharynx, palms, and soles	Fever, malaise, headache with oropharyngeal vesicles that become painful, shallow ulcers	Incubation period 2 to 18 days; lesions heal spontaneously in 2 to 4 weeks
Primary HIV infection	Gingiva, palate, and pharynx	Acute gingivitis and oropharyngeal ulceration, associated with febrile illness resembling mononucleosis and including lymphadenopathy	Followed by HIV seroconversion, asymptomatic HIV infection, and usually ultimately by HIV disease

Condition	Usual Location	Clinical Features	Course
Bacterial or fungal diseases			
Acute necrotizing ulcerative gingivitis ("trench mouth," Vincent's infection)	Gingiva	Painful, bleeding gingiva characterized by necrosis and ulceration of gingival papillae and margins plus lymphadenopathy and foul odor	Continued destruction of tissue followed by remission, but may recur
Prenatal (congenital) syphilis	Palate, jaws, tongue, and teeth	Gummatous involvement of palate, jaws, and facial bones; Hutchinson's incisors, mulberry molars, glossitis, mucous patches, and fissures of corners of mouth	Tooth deformities in permanent dentition irreversible
Primary syphilis (chancre)	Lesion appears where organism enters body; may occur on lips, tongue, or tonsillar area	Small papule developing rapidly into a large, painless ulcer with indurated border; unliteral lymphadenopathy; chancre and lymph nodes containing spirochetes; serologic tests positive by third to fourth week	Healing of chancre in 1 to 2 months, followed by secondary syphilis in 6 to 8 weeks
Secondary syphilis	Oral mucosa frequently involved with mucous patches, primarily on palate, also at commissures of mouth	Maculopapular lesions of oral mucosa, 5 to 10 mm in diameter with central ulceration covered by grayish membrane; eruptions occurring on various mucosal surfaces and skin accompanied by fever, malaise, and sore throat	Lesions may persist from several weeks to 1 year
Tertiary syphilis	Palate and tongue	Gummatous infiltration of palate or tongue followed by ulceration and fibrosis; atrophy of tongue papillae produces characteristic bald tongue and glossitis	Gumma may destroy palate, causing complete perforation
Gonorrhea	Lesions may occur in mouth at site of inoculation or secondarily by hematogenous spread from a primary focus elsewhere	Earliest symptoms are burning or itching sensation, dryness, or heat in mouth followed by acute pain on eating or speaking; tonsils and oropharynx most frequently involved; oral tissues may be diffusely inflamed or ulcerated; saliva develops increased viscosity and fetid odor; submaxillary lymphadenopathy with fever in severe cases	Lesions may resolve with appropriate antibiotic therapy
Tuberculosis	Tongue, tonsillar area, soft palate	A solitary, irregular ulcer covered by a persistent exudate; ulcer has an undermined, firm border	Lesions may persist
Cervicofacial actinomycosis	Swellings in region of face, neck, and floor of mouth	Infection may be associated with an extraction, jaw fracture, or eruption of molar tooth; in acute form resembles an acute pyogenic abscess, but contains yellow "sulfur granules" (gram-positive mycelia and their hyphae)	Acute form may last a few weeks; chronic form lasts months or years; prognosis excellent; actinomycetes respond to antibiotics (tetracyclines or penicillin) but not antifungal drugs
Histoplasmosis	Any area in mouth, particularly tongue, gingiva, or palate	Numerous small nodules may ulcerate; hoarseness and dysphagia may occur because of lesions in larynx usually associated with fever and malaise	May be fatal
Candidiasis	Any area of oral mucosa	Pseudomembranous form has white patches that are easily wiped off leaving red, bleeding, sore surface; erythematous form is flat and red; rarely, candidal leukoplakia appears as white patch in tongue that does not rub off; angular cheilitis due to *Candida* involves sore cracks and redness at angle of mouth; *Candida* seen on KOH preparation in all forms	Responds to antifungals

(continues)

TABLE 5.1 continued

Condition	Usual Location	Clinical Features	Course
Dermatologic diseases			
Mucous membrane pemphigoid	Primarily mucous membranes of the oral cavity, but may also involve the eyes, urethra, vagina, and rectum	Painful, grayish-white collapsed vesicles or bullae with peripheral erythematous zone; gingival lesions desquamate, leaving ulcerated area	Protracted course with remissions and exacerbations; involvement of different sites occurs slowly; glucocorticoids may temporarily reduce symptoms but do not control the disease
Erythema multiforme (Stevens-Johnson syndrome)	Primarily the oral mucosa and skin of hands and feet	Intraoral ruptured bullae surrounded by an inflammatory area; lips may show hemorrhagic crusts; the "iris," or "target" lesion, on the skin is pathognomonic; patient may have severe signs of toxicity	Onset very rapid; condition may last 1 to 2 weeks; may be fatal; acute episodes respond to steroids
Pemphigus vulgaris	Oral mucosa and skin	Ruptured bullae and ulcerated oral areas; mostly in older adults	With repeated recurrence of bullae, toxicity may lead to cachexia, infection, and death within 2 years; often controllable with steroids
Lichen planus	Oral mucosa and skin	White striae in mouth; purplish nodules on skin at sites of friction; occasionally causes oral mucosal ulcers and erosive gingivitis	Protracted course, may respond to topical steroids
Other conditions			
Recurrent aphthous ulcers	Anywhere on nonkeratinized oral mucosa (lips, tongue, buccal mucosa, floor of mouth, soft palate, oropharynx)	Single or clusters of painful ulcers with surrounding erythematous border; lesions may be 1 to 2 mm in diameter in crops (herpetiform), 1 to 5 mm (minor), or 5 to 15 mm (major)	Lesions heal in 1 to 2 weeks but may recur monthly or several times a year; topical steroids give symptomatic relief; systemic glucocorticoids may be needed in severe cases; a tetracycline oral suspension may decrease severity of herpetiform ulcers
Behçet's syndrome	Oral mucosa, eyes, genitalia, gut, and central nervous system	Multiple aphthous ulcers in mouth; inflammatory ocular changes; ulcerative lesions on genitalia; inflammatory bowel disease and CNS disease	Ulcers may persist for several weeks and heal without scarring
Traumatic ulcers	Anywhere on oral mucosa; dentures frequently responsible for ulcers in vestibule	Localized, discrete ulcerated lesion with red border; produced by accidental biting of mucosa, penetration by a foreign object, or chronic irritation by a denture	Lesions usually heal in 7 to 10 days when irritant is removed, unless secondarily infected

Source: Greenspan, in Fauci et al. 1998. Harrison's principles of internal medicine. Reprinted by permission from McGraw-Hill (2000). Copyright 2000 by McGraw-Hill.

systemic condition. For example, the linear gingival erythema and necrotizing ulcerative periodontitis sometimes seen in HIV infection have been difficult to resolve with routine dental curettage and prophylaxis (Glick et al. 1994b).

The appearance of soft or hard tissue pigmentation is associated with a number of diseases and treatments. Malignant melanoma can appear in the mouth as brown or black flat or raised spots. Kaposi's sarcoma can appear as a flat or raised pigmented lesion. Addison's disease causes blotches or spots of bluish-black or dark brown pigmentation to occur early in the disease. Congenital discrete brown or black patches (nevi) can appear in any part of the mouth. Pigmentation of the tooth crowns may be seen in children with cystic fibrosis and porphyria and those exposed to tetracycline during tooth development.

The oral tissues can also reflect nutritional status and exposure to risk factors such as tobacco. The