

DENTAL AND ORAL HEALTH PROBLEMS: PREVENTION AND SERVICES

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DENTAL AND ORAL HEALTH PROBLEMS: PREVENTION AND SERVICES

Introduction

For the last three decades, dentistry has emphasized population-wide public oral health measures to prevent dental caries (e.g., fluoridation of water supplies) and the treatment of dental caries¹ in younger children, assuming that early interventions would achieve the best short- and long-term effects (4). This emphasis has clearly proved successful. In the last 20 years, the prevalence of dental caries in all age groups, including adolescents ages 10 through 18, has declined dramatically (97).

As a consequence of the success of preventive measures in reducing dental caries and of dentistry's focus on the treatment of dental caries in younger children, however, many aspects of the dental and oral health of adolescents have been neglected (1). Traditionally, many dental professionals have tended to regard adolescence as a quiescent period with few dental needs, a continuation of childhood in which earlier dental intervention carried the patient to adulthood in good oral health (20). In fact, however, adolescence is a unique time, in terms of dental considerations, during which:

- dental caries rates increase from childhood (18);
- the first signs of periodontal disease² occur (20);
- up to a third of facial growth occurs (during a relatively short growth spurt) (34); and
- most orthodontic therapy occurs.

Furthermore, the transition from childhood to consenting adulthood and responsibility for care, along with issues such as differences in dental disease patterns and care-seeking behaviors of specific groups of adolescents, and unmet dental treatment needs, make adolescence a pivotal period with respect to dental and oral health.

This chapter covers several topics pertaining to the oral health of U.S. adolescents, beginning with physiologic and anatomic changes that affect adolescents' teeth and related structures and the prevalence of major dental problems in 10- to 18-year-olds.⁴ It also identifies a number of factors that are associated with adolescent dental health problems. Prevention of dental and oral health problems is addressed, along with the dental service delivery system. Finally, the Federal Government's role in oral health is discussed, and conclusions and policy implications are presented.

Background on Adolescents' Dental and Oral Health

Biological Factors That Affect Adolescents' Dental and Oral Health

Puberty is the initiation of adolescence, and several of the physical developmental changes that characterize puberty are mirrored in a person's oral cavity (mouth). From the standpoint of oral health, three types of changes during adolescence are particularly important:

- . the transition from primary to permanent teeth,
- . skeletal growth, and
- . hormonal change,

The first few years of adolescence are a dynamic time in terms of dentition (teeth). Between the ages of 10 and 12, a person's entire set of primary teeth has been replaced with permanent successors, second or 12-year-old molars have erupted, and only the third molars remain to develop and erupt (27). By ages 12 or 13, an individual's permanent teeth are usually stable.

Skeletal growth during adolescence has implications for orthodontic treatment. The face grows

¹Dental caries can be defined as the localized, progressive decay of a tooth, starting on the surface and, if untreated, extending to the inner tooth chamber and resulting in infection.

²Periodontal disease is an, disease of the tissue surrounding the teeth. The two most prevalent periodontal diseases are *gingivitis* (inflammation confined to the gums) and *periodontitis* (inflammation of both the gum and the other supporting structures of the teeth).

³Orthodontics is the area of dentistry concerned with the bite and how teeth mesh together.

⁴For the purpose of this Report, OTA has focused on adolescents ages 10 through 18. Data pertaining to dental health are not readily available for this age group. For that reason, some of the data cited in this chapter do not conform precisely to this age grouping.

significantly during adolescence, completing almost all of the vertical growth that affects tooth position, facial contour, and space available for teeth (66). Orthodontic treatment must take skeletal growth into account during this period.⁵

Hormonal changes seem to affect the susceptibility of adolescents to gingival problems (74) (e.g., because hormones interact with local irritating factors such as plaque and calculus). Like other aspects of adolescents' dental health, however, the relationship between hormonal changes and gingival problems is poorly understood.

Trends in the Incidence and Prevalence of Adolescents' Dental and Oral Health Problems

The major dental diseases and conditions affecting adolescents (indeed, all age groups) are dental caries, periodontal disease, and malocclusion. These three problems and various indexes used to measure the extent of these problems are discussed in box 8-A.

Over the last three decades, adolescents have experienced some dramatic changes in dental disease patterns—the most impressive of which is the drop in prevalence of dental caries during the last 20 years.⁷ Malocclusion has also undergone a transition in recent decades, from a condition caused to a significant degree by premature tooth loss due to dental caries and subsequent crowding of teeth to a condition that is largely inherited (1a).

Dental Caries

For most U.S. adolescents, the situation with respect to dental caries seems to have changed significantly for the better in recent years. Data collected among U.S. school children by the Na-

tional Institute of Dental Research (NIDR) in the U.S. Department of Health and Human Services (DHHS) suggest that the prevalence of dental caries as measured by the DMFS index⁸ has been diminishing among 10- to 17-year-olds (see figure 8-1). Also, they suggest that the percentage of caries-free adolescents has been increasing (see figure 8-1).

Although the prevalence of dental caries still remains higher among adolescents than among younger children, data from the NIDR surveys shown in figure 8-2 indicate that 10- to 17-year-old school children in this country experienced a 20- to 40-percent decline in the prevalence of dental caries from 1980 to 1987 (97).

The data from the NIDR surveys of U.S. school children conducted in 1979-80 and 1986-87 suggest that dental caries of permanent teeth is slowly, but consistently, decreasing in the U.S. adolescent population as a whole. Despite the overall improvements, however, it is important to note that dental caries remains a significant dental problem for certain groups of adolescents.⁹

Figure 8-3 shows data from the NIDR surveys that compare white and nonwhite adolescents with respect to the distribution of components of age-specific mean DMFT scores.¹⁰ In both surveys, the D component of the DMFT index (decayed teeth) accounted for a higher percentage of age-specific mean DMFT among nonwhite adolescents than among white adolescents. This means that nonwhite adolescents had a higher percentage of untreated caries than white adolescents. The M component of the DMFT index (missing teeth) accounted for a larger and far more rapidly increasing percentage of mean DMFT among nonwhite adolescents ages 10

⁵Unfortunately, no precise predictor of facial growth exists, and while such growth can be tracked and extremely identified, the development of useful tools to help plot an adolescent's final orthodontic status remains elusive (19).

⁶Plaque is a soft deposit of bacteria and other materials on the surface of a tooth. Calculus is a hard deposit of calcium phosphate and carbonate with organic matter on the surfaces of the teeth.

⁷The main data sources used to describe trends in the prevalence of dental caries in adolescents are national surveys of school children performed by or for the Federal Government—e.g., National Institute of Dental Research: *National Caries Program, The Prevalence of Dental Caries in United States School Children, 1979-80* and *Oral Health of U.S. Children: The National Survey of Dental Caries in U.S. School Children, 1986-87* (94,97). These data sources have limitations described in box 8-B. One of the primary limitations is that national survey data do not adequately portray the caries experience of particular subgroups of adolescents with unique circumstances or risks, such as poor or disabled adolescents or adolescents who do not attend school.

⁸The DMFS index and the DMFT index are used to measure the prevalence of dental caries and are described in box 8-A.

⁹See the following section on "Factors Associated With Adolescents' Dental and Oral Health Problems."

¹⁰The DMFT index is described in box 8-A.

¹¹These survey data differentiate only between white and nonwhite populations. See box 8-B for further discussion of the limitations of Federal sources of data on dental and oral health.

Box 8-A-Overview of Three Dental Problems: Dental Caries, Periodontal Disease, and Malocclusion

Three major dental diseases and conditions affect adolescents: dental caries, periodontal disease, and malocclusion. These problems, and indexes commonly used to measure the prevalence or other aspects of these problems, are described below.

Dental Caries--Dental caries is the localized, progressive decay of a tooth, beginning on the tooth's outer enamel surface and, if left untreated, extending to the inner tooth chamber. Dental caries is a condition to which individuals of all age groups and races are susceptible, but the rate of dental caries is highest among adolescents (1).

Far more is known today about dental caries than even a decade ago. Basically, dental caries is an infectious condition that requires a combination of a susceptible host, cariogenic bacteria, and a diet high in carbohydrates; over an extended period of time (usually at least several months), the acid produced by bacterial metabolism leads to the decalcification of the tooth.

One especially virulent form of caries that affects a small portion of adolescents is *rampant caries*. Rampant caries involves extensive breakdown of enamel and dentin, and pulpal pathosis. It devastates the dentition and creates pain. This rapidly progressing condition can occur in individuals with or without a significant history of dental caries. Not all patients who experience high caries activity experience rampant caries, but the destruction of rampant caries puts those patients with the condition in the high caries activity group.

The DMFT and DMFS Indexes: Two indexes are commonly used to measure the prevalence of dental caries. One of these, the DMFT index, measures the average number per person in a specified population of Decayed permanent teeth in need of a filling or extraction, Missing permanent teeth that have been removed as a result of caries, and Filled permanent teeth. The other index, the DMFS index, measures the average number per person in a specified population of Decayed permanent tooth surfaces, Missing permanent teeth, and Filled (or restored) Surfaces of permanent Teeth. The DMFS index is a somewhat more sensitive measure of the prevalence of dental caries, because it identifies caries on several sites of each tooth. The technique of examination for the both the DMFS and the DMFT index is described in a variety of references (79,97). Sometimes, the separate components of the DMFT or DMFS index are used as a measure of service utilization (e.g., the F component is an indication of dental treatment of decayed teeth, and the M component may suggest what type of dental care has or has not been received (i.e., a high M component suggests that teeth were extracted as a result of untreated decay).

Treatment: The treatment for dental caries varies, depending on the condition's severity. Although dental caries in its mildest form affects only the tooth's enamel and causes lesions that may not require treatment, dental caries that progresses beyond the tooth's enamel to the inner tooth may cause lesions that necessitate a filling or dental restoration, pulpal therapy, or even removal of the tooth. The focus in this chapter is on carious lesions requiring treatment.

Periodontal Disease--Periodontal disease includes several diseases of the tissue surrounding and supporting the teeth (76). The two most prevalent periodontal diseases are gingivitis and periodontitis. *Gingivitis*, by far the most common, is inflammation of the gingiva (gum) only; and is by itself relatively innocuous. *Periodontitis* is inflammation of both the gums and other supporting structures of the teeth (e.g., the outer bone of the tooth socket, the outer layer of the root of the tooth, and the soft tissues that attach these structures to one another). Unlike gingivitis, periodontitis is associated with the destruction or loss of the supporting structures of the teeth. Periodontitis does not develop in the absence of gingivitis, but gingivitis does not always lead to periodontitis. Bacterial infection is an essential factor in both gingivitis and periodontitis (76).

Periodontal disease is more common and more severe among adults than among adolescents. Periodontal problems are generally fewer and less severe than dental caries problems among adolescents, rarely leading to tooth loss during this age period. Nevertheless, adolescents are affected by a variety of acute and chronic periodontal problems, ranging from mild gingivitis to frank periodontal disease. One chronic periodontal condition peculiar to adolescence is *localized juvenile periodontitis*, which causes the loss of alveolar bone supporting permanent teeth and the weakening of the dentition. Thought to be caused by the organism *Haemophilus (Actinobacillus) actinomycetemcomitans*, or a combination of organisms, localized juvenile periodontitis is insidious and is not necessarily present with inflammation as is gingival disease. It occurs in a small percentage of adolescents,

¹Dental pulp is the soft sensitive tissue that fills the chamber of the tooth.

Box 8-A--Overview of Three Dental Problems: Dental Caries, Periodontal Disease, and Malocclusion—Continued

usually early on. The superficial gingival tissue of a person with localized juvenile periodontitis can appear normal, so the condition is often missed or diagnosed late in its course.

The Simplified Oral Hygiene Index (OHI-S): The OHI-S is a measure of oral cleanliness and plaque control, with a low score denoting good oral hygiene. Good oral hygiene can improve periodontal health (76).

Periodontal Health Measures: The periodontal health of 14-to 17-year-old school children in 1986-87 was assessed using two measures—gingival bleeding upon probing and periodontal attachment loss (11,12,97). Bleeding gums are generally the result of mild gingivitis. Periodontal attachment loss is a measurement of periodontal destruction—the loss or destruction of the supporting structures results in the formation of pathologic spaces or pockets around the teeth. These pockets are measured in millimeters using a “periodontal probe” (97).

Treatment: Uncomplicated gingivitis is usually easy to treat with nonsurgical methods such as plaque removal (76). Daily plaque removal is considered optimally conducive to gingival health. The treatment of more serious periodontal disease may involve periodontal surgery or nonsurgical methods such as the “Keyes technique” (76).

Malocclusion—Malocclusion is the malpositioning of maxillary (upper jaw bone) and mandibular (lower jaw bone) teeth, a condition that can have both esthetic, functional, and emotional implications (1). There is no clear relationship between malocclusion and either periodontal disease, dysfunction of the temporomandibular joint, or other oral problems.

Malocclusion is largely due to genetic factors, although individuals who experience premature primary tooth loss due to dental caries may later experience orthodontic problems as a result. In its minor and even moderate manifestations, malocclusion seldom creates pain and is rarely disfiguring. In its more severe form, malocclusion causes functional problems in chewing, may predispose one to periodontal conditions (due to the inability to clean between teeth), and can create significant emotional problems (due to diminished self-confidence and self-esteem) (1).

Treatment: Many malocclusions of a minor variety can be prevented, intercepted, or corrected by the supervision of a dentist and provision of space maintenance appliances or minor orthodontic treatment. The correction of more major malocclusions typically requires major orthodontic treatment.

Orthodontic Treatment Priority Index (TPI): **Determining the** prevalence and severity of malocclusion is a complicated procedure and is, ultimately, subjective. Survey data reflect the judgment of orthodontists who have examined patients and a variety of records, including radiographs and models of teeth. From this information, a score, or orthodontic TPI, is determined. The orthodontic TPI score is a score ranging from 0 (normal occlusion) to 10 (very severe occlusion, with treatment mandatory). A TPI score of 4 to 6 is considered a definite malocclusion, but treatment is elective.

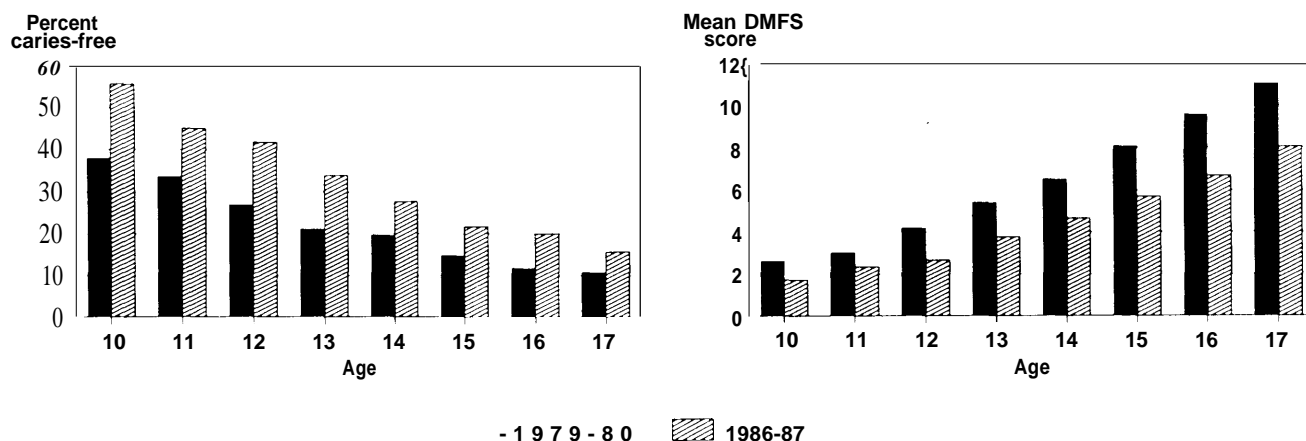
SOURCES: Office of Technology Assessment, 1991, based on the followingsources: American Academy of Pediatric Dentistry, “Guidelines for Dental Health of the Adolescent,” Chicago, IL, May 1986; M. Bhat, “Periodontal Attachment Loss in 14- to 17-Year-Old U.S. School Children,” Program and Abstracts, American Association for Public Health Dentistry, November 1989; M. Bhat and J. Brunelle, “Gingival Status of 14- to 17-Year-Old U.S. School Children,” *Journal of Dental Research* 68:955, June 1989; U.S. Congress, Office of Technology Assessment, *Periodontal Disease: Assessing the Effectiveness and Costs of the Keyes Technique—Health Technology Case Study #5*, OTA-BP-Ii-9 (Washington, DC: U.S. Government Printing Office, May 1981); U.S. Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics, *Decayed, Missing and Filled Teeth Among Children*, DHEW Pub. No. (HSM)72-1003 (Washington DC: U.S. Government Printing Office, August 1972); and U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Oral Health of U.S. Children: The National Survey of Dental Caries in U.S. School Children, 1986-87*, NIH Pub. No. 89-2247 (Washington, DC: U.S. Government Printing Office, September 1989).

to 17 than among their white counterparts. This means that nonwhite adolescents lost more teeth to caries than white adolescents. Finally, the F component of the DMFT index (filled teeth) represents a greater percentage of the DMFT index for white adolescents ages 10 to 17 than for nonwhite adolescents. This means that more decayed teeth of white

adolescents are filled than decayed teeth of nonwhite adolescents.

table 8-1 shows differences in selected dental treatment needs due to caries for white and nonwhite 10- and 17-year-olds in 1979-80. In every category, the needs of nonwhite adolescents exceeded those of white adolescents. The racial disparity in treatment

Figure 8-I—Caries-Free Individuals and Mean DMFS Scores Among U.S. School Children Ages 10 to 17, 1979-80 and 1986-87^{a,b}



^aThe data shown in this figure are from two national school-based surveys conducted by the National Institute of Dental Research in 1979-80 and 1986-87. ^bThe DMFS index measures the mean number per person of Decayed permanent tooth surfaces, Missing permanent teeth, and Filled Surfaces of permanent teeth.

SOURCE: Office of Technology Assessment, 1991, based on the following: 1979-80 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *National Caries Program, The Prevalence of Dental Caries in United States School Children, 1979-80*, NIH Pub. No. 82-2245 (Washington, DC: U.S. Government Printing Office, 1982). 1986-87 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Oral Health of U.S. Children: The National Survey of Dental Caries in U.S. School Children, 1986-87*, NIH Pub. No. 89-2247 (Washington, DC: U.S. Government Printing Office, September 1989).

needs was more pronounced among 17-year-olds than among 10-year-olds.

While major school-based studies show an overall decrease in caries prevalence, other smaller studies point to a changing pattern and distribution of dental caries. Though uncommon, rampant caries¹² affects a small portion of adolescents, devastating the dentition and creating pain. Perhaps as many as one-fifth of school children get as much as half of the dental caries in the population (35). Studies of naval recruits, many of whom are older adolescents, show similar findings—5 percent of those individuals account for 38 percent of new caries (44). Although the caries-active group is small, it represents a group which seems resistant to most preventive measures that benefit the population in general.

Periodontal Disease

National representative data from NIDR's school-based surveys paint a generally positive picture of periodontal health for most American adolescents ages 14 to 17 (12,95). Although many school children do experience some gingival inflammation

(signified by bleeding gums upon probing), very few have more serious problems (e.g., periodontal attachment loss of more than 2 mm). Older studies also suggest that many school children need moderate gingival treatment and improved oral hygiene (62,63, 95).

According to the NIDR 1986-87 school-based survey, nonwhite adolescents ages 14 to 17 tended to have slightly worse periodontal health than white adolescents (see figure 8-4). The percentage of nonwhite adolescents with periodontal attachment loss greatly exceeded the percentage of white adolescents with periodontal attachment loss.

Localized juvenile periodontitis (see box 8-A) affects an estimated 0.1 to 2.3 percent of U.S. adolescents (69). If untreated, the condition can cause significant periodontal destruction, including bone and tooth loss.

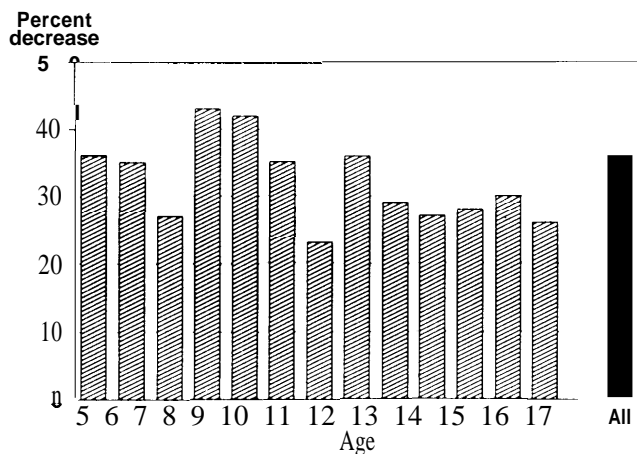
Malocclusion¹³

A review of available data on malocclusion found that the condition tends to worsen in adolescence (57). Crowding increases, some orthodontic prob-

¹²Rampant caries is a rapidly progressing form of dental caries which by definition involves extensive breakdown of enamel and dentin, and pulpal pathosis, and can occur in patients with or without a significant caries history.

¹³Box 8-A discusses malocclusion, along with its treatment and measurement. Preventive services are discussed in a later section.

Figure 8-2—Percentage Decrease From 1980 to 1987 in Caries Prevalence Among U.S. School Children Ages 5 to 17^a



^aThe data shown in this figure are from two national school-based surveys conducted by the National Institute of Dental Research in 1979-80 and 1986-87.

SOURCE: Office of Technology Assessment, 1991, based on the following: 1979-80 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *National Caries Program, The Prevalence of Dental Caries in United States School Children, 1979-80*, NIH Pub. No. 82-2245 (Washington, DC: U.S. Government Printing Office, 1982). 1986-87 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Oral Health of U.S. Children: The National Survey of Dental Caries in U.S. School Children, 1986-87*, NIH Pub. No. 89-2247 (Washington, DC: U.S. Government Printing Office, September 1989).

blems worsen, and others become apparent later in adolescence. Estimates of malocclusion in the adolescent population available from the National Center on Health Statistics in DHHS are based on national data from 1970 (81).

Table 8-2 shows data from 1970 on the average orthodontic Treatment Priority Index score for U.S. adolescents ages 12 to 17 by sex and race.¹⁴ White male adolescents had the highest Treatment Priority Index score (5.2), and black male adolescents had the lowest (4.6). These scores fall into a range in which there is a definite malocclusion but treatment is elective.

Table 8-3 shows a breakdown of the orthodontic Treatment Priority Index scores for all U.S. adolescents ages 12 to 17 in 1970. About 13 to 16 percent

(about 3.6 million adolescents in 1970¹⁵) had severe to very severe malocclusion.

Factors Associated With Adolescents' Dental and Oral Health Problems

Federal sources of data on the dental health problems of adolescents include national surveys by NIDR, as well as other national surveys conducted by various agencies in DHHS (see box 8-B). These national surveys, as a whole, have yielded limited information about subgroups of the population. Available data on racial differences in dental disease patterns, for example, differentiate only between whites and nonwhites. The national surveys are not designed to explain why racial differences in dental disease patterns may occur by, for example, also collecting information on family income level or insurance status. Race, family income, and insurance status, along with education, age, sex, and perceived need, have been shown to be correlated with the use of dental services (31,82), and consequently associated with dental disease patterns. Also, past history of dental disease, oral hygiene behaviors, and diet may affect dental disease patterns.

Adolescents in certain racial and ethnic minority groups, disabled adolescents, and adolescents in institutions seem to experience greater dental disease than other adolescents. But the data on these groups of adolescents are very limited, reflecting the national data's descriptiveness, and are shallow in terms of explaining differences in disease patterns and use of dental services. Despite the limitations of the data and the possibility of misinterpretation, it is important to understand that, for whatever the reasons, some adolescents have a greater need for dental care than others. Understanding the reasons is important for designing interventions appropriate for those adolescents.

Adolescents in Racial and Ethnic Minority Groups¹⁶

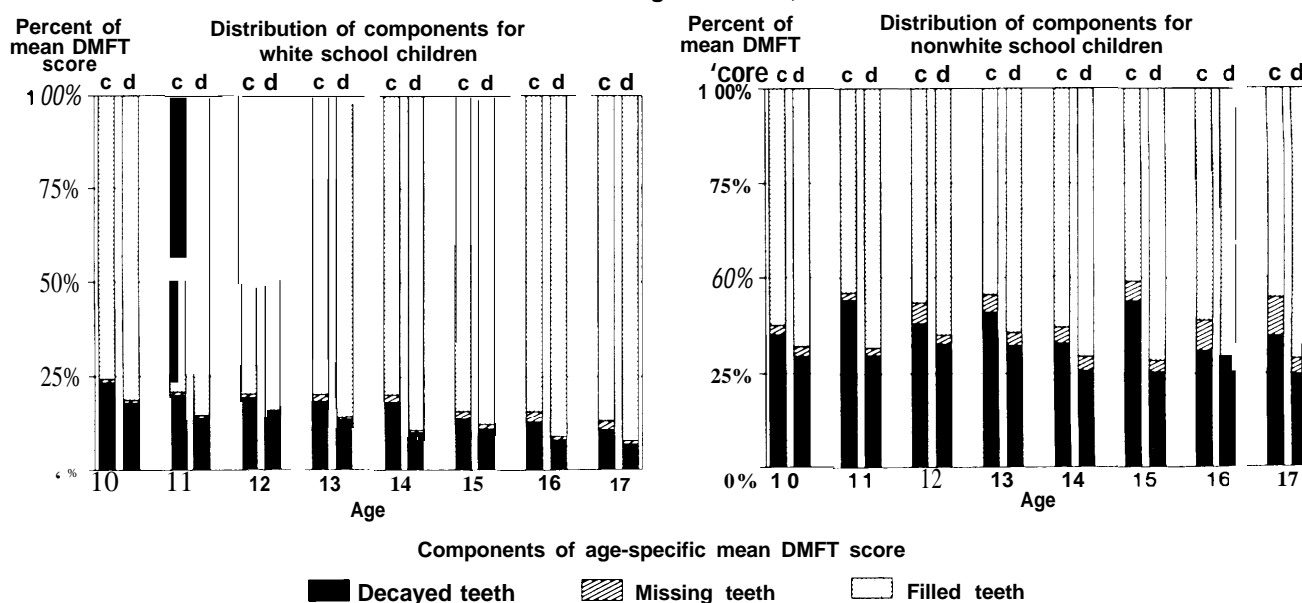
Data from the 1979-80 NIDR survey of school children suggest that nonwhite adolescents in this country experience more unmet need for dental

¹⁴The orthodontic Treatment Priority Index is described in box 8-A.

¹⁵Based on U.S. Department of Commerce, Bureau of the Census, estimates of the U.S. residents as of July 1, 1989, the equivalent number of adolescents age 12 to 17 currently affected by severe or very severe malocclusion would be between 2.6 and 3.2 million.

¹⁶Some sources of data on dental health separate different ethnic or racial minority groups so that the caries prevalence or other aspects of oral health are more closely related to that group. In most cases, however, minority groups are lumped together with various titles such as 'minorities' or 'blacks and others.' The data below describe some minority groups studied in more detail.

Figure 8-3-Distribution of Components of Age-Specific Mean DMFT Scores for White and Nonwhite U.S. School Children Ages 10 to 17, 1979-80 and 1986-87^{a,b}



^aThe data shown in this figure are from two national school-based surveys conducted by the National Institute of Dental Research in 1979-80 and 1986-87.
^bThe DMFT index measures the mean number per person of Decayed, Missing, and Filled permanent Teeth.
 c, 1979-80.
 d, 1986-87.

SOURCE: Office of Technology Assessment, 1991, based on the following: 1979-80 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *National Caries Program, The Prevalence of Dental Caries in United States School Children, 1979-80*, NIH Pub. No. 82-2245 (Washington, DC: U.S. Government Printing Office, 1982). 1986-87 data: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Oral Health of U.S. Children: The National Survey of Dental Caries in U.S. School Children, 1986-87*, NIH Pub. No. 89-2247 (Washington, DC: U.S. Government Printing Office, September 1989).

treatment than their white peers (see table 8-1).¹⁷ Because of these needs, nonwhite adolescents experience undesirable effects from dental conditions—restricted-activity days,¹⁸ bed-disability days,¹⁹ and lost school days—to a greater degree than their white peers do (88).

In 1986-87, according to NIDR, 22 percent of 10-year-olds needed restoration (filling) of permanent teeth (94). For white 10-year-olds, the figure was slightly under 19 percent; for nonwhite 10-year-olds, though, the percentage was over 32 percent. The need for restoration of permanent teeth changes through adolescence. In 1986-87, over 12 percent of all 17-year-olds needed restorations—8 percent of white 17-year-olds and 29 percent of nonwhite 17-year-olds (97).

In 1983-84, the Indian Health Service in the Public Health Service of DHHS conducted a study of Indian children on reservations and in other areas served by the Indian Health Service and found that, overall, American Indian children have twice the amount of dental caries as the national average (90). The mean DMFT score for 13- to 19-year-olds ranged from a low of 9.4 in Southwestern Indians to a high of 12.7 in those from the Northwest. The F (filled teeth) component of the DMFT, an indicator of treated caries, ranged from 50 to 77 percent (i.e., that half to three-quarters of decayed teeth were filled).

A study in Colorado showed that children of migrant workers between ages 11 and 15 had a DMFS rating of 5.87, exceeding the DMFS rate of

¹⁷Available data differentiating oral health status by race do not take socioeconomic status or other, possibly confounding, factors into account. For example, a 1982-84 survey of Mexican-Americans (not specifically adolescents, however) found that an individual's level of acculturation was significantly associated with the prevalence of gingivitis and periodontal pocketing (i.e., those with low acculturation status had significantly higher disease levels than those with high acculturation status) (45a).

¹⁸Restricted-activity days are days on which a person's activity is restricted by illness or injury.

¹⁹Bed-disability days are days on which a person spends more than half the day in bed because of illness or injury.

Table 8-I-Selected Dental Treatment Needs of White and Nonwhite U.S. Adolescents Ages 10 and 17, 1979-80^a

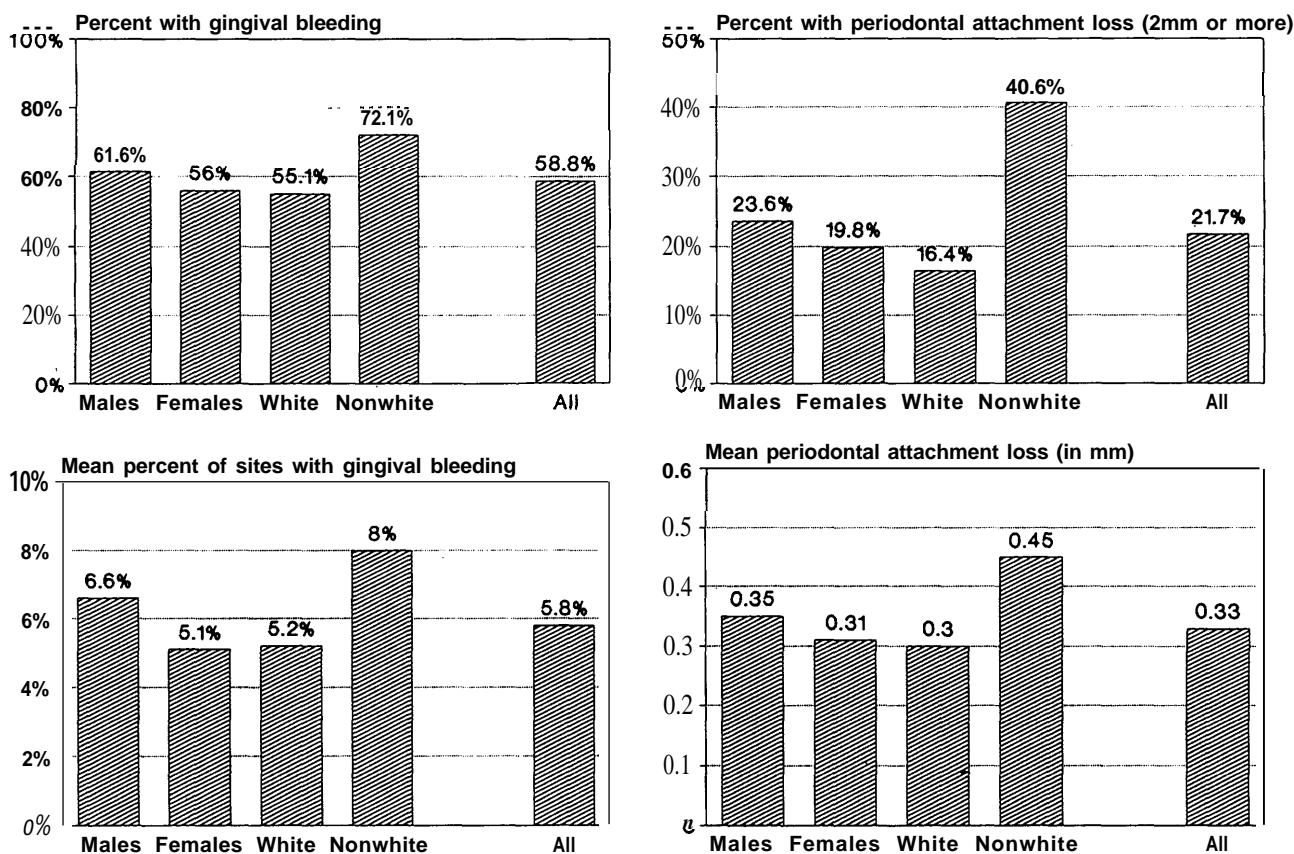
Age (years)	Percent of adolescents in need of:							
	Tooth extractions		Pulpal therapy		Tooth replacement		Need for crowns	
	White	Nonwhite	White	Nonwhite	White	Nonwhite	White	Nonwhite
10	0.5	2.8	1.2	1.8	1.1	1.8	2.0	2.3
17	2.1	10.4	1.3	6.9	6.7	17.9	3.5	10.8

^aAnalogous data were not reported in 1986-87 (97).

^bPermanent tooth extractions due to disease.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Dental Treatment Needs of United States Children, 1979-80*, NIH Pub. No. 83-2246 (Washington, DC: U.S. Government Printing Office, December 1982).

Figure 8-4-Periodontal Health Status of U.S. School Children Ages 14 to 17, by Gender and Race, 1986-87



SOURCE: Office of Technology Assessment, 1991, based on the following: Gingival status: M. Bhat, "Periodontal Attachment Loss in 14- to 17-Year-Old U.S. School Children," Program and Abstracts, American Association for Public Health Dentistry, Richmond, VA, 1989; Periodontal attachment: M. Bhat and J. Brunelle, "Gingival Status of 14- to 17-Year-Old U.S. School Children," *Journal of Dental Research* 68S55, June 1989.

the general U.S. population of that age (16). A study in Minnesota showed that by age 13, 73 percent of the occlusal (biting) surfaces of migrant children's first permanent molars were decayed, missing, or filled (24). A study in Michigan showed that migrant children 5- to 14-years-old had consistently higher DMFS scores than other nonmigrant children (104).

Figure 8-5 shows the gingival treatment needs of white and nonwhite U.S. adolescents ages 10 to 17 in 1979-80 using a scoring system from 0 (low need) to 4 (high need). The percentages of adolescents who had moderate or serious gingival problems (or were not scored) were generally higher among nonwhite than among white adolescents.

Data from the Indian Health Service study show that by the end of adolescence, two out of five young American Indian patients have destructive periodontal disease with bone loss (90). Six out of ten American Indian children ages 19 and under have gum disease.

Data from NIDR suggest that only a small percentage of U.S. children receive orthodontic care (95). In 1979-80, about 25 percent of 17-year-olds had ever received any orthodontic treatment but black adolescents were far less likely to have received it (4 percent of black adolescents had ever received orthodontic treatment) than white adolescent (27 percent had ever received orthodontic treatment) (95). Although it appears that malocclusion occurs consistently across races (see table 8-2), the treatment of orthodontic problems does not seem to reflect the distribution of this problem.

In 1987, restricted-activity days due to acute dental conditions averaged 1.5 days per 100 persons per year for U.S. children 5 to 17 years of age (88). In 1987, black children under age 18 had slightly more restricted-activity days than whites of the same age (6.9 days per 100 persons for black children v, 5.6 days per 100 persons for white children).

Black children under age 18 in this country suffer more bed-disability days due to acute dental conditions than whites. In 1987, black children under age 18 had 4.3 bed-disability days per 100 persons per year due to acute dental conditions, while white children under age 18 had only 1.4 bed-disability days (88).

Black children ages 5 to 17 in this country experience almost four times as many school days lost due to acute dental conditions as whites do. In 1987, black children ages 5 to 17 lost 3.9 school days per 100 persons per year due to acute dental conditions, while white children lost 1.0 school day per 100 persons per year (88). The impact of acute dental conditions as compared to other acute conditions on school performance or work is not known,

Table 8-2—Malocclusion Among U.S. Adolescents Ages 12 to 17, by Race and Gender, 1970

Age (years)	Orthodontic Treatment Priority Index (TPI) score ^a			
	White		Black	
	Male	Female	Male	Female
12	5.2	5.6	4.1	4.9
13	5.2	5.0	4.2	5.6
14	5.1	4.7	4.8	6.1
15	5.5	4.8	5.0	4.9
16	4.9	4.6	5.3	5.0
17	5.4	4.8	4.5	3.9
For group	5.2	4.9	4.6	5.1

^aThe orthodontic Treatment Priority Index (TPI) score is a Score ranging from 0 (normal occlusion) to 10 (very severe malocclusion with treatment mandatory); a TPI score of 4-6 is considered a definite malocclusion, but treatment is elective.

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics, *An Assessment of the Occlusion of the Teeth of Youths 12-17 Years*, DHEW Pub, No. (HRA)77-1644 (Washington, DC: U.S. Government Printing Office, February 1977).

Data from the National Health Examination Survey of the late 1960s suggest that white U.S. adolescents ages 12 through 17 tend to have slightly better oral hygiene as measured by the Simplified Oral Hygiene Index than black adolescents (see table 8-4),²⁰ although both blacks' and whites' scores were representative of relatively good oral hygiene. The racial differences may reflect personal oral hygiene behaviors which may be related to access to care, patient education, or other factors.

Adolescents With Disabilities²¹

A reliable picture of the dental health of U.S. adolescents with disabilities is unavailable. Adolescents with disabilities (and disabled people of other ages) have not been well-evaluated for dental caries. Most studies of dental caries among disabled people have been small in scale and have used a variety of indices. The lack of data, variety of indices, and inadequate control of variables in many studies make conclusions about the extent to which dental caries affects disabled adolescents difficult to draw. The discussion that follows draws on the few good studies that are available.

²⁰The Simplified Oral Hygiene Index, as noted in box 8-A, is a measure of oral cleanliness and plaque control. A low score indicates good oral hygiene.

²¹As discussed in ch. 6, 'Chronic Physical Illness: prevention and Services,' in this volume, the term disabled is used in many ways. In 1982, OTA distinguished between a *disability* (i.e., a limited ability or inability to perform one or more basic life functions—at a level considered "typical") and a *handicap* (i. e., an inability to perform one or more life functions—e.g., working-at a "typical" level because of the interaction of the individual's disability with the physical and social environments) (77). The terms handicapped and disabled have not been used consistently in studies of dental disease, and the national dental surveys described earlier did not break down the study samples into disabled and non-disabled. The discussion here uses the term disabled as the general term for both disabled and handicapped adolescents.

Table 8-3—Distribution of Malocclusion Among U.S. Adolescents Ages 12 to 17, by Race and Gender, 1970

TPI score	Percent with orthodontic Treatment Priority Index score								
	White and black			White			Black		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
0 = normal occlusion	11.0	10.8	11.2	10.5	10.2	10.7	14.7	15.0	14.3
1-3 = minor malocclusion	34.8	34.0	35.8	34.5	33.6	35.7	36.9	36.4	37.3
4-6 = definite malocclusion	25.2	25.7	24.6	25.8	26.0	25.5	21.0	23.3	18.8
7-9 = severe malocclusion	13.0	12.8	13.0	13.0	12.7	13.2	12.2	13.5	11.0
10 = very severe malocclusion	16.0	16.7	15.4	16.7	17.5	14.9	15.2	11.8	18.6

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics, *An Assessment of the Occlusion of the Teeth of Youths 12-17 Years*, DHEW Pub. No. (HRA)77-1644 (Washington, DC: U.S. Government Printing Office, February 1977).

Using data drawn from more than 20,000 disabled patients in 1984, Nowak demonstrated a mean DMFT score among 13- to 17-year-old disabled adolescents of 6.0; this compared to a DMFT score of 6.3 for an analogous age cohort in the general population (58). The breakdown of the DMFT score for 11- to 15-year-old disabled adolescents (1.18 (D), 2.48 (M), and 2.09 (F)) suggests that disabled adolescents are receiving treatment for dental caries but continue to have dental caries that progress to tooth loss.

A review of the literature by Tesini shows that periodontal conditions are a significantly greater concern for disabled adolescents than is caries (75). The probable reason is that the prevention of periodontal diseases involves good oral hygiene practices which may be given low priority by those caring for disabled persons or require a dexterity some disabled persons may not have.

Disabled adolescents who are unable to engage in a major activity (i.e., attend school) tend to visit the dentist at a rate similar to the rate among other underserved groups (87). In 1986, only 54.4 percent of seriously disabled adolescents between the ages of 12 and 17 had at least an annual dental visit (87). Disabled adolescents with less disability or limitation did only slightly better. In 1986, 62.2 percent of less seriously disabled adolescents between the ages of 12 and 17 had at least an annual dental visit (87). Disabled adolescents' infrequent dental visits may be related to a variety of factors, including preoccu-

pation with their disabling condition (26), inability to find a dentist (70), or financing²² (33).

Adolescents in Juvenile Justice Facilities

Small studies have shown that adolescents ages 13 through 16 who are in juvenile justice facilities had more dental decay (as well as poorer nutritional status, and more vision and hearing impairments) than adolescents from similar communities who had never been in juvenile justice facilities (64). It is not clear, however, what the dental status of these adolescents was prior to entering juvenile justice facilities .23

Adolescents With Certain Behaviors or Conditions

A variety of behaviors and conditions affect adolescents' oral health-behaviors that include ignoring personal dental hygiene practices, using alcohol and other substances, using oral contraceptives, using smokeless tobacco or smoking cigarettes, participating in athletics (and experiencing related injuries), and *conditions* that include bulimia nervosa,²⁴ pregnancy, and sexually transmitted diseases (see table 8-5). Some of these behaviors and conditions occur infrequently but result in long-term damage to oral structures when they occur. Others occur more frequently but have minor or reversible effects.

Prevention of Adolescents' Dental and Oral Health Problems

The major dental and oral health problems faced by adolescents in the United States—i.e., dental

²²For further discussion of financing issues in dental care, see: the discussion below; ch. 16, "Financial Access to Health Services," in Vol. III, and U.S. Congress Office of Technology Assessment, *Children's Dental Services Under the Medicaid Program* (78).

²³For further discussion of the health needs of adolescents in juvenile justice facilities, see ch. 13, "Delinquency: Prevention and Services," in this volume.

²⁴*Bulimianervosa* is a severe eating disorder characterized by a compulsion to binge and then purge the body by self-induced vomiting or use of laxatives. For a further discussion see ch. 7, "Nutrition and Fitness Problems: Prevention and Services," in this volume.

Box 8-B—Federal Sources of Data on Adolescents' Dental and Oral Health

Several components of the Public Health Service within the U.S. Department of Health and Human Services collect data on adolescents' dental and oral health:

National Institute of Dental Research (NIDR), National Institutes of Health

—*National Dental Caries Prevalence Survey, 1979-80*: data on DMFS and DMFT, specific dental treatment needs, by age and race (white and nonwhite), and gingival health assessment of U.S. school children.

—*National Survey of Dental Caries in U.S. School Children: 1986-87*: data on DMFS and DMFT, by age, race (white and nonwhite), and geographic location, and gingival health assessment of U.S. school children.

National Center for Health Statistics, Centers for Disease Control

—*National Health Interview Survey (NHIS), annual*: data on utilization of dental services by age, income, and residence; acute dental conditions and associated restricted-activity days, bed-disability days, lost school days by age and gender, and race and family income. Usually, these questions are asked of adults about their children. The 1982 survey included a Preventive Care Supplement, which included data on the first dental visit. The 1985 survey included a special Health Promotion and Disease Prevention Questionnaire, with a dental component.

—*National Health and Nutrition Examination Survey (NHANES) III, 1988-94*: data collected from questionnaires as well as from physical and oral examinations. Data collection will span from 1988 through 1994 and will include persons 2 months old and older. The dental component will include an assessment of caries, periodontal status, tooth loss, soft-tissue lesions, malocclusion, and tooth trauma.

National Center for Health Services Research (now Agency for Health Care Policy and Research)

—*National Medical Care Expenditure Survey (NMCES), 1977*, and *National Medical Expenditure Survey (NMES), 1987*: data on dental expenditures and utilization of services, by age, race, and family income.

Several authors involved in dental epidemiology and research, as well as dental public health, have noted that *Federal data collection programs may not provide accurate projections of dental and oral health need within special populations (22,35,90)*. For example, the NIDR surveys of U.S. school children differentiate only between white and nonwhite children and include only those children who attend school. This approach to data collection may yield information about aggregate trends but is likely to mask the disease status and treatment needs of certain populations.

SOURCE: Office of Technology Assessment, 1991.

caries, periodontal disease, and malocclusion—are often preventable conditions. Effective preventive measures involve water fluoridation and other preventive efforts at the community level, the services of dental professionals, and personal dental hygiene practices.

Preventive Interventions for Major Dental Health Problems

Prevention of Dental Caries

Dental caries, the major dental infectious disease problem for adolescents, can be prevented in the following ways:

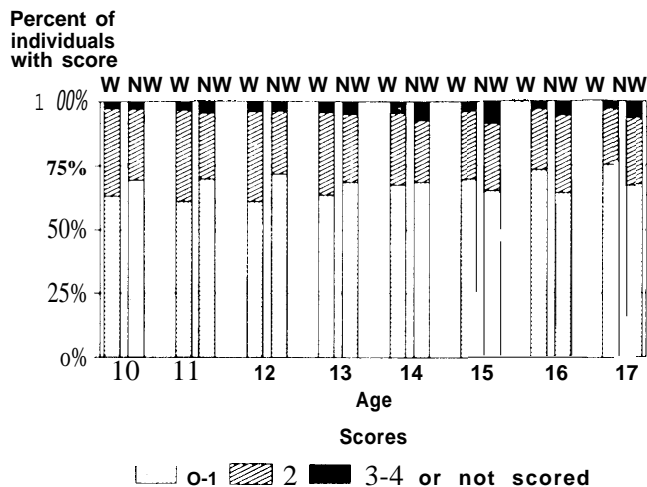
- . by increasing the resistance of the teeth via the use of fluoride and dental (occlusal) sealants,²⁵

- by reducing or interfering with the caries-producing microorganisms in contact with the teeth through the use of fluoride and oral hygiene procedures, and
- by altering a person's oral environment through dietary interventions (36).

Fluoride--Fluoride has been key in the overall reductions in dental caries among adolescents. According to the American Academy of Pediatric Dentistry, adolescents can benefit from fluoride throughout their teenage years and into early adulthood (1a). The benefit of incorporating fluoride into the developing enamel of permanent teeth ends around age 14 (or at the time of the eruption of the second permanent molars) (36), but the benefits of remineralization and the antimicrobial activity of fluoride continue beyond that age (1a). These

²⁵*Dental sealants* are thin coatings of plastic material placed on the occlusal (chewing) surfaces of posterior teeth to prevent the accumulation of food debris and bacteria in the pits and fissures of these teeth and subsequent dental decay (36).

Figure 8-5—Gingival Treatment Needs of White and Nonwhite U.S. Adolescents Ages 10 to 17, 1979-80



NOTE: W = White; NW = Nonwhite
 scoring Criteria: 0 - free of disease; 1 or 2 = needs minor treatment; 3 = moderate problem; 4 - disease will not respond to self-care.
 SOURCE: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental Research, *Dental Treatment Needs of United States Children 1979-80*, NIH Pub. No. 83-2246 (Washington, DC: U.S. Government Printing Office, December 1982).

benefits can be obtained through water fluoridation,²⁶ through fluoride that is topically applied by a dental professional, or through the use of fluoride rinses or fluoride-containing toothpaste (1a).

Water fluoridation programs have been demonstrated effective in reducing caries in several studies, resulting in a 20- to 40-percent reduction in caries (9,13,14,23,25,47,50,58).²⁷ As of 1988, nearly two-thirds (61 percent) of the U.S. population served by public water supplies had access to fluoridated drinking water (84a). The Federal Government has provided assistance for water fluoridation programs through grants to States and also through technical assistance, health education, and other methods. The Dental Disease Prevention Activity of the Centers for Disease Control in the Public Health Service of DHHS has been responsible for the Federal Government's water fluoridation effort since 1978 (22).

Table 8-4—Oral Hygiene Among U.S. Adolescents Ages 12 to 17 as Measured by the Simplified Oral Hygiene Index (OH I-S), 1966-1970

Age (Years)	OHI-S score ^a	
12	0.94	
13	0.92	
14	0.90	
15	0.87	
16	0.86	
17	0.82	
	White	Black
12-17	0.82	1.34

^aThe Simplified Oral Hygiene Index (OHI-S) is a measure of oral cleanliness and plaque control. A high score indicates poor oral hygiene.

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics, *Oral Hygiene Among Youth 12-17 Years*, DHEW Pub. No. (HRA)76-1633 (Washington, DC: U.S. Government Printing Office, 1976).

In 70 clinical trials of professionally applied topical fluoride, caries was reduced by an average of 30 percent (66). A recent OTA study that sampled seven State Medicaid programs found that professionally applied topical fluoride was a covered dental benefit for adolescents in six of seven programs (78).²⁸ Limitations in State reporting requirements to the Federal Government preclude a determination of how many Medicaid-eligible adolescents actually had fluoride topically applied by a dental professional. The American Dental Association has suggested the inclusion of professionally applied topical fluoride in a model dental health insurance benefit (3).

Nonprofessionally applied topical fluoride, such as that contained in fluoride toothpastes or mouth rinses, is also effective in reducing dental caries. School fluoride rinse programs have been shown to reduce the prevalence of dental caries among participating school children from 16 to 56 percent (17), although there is some evidence that those children in nonfluoridated communities may experience greater benefit (67a). Approximately 10 percent of U.S. school children ages 5 to 17 have access to school fluoride rinse programs (87).

Dental Sealants--According to the Sealant Task Force of the Massachusetts Public Health Depart-

²⁶Recently, concerns have been raised about the carcinogenicity of sodium fluoride (the fluoride compound commonly supplemented in community water supplies). In 1990, the National Toxicology Program at the National Institutes of Health issued preliminary results of a study on the carcinogenicity of sodium fluoride in rats and mice that showed only equivocal evidence of carcinogenicity in male rats (98). After considering the weight of the evidence on sodium fluoride, the Public Health Service's stated policy is to continue appropriate support for the use of fluorides for the prevention of dental decay (98).

²⁷The low-end caries reduction found in some studies may reflect the fact that control subjects were exposed to fluoride in forms other than in drink water (e.g., fluoride toothpaste).

²⁸See the following section for details of the Medicaid program and dental services.

Table 8-5-Behaviors and Conditions With Potential Effects on Adolescents' Dental and Oral Health

Behavior/condition	Potential effects on dental and oral health
<i>Behaviors:</i>	
Cigarette smoking	Short-term uses causes mucosal changes, staining of teeth. Long-term use results in increased oral cancer risk, periodontal disease.
Smokeless tobacco use	Same as for cigarette smoking.
Alcohol and drug use	Short-term use complicates drug administration by dentists and can cause unusual off ice behaviors, dental neglect in addicted patients. Lng-term use is related to oral cancer.
Participation in athletics	Traumatic injuries to teeth and jaws.
Oral contraceptive use	Periodontal disease from hormonal change; increased risk of dry socket after tooth extraction.
<i>Conditions:</i>	
Bulimia	Periodontal problems and acid destruction of teeth from vomiting.
Pregnancy	Gingival inflammation.
Sexually transmitted disease	Oral infections.
HIV infection	Periodontal disease; access to care maybe restricted.
Stress	Oral infection.

SOURCE: P.S. Casamassimo, S.L. Bronstein, J. Christensen, et al., "Periodontal Disease and Temporomandibular Joint Disorders," *Pediatric Dentistry, infancy Through Adolescence*, J.R. Pinkham, P.S. Casamassimo, H. Fields, et al. (eds.) (Philadelphia, PA: W.B. Saunders Co., 1988). Reprinted by permission,

ment, a combination of fluoride and dental sealants is the most effective preventive approach to reducing dental caries (13,56). The National Preventive Dentistry Demonstration Program²⁹ similarly found that a program combining fluoride, sealants, and dental health education³⁰ had greater benefit than did programs with fewer preventive techniques both in communities with fluoridated water and communities without it (10).

In 1983, the National Institutes of Health held a consensus conference on dental sealants, and the consensus development group recommended the use of sealants for the prevention of dental caries (91).

Despite such recommendations, in 1986, fewer than 10 percent of U.S. adolescents had dental sealants (101). Various factors, including practitioner attitudes, low public awareness, low priority for dental health, and cost, have limited the availability of sealants to adolescents (100).

The Bureau of Maternal and Child Health and Resources Development within the Health Resources and Services Administration of DHHS has funded dental sealant programs through competi-

tively awarded funding for its special projects of regional and national significance (SPRANS) (8). State agencies are utilizing Federal funds to initiate sealant programs in various parts of the country (71). The National Institutes of Health and the Center for Disease Control's Dental Disease Prevention Activity effort to encourage the use of sealants continues in this regard with grants to States and public awareness programs (21). On the other hand, the American Dental Association reported in 1988 that only 22 State Medicaid programs (including the District of Columbia) covered dental sealants, and at least one State recently discontinued sealants from its program (2).³¹

Personal Oral Hygiene--Some studies show that meticulous oral hygiene (i.e., including prophylaxis (cleaning) by a dental professional) can virtually eliminate dental caries (5,6,7). To OTA's knowledge, however, there are no clinical trials that show what effects toothbrushing without fluoride toothpaste or flossing has on dental caries (36).

Other Dietary Measures---Restricting sugary foods in the diet has significantly reduced dental

²⁹The National Preventive Dentistry Demonstration Program was conducted jointly by the American Fund for DentHealth and the RAND Corp. and was funded by the Robert Wood Johnson Foundation. The program spanned 4 years and included school children from 10 communities around the country (67a).

³⁰Dental health education is discussed in a separate section below.

³¹It should be noted that some Medicaid dental sealant benefits are limited in scope, allowing only limited application Of sealants (e.g., one sealant per tooth per lifetime) or allowing sealants only on limited teeth (e.g., only bicuspid and molars within 3 years of eruption), for limited ages (e.g., only for children ages 12 and under), or for limited populations (e.g., for developmentally disabled children only) (78).

caries in clinical trials (41,42). This approach has less pronounced effects on dental caries when sugar-restricted diets are not carefully controlled (68,96).

Prevention of Periodontal Disease

The prevention of periodontal disease requires good personal oral hygiene habits, including brushing and flossing, to remove plaque from all teeth surfaces (43,52,73). Personal oral hygiene is also important because gingivitis can be reversed through personal plaque control. Periodontitis is a much more severe disease state and usually requires professional treatment to prevent progression, but personal oral hygiene must be practiced as well (76).

In addition to personal hygiene measures, prophylaxis (cleaning) by a dental professional at least once a year is generally recommended to prevent periodontal diseases (37). The American Dental Association has suggested the inclusion of prophylaxis by a dental professional in a model dental health insurance benefit (3).

Most of the seven State Medicaid programs sampled in a recent OTA study covered dental prophylaxis for adolescents at least annually (one program limited the benefit to children under age 12) (78).

Prevention of Malocclusion

The genetic basis of much of malocclusion in adolescents makes it unpreventable (1a). As noted earlier, however, malocclusion is sometimes caused by the premature loss of primary teeth due to dental caries. The timely use of space-maintaining appliances effectively prevents the shift of teeth that results from the premature loss of primary teeth (37). The American Dental Association has recommended the inclusion of space maintainers as part of a model dental health insurance benefit (3).

In its study of seven State Medicaid programs mentioned previously, OTA found that all seven programs limit coverage of space maintainers for adolescents (78).

Dental Health Education and Behaviors

Dental Health Education

The benefits of dental health education for adolescents are hard to assess. Although such education may tend to increase knowledge (102), its lasting

effect on attitudes and behaviors appears less significant (28). Recent data suggest that adolescents have positive attitudes toward dental health, and that their attitudes improve with education and result in better behaviors (102). There is some indication that concerns about self-image and appearance can encourage good oral health behaviors for adolescents (1,53,54).

A primary locus for receipt of dental health education is during the dental visit (30), although the effectiveness of education in this setting is unknown. This locus presents an obvious problem for adolescents without frequent access to professional dental care. Health care providers other than dentists may have potential for either providing oral health information or providing referrals to dental professionals.

School health education programs are another locus for adolescents' receipt of oral hygiene information, but health education programs are not consistent across schools and generally provide little emphasis on older adolescents, who are at higher risk (30). Some evidence suggests the positive value of these programs if both parents and children are involved, but many programs have been found to be inadequate because they fail to involve the parents (59).

There is no central repository of oral health educational materials (29), although such a repository might inject a consistent element into school-based programs and office- or clinic-based educational materials. Further, adequate evaluations of educational programs and interactions are scarce, specifically in relation to adolescents.

Adolescents' Knowledge of and Attitudes Toward Dental Health

Although there is no similar information for adolescents, data from DHHS national surveys suggest that young adults (ages 18 to 29) know as much as or more than older adults about the benefits of fluoride, the positive effects of brushing and flossing on periodontal health, and the anticaries benefit of sealants (83). Higher income and education levels of these young adults were associated with a greater knowledge of these preventive benefits. Racial differences in young adults' knowledge are small (suggesting that many have been exposed to preventive information), but nonwhites do appear to know less about sealants than do whites.

A small study of adolescents in Minneapolis found that almost 75 percent of the predominantly white adolescents sampled had a regular dentist (54). Ninety percent said they brushed their teeth daily, and 80 percent felt tooth decay was a serious problem. Eighty-four percent believed that caries was preventable, though few knew much about preventive methods. A study of inner-city, largely black adolescents found that study participants were good at assessing their overall oral health, but they were not as good at assessing their gingival health status when compared with a dentist's assessment (15).

Adolescents' responsibilities in health care-seeking change over the course of adolescence. During the first part of adolescence, an adolescent typically depends on a parent or legal guardian for the initiation of health care visits; at the end of adolescence, decisions about care-seeking are increasingly likely to be a personal decision. Utilization of dental care parallels this change; dental visits drop off in the transition between adolescence and young adulthood (83). Meanwhile, the acute manifestations of dental conditions consistently increase in the early adult period (87).

Interventions and Services for the Treatment of Adolescents' Dental and Oral Health Problems

Interventions for the Treatment of Adolescents' Dental Health Problems

The usual therapies for dental caries include fillings (restorations), pulpal therapy, and, sometimes, removal of the affected tooth (see box 8-A). Therapies for periodontal disease include plaque removal, in the case of uncomplicated gingivitis, and various surgical and nonsurgical treatments, in the case of more serious periodontal disease. The treatment of malocclusion depends on its severity. Minor malocclusions can often be corrected by space-maintaining appliances or minor orthodontic treatment. Major malocclusions may require major orthodontic treatment. Few, if any, efforts have been made to trace the effects of specific interventions for the treatment of dental health problems from adolescence into adulthood.

The Dental Service Delivery System

Access to services in the U.S. dental care service delivery system is strongly influenced by the ability of patients to pay for services. Family income is directly associated with adolescents' utilization of dental care (39,87). Most oral health services are provided in private practices, which represent 85 percent of dentists (45), and are provided to middle- and upper-income patients (40). The likelihood that an adolescent has had a dental visit within the last year increases with family income (see figure 8-6). The likelihood also increases with private dental insurance. About four of five 12- to 17-year-olds with private dental insurance make at least annual visits to the dentist, while only about three of five without private dental insurance make such visits (87). The private dental insurance status of adolescents in various categories (gender, race/ethnicity, family income, activity limitation) is shown in table 8-6. Many adolescents from low-income families rely on public clinics or public insurance or both. Many public dental programs are federally sponsored (see below), but State and local governments are also active in providing dental health education and services to adolescents from low-income families.³² The size and scope of both State and local dental programs vary considerably. Local dental programs are more likely to provide clinical services than State dental programs (46). In a recent survey of local dental health agencies, 109 of 127 local health agencies that provide for clinical services (80 percent of survey respondents) provided them to adolescents (51). The clinical components were generally limited to preventive, emergency, and basic restorative services. Some local health agencies providing dental education programs targeted junior high (52 of 125 agencies) or high school (34 of 125 agencies) students, but twice as many (104 of 125 agencies) targeted elementary school students.

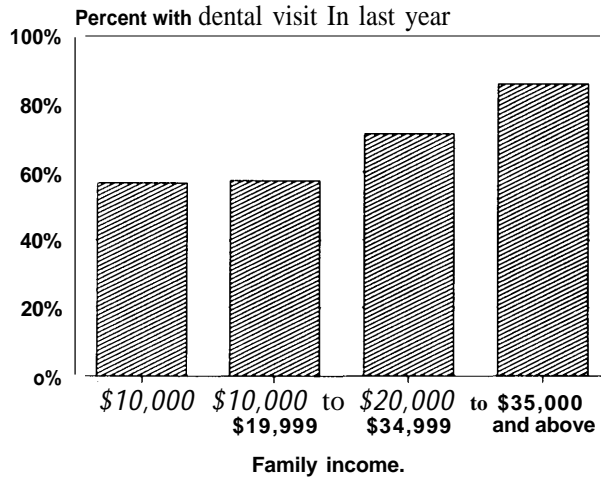
Federal Programs Pertaining to Adolescents' Dental and Oral Health

DHHS is the primary locus of Federal dental and oral health programs. Several DHHS agencies are involved in dental and oral health programs:

- . the Public Health Service, which includes the National Institute of Dental Research (NIDR)

³² Funding for local agencies comes from a variety of sources, including local taxes, State grants, Federal grants, revenue sharing, direct payment, and third-party reimbursement (including Medicaid).

Figure 8-6-Percentage of U.S. Adolescents Ages 12 to 17 With a Dental Visit in the Past Year, by Family Income,^a 1986



^aFamily income was adjusted for family size.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, *Use of Dental Services and Dental Health, 1986*, DHHS Pub. No. (PHS)88-1593 (Washington, DC: U.S. Government Printing Office, October 1988).

of the National Institutes of Health; the Health Resources and Services Administration, which provides dental care through its National Health Service Corps; the Indian Health Service; and various other Public Health Service agencies (e.g., Centers for Disease Control); and

the Health Care Financing Administration, which administers the Medicare and Medicaid programs.

In fiscal year 1988, as shown in figure 8-7, these DHHS agencies spent nearly \$580 million on oral and dental health (32). Almost 4 percent of total Medicaid expenditures for adolescents ages 10 to 18 was spent on dental services in fiscal year 1988 (82a).

An Interim Study Group on Dental Activities appointed by DHHS in 1987 found that a focus for dental and oral health activities within DHHS was lacking (45). That study group suggested that a central focus for oral health activities should be located within the Public Health Service at the Office of the Assistant Secretary for Health and should be advised by a formally chartered committee (45).

Table 8-6-Private Dental Insurance Status of U.S. Adolescents Ages 12 to 17, by Various Demographic Categories, 1986a

Demographic category	Percent with private dental insurance	Percent without private dental insurance
Males	44.0%	52.1%
Females	42.2	53.3
Whites	45.6%	50.3%
Blacks	30.2	65.2
Hispanic	35.1	60.5
Mexican-American	36.8	59.6
Other Hispanic	33.0	61.7
Family income:		
Under \$10,000	10.6%	86.5%
\$10,000-\$19,999	28.3	67.9
\$20,000-\$34,999	50.5	46.6
\$35,000 or more	63.1	33.8
Unable to engage in major activity..	26.0%	74.0%

^aTotals do not equal 100 due to unknown coverage.

^bDisabled.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, *Use of Dental Services and Dental Health, 1986*, DHHS Pub. No. (PHS)88-1593 (Washington, DC: U.S. Government Printing Office, October 1988).

Public Health Service

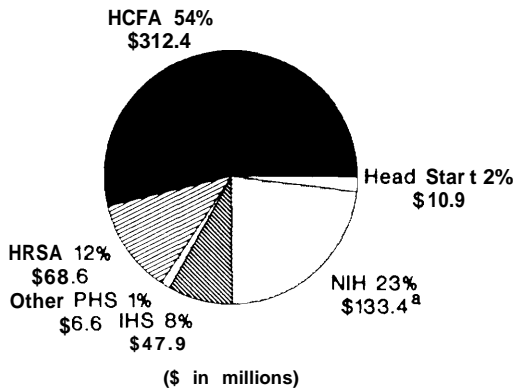
The Public Health Service has many responsibilities for the Nation's oral health, including research on oral health problems, support of community fluoridation efforts, and support for the direct provision of services.

NIDR, one of the National Institutes of Health, is the primary agency supporting Federal research on oral health—the causes, prevention, diagnosis, and treatment of oral and dental diseases and conditions. The limitations of national surveys conducted by NIDR were discussed previously.

The Federal Government's water fluoridation activities, as mentioned previously, are overseen by the Centers for Disease Control's Dental Disease Prevention Activity. Water fluoridation programs have been shown effective in reducing dental caries, but almost one-third of the U.S. population served by public water supplies lacks access to fluoridated water (67a).

In September 1989, the Bureau of Maternal and Child Health and Resources Development within the Health Resources and Services Administration of the Public Health Service sponsored a Workshop on the Oral Health of Mothers and Children (72). A full

Figure 8-7—Dental and Oral Health Expenditures by the U.S. Department of Health and Human Services, Fiscal Year 1988



ABBREVIATIONS: HCFA = Health Care Financing Administration, HRSA = Health Resources and Services Administration, IHS = Indian Health Service, NIH = National Institutes of Health, PHS = Public Health Service,

^aThe National Institutes of Health includes the National Institute of Dental Research.

SOURCE: S. Ginsburg and R.E. Schmidt, *An Inventory of Resources and Activities Devoted to Dental and Oral Health in the Department of Health and Human Services* (Bethesda, MD: Richard Schmidt Associates, Ltd., April 1989).

report containing the workshop participants' recommendations should be issued soon on issues that include oral health policy, integration and collaboration, advocacy, resources for oral health, oral health education and promotion, oral health status, contributing factors, oral health standards, documentation and evaluation, and research.

Direct dental services are provided through approximately 300 community health centers and migrant health programs that receive Federal grants under section 330 of the Public Health Service Act. Section 330 grants go to public and private nonprofit organizations that provide primary health care to populations or areas that are "medically under-erved." Almost all Public Health Service National Health Service Corps personnel are assigned to community health centers and migrant health programs. At least 121,000 adolescents received dental care in these centers in 1989 (55).

Another direct dental service program in the purview of the Public Health Service is the Indian Health Service, which has the responsibility for

providing care to American Indians and Alaska Natives.

Health Care Financing Administration

Though the Public Health Service supports various dental and oral health activities, the Medicaid program administered at the Federal level by the Health Care Financing Administration is the largest source of public expenditures for oral health services for children and adolescents.

While Medicaid provides public health insurance for low-income people of all ages, its Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program is specifically intended to serve children under age 18 (or age 21) and is the program through which most children under Medicaid receive dental care.³³ Further, Medicaid eligibility does not translate into utilization of services. In 1988, 46 States and the District of Columbia reported that of over 9 million Medicaid recipients under age 18 who were eligible for dental services, only 26 percent had a dental service of some kind performed (2). In New Jersey, for example, only about one-third of 15- to 20-year-olds who were covered by Medicaid received dental services in fiscal year 1988.

As part of a separate study, OTA recently surveyed the Medicaid/EPSDT dental programs in seven States regarding their coverage of selected preventive and therapeutic services (78). The survey found that some of the seven State programs did not provide a minimal dental benefit package, choosing not to cover certain procedures, such as sealants, despite the Health Care Financing Administration's instructions to the contrary. The study also identified several barriers within the Medicaid program that block access to services, including structural aspects of the program, low provider participation, low fees and other reimbursement issues, and burdensome paperwork.

Conclusions and Policy Implications

In general, available national data on the U.S. adolescent school population from NIDR show a remarkable decline in the prevalence of dental caries since 1979-80. Unfortunately, the data from these surveys do not provide much information about specific subgroups of adolescents. They do show, however, that white adolescents have far fewer

33 For a discussion of Medicaid and its EPSDT program, see ch. 16, "Financial Access to Health Services," in Vol. III.

decayed teeth than nonwhite adolescents, fewer missing teeth due to decay, and more restored (previously decayed but treated) teeth. Other smaller studies confirm this observation within specific groups of adolescents, including the children of migrant workers and American Indians. Also, there is some evidence to suggest that adolescents with disabilities and adolescents in juvenile justice facilities have poorer dental health than the adolescent population as a whole. Other adolescents not represented in the data are those who do not attend school, since the national surveys are school-based. Oversampling of specific populations in national surveys or conducting occasional special surveys may rectify this gap in information,

Another limitation of the national data on dental caries is that they do not provide information on possible confounding factors. Such factors might especially include income level and insurance status, but adolescents' perceived need of dental care, past history of dental disease, oral hygiene behaviors, and diet may also be relevant. More information on whether these factors may confound data on the prevalence of dental caries among racial or ethnic minority groups is necessary to further define the apparent differences between national white and nonwhite prevalence rates and to design appropriate interventions.

The most recent data on periodontal disease in adolescents (1986-87) from NIDR do not suggest severe periodontal problems in most adolescents, but rather, fairly widespread mild gingival conditions. Nonwhite adolescents tended to experience more gingival and periodontal problems than white adolescents.

Malocclusion, another dental problem for some adolescents, has not been studied or analyzed recently. Old data (1970) suggest that malocclusion is a problem that requires treatment for nearly 30 percent of adolescents. In 1979-80, about 25 percent of 17-year-olds had ever received any orthodontic treatment, but black adolescents were far less likely to have received it (96 percent of black adolescents had never received orthodontic treatment) than white adolescents (73 percent had never received orthodontic treatment), though there do not appear to be great differences in the occurrence of severe malocclusion conditions (81). An additional complication, besides the lack of recent data, is that the measurement tool used to assess the severity of

malocclusion is subjective, rendering absolute conclusions based on the available data questionable.

Conclusions about the prevalence of these dental problems are limited by the data, but it is clear that there are discrepancies in the occurrence of these dental problems among groups of adolescents. Interestingly, there are also discrepancies among adolescents in their access to dental services; dental insurance and income are primary factors influencing an adolescent's dental visit within the past year. Adolescents from low-income families are the least likely to have private dental insurance and are also the least likely to have visited a dentist within the last year. Similarly, white adolescents are more likely than nonwhite adolescents to have private dental insurance and are more likely than black adolescents to have had a dental visit. There is no direct evidence to suggest that adolescents who suffer the worst dental problems have the least access to dental services, but the possibility that this may be the case would seem to warrant further studies of certain groups of adolescents.

Publicly funded dental programs may not be accessible to all low-income adolescents; of over 9 million Medicaid recipients under age 18 who were eligible for dental services, only 26 percent had a dental service of some kind performed. One way publicly funded dental programs could become more accessible is if more dentists would treat low-income adolescents—reimbursement rates, program administration, and program structure appear to be barriers to dentists' participation in the Medicaid program.

Since the visit to a dentist is a primary locus for dental health education, low-income adolescents may have less access to dental health education than other adolescents. It is at least conceivable that increasing low-income adolescents' oral health awareness might spur their dental care-seeking behaviors, thereby improving their effective access to dental services.

Topical fluoride, sealants, prophylaxis (teeth cleaning by dental professionals), restorations, and space maintenance are the primary preventive or therapeutic treatments for most adolescents' dental problems (not including extraction). Unfortunately, not all publicly funded dental programs offer these primary services or the services are offered on a limited basis. Thus, many low-income adolescents lack access to

certain dental treatments that could reduce or prevent their dental diseases.

Besides professional services, personal oral hygiene plays a significant role in dental health (e.g., personal plaque control can reverse gingivitis and self-application of fluoride can help prevent caries). Adolescents are held responsible for their personal hygiene behaviors, but it is not clear that they are provided with adequate information. The effectiveness of health education programs can be measured in terms of changes in attitudes or behaviors or, preferably, in terms of changes in the rate of disease.

Schools and dental offices and clinics are primary sites for dental health education. A central repository of dental health education materials<. g., within the Public Health Service—could improve the likelihood of consistent information and improve the chances for coordinated educational activities.

Dentists should also be included in dental educational activities. To treat adolescents effectively, dentists probably could benefit from materials intended to make them more aware of adolescent-specific dental conditions (e.g., localized juvenile periodontitis) and adolescent-specific needs (e.g., for information on the effects of behaviors such as smokeless tobacco).

Chapter 8 References

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