

Child Indicators: Dental Health

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Maintaining good dental health among children in the United States today should be easy: regular tooth brushing, flossing, exposure to fluoride, and attention to good nutrition, together with visits to a dentist twice a year, should be enough to assure that a child rarely suffers the pain of an abscessed tooth, or loses a tooth to severe decay. However, many young children, especially those living in poor families, continue to suffer with mouths full of deep cavities, swollen jaws and cheeks, and episodes of around-the-clock pain. Some children regard tooth decay as inevitable and the pain associated with dental therapy as so unpleasant that they would rather have their teeth pulled than fixed.¹

Maintaining good dental health in children is important not only because it prevents childhood pain and suffering and the school absenteeism that results from dental disease, but also because tooth loss in childhood can adversely affect how the jaws and teeth function as the child matures.² Furthermore, unhealthy teeth are considered unattractive, and negative responses to the appearance of a child's teeth can impair the child's social confidence. Dental health can influence a child's overall chances for success just as do other, more frequently recognized aspects of physical health.³

This Child Indicators article reviews several measures of dental health in children and the evidence on children's dental health. While children's dental health has improved substantially over the past two decades, with large declines in the average number of cavities per child, a number of children experience a disproportionate share of dental disease.⁴ Poor children in particular, because they are less likely than their wealthier peers to receive dental services, are at the highest risk of suffering the pain and consequences of untreated dental disease. Although federal law requires states to provide dental services to poor children through the early and periodic screening, diagnosis, and treatment (EPSDT) component of the Medicaid

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program, in practice many poor children fail to receive these services. The reasons for this failure are summarized in the section on utilization of services in this article.

Measuring Children's Dental Health

Good dental health is usually defined as the absence of dental caries (tooth decay) and gingivitis (gum disease), combined with proper tooth and jaw function. Teeth that have never experienced any decay are considered the healthiest, and teeth in which decay has been treated (that is, the cavities have been filled) are considered healthier than teeth with untreated decay. The most comprehensive definition of good dental health would also include the appearance of the teeth: poorly aligned, crowded, mottled, or yellowed teeth are considered inferior, although their inferiority may be purely aesthetic.

The most frequently used indicators of dental health, both in individual children and in populations of children, are based on the presence of treated and untreated tooth decay. Other elements of children's dental health, such as proper tooth alignment and

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appearance, had not been captured in an index suitable for population studies until very recently, and are rarely collected as part of large-scale surveys in the United States.⁵ Periodontal (gum) disease is most prevalent in adults over 35, and is a significant factor contributing to tooth loss for older adults, but because the most severe forms of periodontal disease are found only infrequently in children, the presence of periodontal disease is rarely used as a measure of dental health in children.⁶

Measures of the prevalence of dental caries are based either on the number of decayed, missing, and filled teeth (DMFT), or on the number of decayed, missing, and

filled tooth surfaces (DMFS). Only the DMFT indicator and its variants are reported in this article.⁷ Filled teeth are defined as those in which caries have been filled, and decayed teeth are those with untreated caries present. When a tooth has both untreated and treated decay present, the tooth is counted only as decayed. The counts are taken either on a child's primary teeth (and denoted with lowercase letters: dft) or on a child's permanent teeth (and denoted with uppercase letters: DMFT). Primary and permanent teeth are not represented in the same indicator. Children usually begin losing their primary teeth and gaining their permanent teeth at about age five or six and typically have lost all their primary teeth by their early teens. Accordingly, the dft indicator is most relevant for children under five, both the dft and the DMFT indicators are relevant for 5- to 11-year-olds, and the DMFT indicator alone is used for children over 11 years of age. Since primary tooth loss is normal for maturing children, missing teeth are not represented in the dft indicator. The dft indicator thus contains somewhat less information about a child's dental health than does the DMFT indicator, since some children do lose primary teeth to advanced untreated decay.

One indicator of dental health in groups of children is the percentage of children who are "caries-free," defined as those children whose teeth show no evidence of dental caries, treated or untreated. Again, because of the change in dentition as children age, the caries-free indicator is reported for primary teeth only for 2- to 9-year-olds, and for permanent teeth only for 5- to 17-year-olds. For children 5 to 9 years old, two caries-free statistics may be reported, one based on the primary teeth and one on the permanent teeth.

The dft and DMFT indicators reveal the extent to which dental caries have damaged a child's teeth, and thus serve as indicators both of dental health and of the amount of dental services received and/or required by a child. A variant of these indicators is the ratio of untreated decayed teeth to the total count of decayed, missing,

and filled teeth. This ratio, abbreviated %d/dft or %D/DMFT, serves as an indicator of how well a child's dental needs are being met. For example, in 1988–91 a nationwide survey of children ages 5 to 17 found a mean DMFT of 1.6, indicating that, on average, children in this age group had 1.6 decayed, missing, and filled teeth.⁸ The mean %D/DMFT for the same group was 21%, indicating that roughly one in five decayed teeth was untreated.⁹

National Data Sources

National information on children's dental health is generally based on large household surveys. The data presented in this article were collected in five nationwide surveys: the National Health and Nutrition Examination Survey I, 1971–74 (NHANES I), the National Health and Nutrition Examination Survey III, 1988–91 (NHANES III), the National Institute of Dental Research's (NIDR) surveys of oral health in school children in 1979–80 and 1986–87, and the National Health Interview Survey, 1989 (NHIS).

The NHANES were designed to produce nationally representative data on a wide variety of health indicators, including dental health, for the civilian noninstitutionalized U.S. population.¹⁰ The NIDR surveys were designed to produce nationally representative data on oral health for all children in grades K–12 enrolled in public or private schools.¹¹ Certain groups were not captured in these two surveys (in the case of the NHANES, homeless persons or migrant workers and their families, and in the case of the NIDR, children who were not enrolled in school—also principally children whose families were homeless or migrant). Because these omitted groups may be more likely than average to experience poor dental health, the rates of dental disease among children as measured by the NHANES and the NIDR may be understated. However, children living in such families represent a small fraction of all children, so any underestimate of overall population measures in data from these surveys is likely to be small. Nonetheless, identification of unmet dental health needs in populations of children not well represented in these surveys is problematic. In addition, because radiographic

examinations were not conducted as part of these surveys, some caries occurring in difficult-to-observe locations (between the teeth, for instance) may go undetected, and for this reason, too, the dental caries indicators based on these surveys may represent underestimates of actual caries prevalence.

The NHIS is a nationally representative sample of the civilian noninstitutionalized population, designed to collect data on selected health topics. In addition to oral

By age 17, almost 80% of youths will have experienced at least one episode of tooth decay, making this form of disease one of the most commonly experienced.

health, the 1989 NHIS also collected data on a wide range of other topics, including mental health, AIDS awareness, and diabetes. Unlike the NHANES and NIDR, which rely on physical examination of teeth by trained examiners, the NHIS data are collected in personal household interviews. Adults in the surveyed household respond for household members under 19 years of age, but 17- and 18-year-olds are permitted to respond for themselves if they wish. To the extent that survey nonparticipants are less likely than average to receive dental services (because, for instance, they are homeless), the rates of service receipt represented in the NHIS data may be slightly overstated.

Children's Dental Health by Age

Table 1 presents various measures of dental health in both primary and permanent teeth for children ages 2 to 17. Data are from the NHANES III for the years 1988 to 1991—the most current data available at the time when this article was written.

The data demonstrate clearly the progressive nature of dental disease. The mean number of decayed and filled primary teeth among 5- to 9-year-olds is more than three times the mean number of dft among 2- to 4-year-olds, although 2- to 4-year-olds have more primary teeth than 5- to 9-year-olds.

Table 1

| Various Measures of Dental Health for U.S. Children, Ages 2 to 17, 1988–91 | | | | | | |
|--|--|--|---|--|---|--|
| Age | Percentage of Children Whose Primary Teeth Are Caries-Free | Percentage of Children Whose Permanent Teeth Are Caries-Free | Mean Number of Decayed and Filled Primary Teeth (dft) | Mean Number of Decayed, Missing, and Filled Permanent Teeth (DMFT) | Mean Percentage of Decayed Primary Teeth with Untreated Caries (%d/dft) | Mean Percentage of Decayed Permanent Teeth with Untreated Caries (%D/DMFT) |
| 2 to 4 | 83 | | 0.6 | | 82 | |
| 5 to 9* | 50 | | 1.9 | | 40 | |
| 5 to 11* | | 74 | | 0.6 | | 29 |
| 12 to 17 | | 33 | | 2.8 | | 17 |

A variety of statistics are used to measure dental health in children. Most are based on the number of dental caries (decayed teeth), both treated (filled) and untreated. In addition, since children have two sets of teeth and change teeth typically between ages 5 and 11 years, statistics are reported separately for each set of teeth. Among the measures in this table, “percentage caries-free” is the percentage of children in the reference population who, when examined, showed no evidence of caries (treated or untreated). The measures dft and DMFT are the mean number of decayed (d), missing (m), and filled (f) teeth in a population of children. The lowercase letters (dft) signify primary teeth, and the uppercase letters (DMFT), permanent teeth. The measures %d/dft and %D/DMFT are the mean percentages of decayed teeth with untreated caries in primary and permanent teeth, respectively.

- The data show the progressive nature of dental disease. Older children are less likely to be caries-free and tend to have more dental disease (treated and untreated) than younger children.
- Taken together, the various measures demonstrate that dental disease is not evenly distributed among the population of children in the United States. More than half of children ages 5 to 17 years had experienced no caries in their permanent teeth from 1988 to 1991. Yet, the mean number of decayed and filled teeth among the minority of children in that age group who actually experienced decay exceeded 3.5, and more than 1 in 5 of those children who experienced decay had 5 or more decayed teeth.

* Note: The age groupings for ages 5 to 9 years and 5 to 11 years overlap because 5 to 9 years is the older of two age groups for which the indicators showing the health of the primary teeth are relevant, while 5 to 11 years is the younger of two age groups for which the indicators showing the health of the permanent teeth are relevant.

Source: Kaste, L.M., Selwitz, R.H., Oldakowski, R.J., et al. Coronal caries in the primary and permanent dentition of children and adolescents 1–17 years of age: United States, 1988–1991. *Journal of Dental Research* (February 1996) 75, Spec. No.: 631–41, Table 2, Table 5, and Table 9.

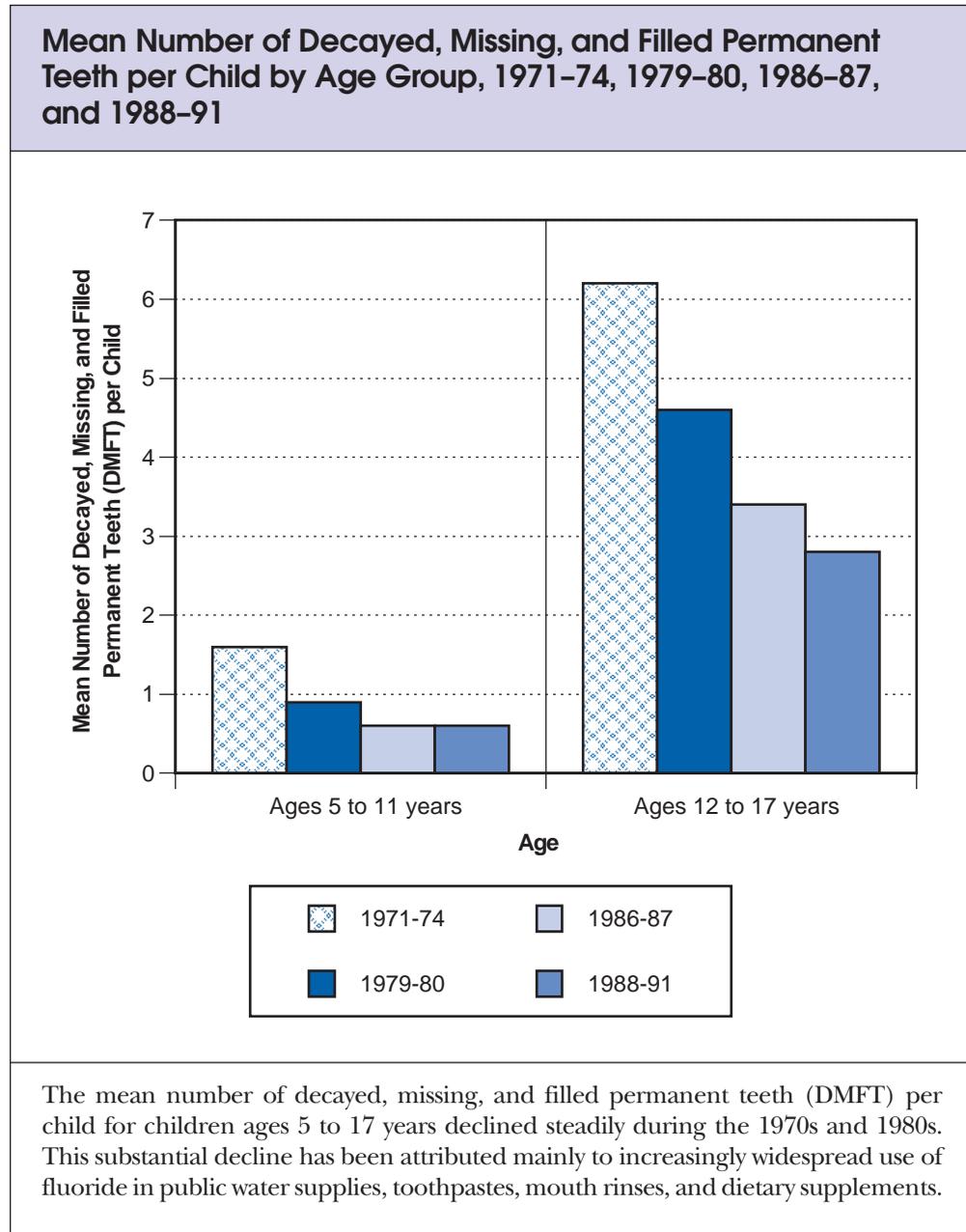
Similarly, 12- to 17-year-olds have many more decayed, missing, and filled permanent teeth than 5- to 11-year-olds (but 12- to 17-year-olds also have many more permanent teeth than 5- to 11-year-olds). The increase in dental disease with age is also seen in the percentage caries-free measure, which declines from 83% in 2- to 4-year-olds to only 33% in 12- to 17-year-olds. In fact, by age 17 almost 80% of youths will have experienced at least one episode of tooth decay, making this form of disease one of the most commonly experienced diseases in the U.S. child population.¹² Finally, although the measures of dental disease experienced (dft, DMFT, presence of caries) increase with age,

the measures of untreated disease (% d/dft and % D/DMFT) decline with increasing age, suggesting that older children are more likely to have their caries treated than younger children.

Recent Time Trends in Dental Health

As shown in Figure 1, which combines data from the NHANES and the NIDR, the mean number of decayed, missing, and filled permanent teeth (DMFT) per child for children in the age groups 5 to 11 years old and 12 to 17 years old declined steadily during the 1970s and 1980s. The mean

Figure 1



Sources: The **1971–74** data are from U.S. Department of Health and Human Services. *Decayed, missing, and filled teeth among persons 1–74 years*. Vital and health statistics, Series 11, No. 223. Hyattsville, MD: National Center for Health Statistics, 1981, p. 12, Table D; **1979–80** data from National Institute of Dental Research. *The prevalence of dental caries in U.S. children, 1979–80: National dental caries prevalence survey*. NIH Publication No. 82-2245. Bethesda, MD: U.S. Department of Health and Human Services, December 1981; **1986–87** data from U.S. Department of Health and Human Services. *Oral health of United States children: National and regional findings*. NIH Publication No. 89-2247. Bethesda, MD: DHHS, 1989, p. 5; **1988–91** data from NHANES III, reported in Kaste, L.M., Selwitz, R.H., Oldakowski, R.J., et al. Coronal caries in the primary and permanent dentition of children and adolescents 1–17 years of age: United States, 1988–1991. *Journal of Dental Research* (February 1996) 75, Spec. No.: 631–41. **Note:** The DMFTs for 1979–80 and 1986–87 are weighted averages of the individual-year age groupings in the sources.

DMFT in both age groups fell by approximately 60% during the 20-year period to means of 0.6 DMFT in 5- to 11-year-olds and 2.8 DMFT in 12- to 17-year-olds in 1988–91. This substantial decline in mean DMFT was accompanied by an equally encouraging increase in the proportion of

children who were caries-free in their permanent teeth from 37% of 5- to 17-year-olds in 1979–80 to 55% of the same age group in 1988–91.^{13,14}

The substantial decline in the experience of caries among school-age children

in recent decades has been attributed mainly to increasingly widespread intake of fluoride, through use of fluoridated public water and fluoride toothpastes and mouth rinses.¹⁵ By the early 1990s, more than half (62%) of the U.S. population who used public water supply systems received fluoridated water¹⁶ (in 1950, only 10% of the

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population using public water supply systems received fluoridated water),¹⁷ and 94% of U.S. children used fluoride toothpaste.¹⁸ Other sources of fluoride were used much less frequently. Only about 10% of children used either fluoride supplements (fluoride pills or drops, used most often to provide regular fluoride to children whose water does not contain adequate fluoride) or fluoride mouth rinses at home or in school programs.¹⁹

Despite steady improvements in children's dental health over the past two decades, severe dental problems remain a fact of life for many children. While NHANES III (1988–91) showed that the permanent teeth of 55% of children and adolescents ages 5 to 17 were free of caries,²⁰ the same survey revealed that a small proportion of children experienced a disproportionate share of dental disease: Some 80% of all caries were found in just 25% of 5- to 17-year-olds. The mean DMFT measure among the 25% of 5- to 17-year-olds who experienced the most decay in their permanent teeth was approximately 8.0, compared to an overall mean for the same age group of 2.8 DMFT.²¹ In addition, untreated dental disease remains a serious problem for some children.

Race/Ethnic Group Differences in Dental Health and Utilization of Dental Services

Table 2 shows both the DMFT and the mean percentage of unfilled decayed teeth (% D/DMFT) among children ages

5 to 17 years in three groups of children: whites, blacks, and Mexican Americans (who may be of any race). The three racial/ethnic groups represented in Table 2 had very similar mean DMFT and percentage caries-free scores, which suggests that on average, the three groups suffered dental caries at similar rates. However, the mean percentage of unfilled decayed teeth, %D/DMFT, varied considerably among the three groups. Blacks and Mexican Americans, on average, exhibited more than twice the percentage of unfilled cavities exhibited by whites. This difference is consistent with the NHIS data reported in the table, which shows that white children received more dental services than did black or Mexican-American children.

Dental Insurance and the Utilization of Dental Services

One reason that white children receive more dental services than do black or Mexican-American children is that white children are more likely than children in the other ethnic/racial groups to have private dental insurance coverage. While 52% of white children ages 2 to 17 had private dental insurance in 1989, only 39% of black children and 32% of Mexican-American children did.²² Private dental insurance is an important factor in the amount of dental services a child receives. The 1989 NHIS survey shows that among children ages 5 to 17,²³ those with private dental insurance saw a dentist on average more than three times a year, while those without private dental insurance saw a dentist on average less than twice a year.²⁴ Data from the same survey also show that a child's private dental insurance status is related to family income. While only 14% of all children ages 2 to 17 from families with incomes below the federal poverty level (\$11,662 per year for a family of four in 1989)²⁵ had private dental insurance, 54% of children ages 2 to 17 from families with incomes in the \$20,000 to \$34,999 range, and 69% of those from families with incomes of \$35,000 or more, had private dental insurance.²⁶

Data from the same survey also show, however, that while dental insurance is a

Table 2

| Various Measures of Dental Health and Dental Services Received Among Children Ages 5 to 17 in Different Racial/Ethnic Groups in 1988–91 | | | | |
|---|--|--|----------------------------------|---|
| Race/Ethnicity Group ^a | 1988–91 | | 1989 | |
| | Mean Number of Decayed, Missing, and Filled Teeth (DMFT) | Percentage of Untreated Caries (%D/DMFT) | Number of Dental Visits per Year | Percentage of Children Who Never Had a Dental Visit |
| White | 1.6 | 18.4 | 2.6 | 6.5 |
| Black | 1.4 | 39.0 | 1.1 | 9.9 |
| Mexican American | 1.7 | 38.4 | 1.6 | 21.1 |

^a Whites and blacks may include Mexican Americans. Mexican Americans may include persons of any race, including whites and blacks.

Measures of dental health (DMFT and %D/DMFT) are based on dental examinations. The data on use of dental services is based on interviews, typically of parents. The number of dental visits per year is the mean number of visits to a dentist's office for treatment or advice, including services by technicians or hygienists, and including visits to orthodontists and oral surgeons. The percentage who never had a dental visit reflects the percentage of children who have never in their lives had a visit to a dentist.

- Although children in all three racial/ethnic groups had similar rates of dental caries, as reflected by the similar mean DMFT scores, black and Mexican-American children had on average more than twice as many untreated decayed teeth as did white children.
- Black and Mexican-American children had fewer visits, on average, to the dentist each year, and were more likely than white children never to have visited a dentist.

Sources: **Dental Health Measures:** NHANES III data reported in Kaste, L.M., Selwitz, R.H., Oldakowski, R.J., et al. Coronal caries in the primary and permanent dentition of children and adolescents 1–17 years of age: United States, 1988–91. *Journal of Dental Research* (February 1996) 75, Spec. No.: 631–34, Table 9; **Dental Services Measures:** U.S. Department of Health and Human Services. *Dental services and oral health: United States, 1989*. Vital and Health Statistics, Series 10, No. 183. Hyattsville, MD: National Center for Health Statistics, December 1992, Tables 10 and 17.

factor in the frequency with which a child receives dental services, both race and income play roles independent of private insurance status. For instance, white children ages 5 to 17 with private dental insurance saw a dentist on average more than twice as often as did privately insured black children in the same age group (3.4 times per year as compared to 1.6 times per year). Similarly, children ages 5 to 17 with private dental insurance in families with incomes of \$35,000 and over saw a dentist on average 3.7 times per year, while children with private dental insurance in the same age group in families with incomes in the \$10,000 to \$19,999 range saw a dentist less than half as often.²⁴

While private dental insurance is a factor in many children's access to dental services,

for children in families with incomes below the federal poverty level, it is the efficacy of public dental insurance that matters. Most children from families with incomes below the federal poverty level are eligible to receive dental care through Medicaid's EPSDT program, a federal-state program first implemented in 1972. Dental services that the states must provide to EPSDT eligible children (up to age 20)²⁷ include dental screenings at a frequency consistent with recognized professional dental guidelines, and any follow-up treatment needed for problems identified at these screenings, including filling cavities. States are specifically required to recruit dentists to participate in EPSDT, locate eligible families and inform them about EPSDT services, and assure that providers perform the required services.²⁷

EPSDT services have not, however, reached the majority of poor children. According to a report by the Office of the Inspector General of the Department of Health and Human Services, only 20% of all children ages birth to 20 years who were enrolled in Medicaid and eligible for EPSDT actually received preventive dental services.²⁸ Reasons why such a low percentage of eligible children are reported to be served include: (1) underreporting of service use due to ambiguities and variations in program data reporting conventions among the states and the Health Care Financing Administration (HCFA), (2) failure of families of eligible children to seek services because they are not aware of their children's dental health needs or because they are unaware of or do not value the program's services, and (3) an inadequate supply of dental service providers for low-income children.

A shortage of dentists who will accept Medicaid patients is one of the most frequently cited reasons for states' failure to deliver EPSDT dental services to poor children.²⁹ According to a recent survey of dentists, reasons for dentists' unwillingness to treat Medicaid patients include inadequate reimbursement rates, heavy paperwork burdens imposed by the program, requirements for prior authorization of routine

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treatments, and delayed or denied reimbursements.³⁰ Dentists also report problems with patients, including missed appointments and poor compliance. Although the federal regulations for EPSDT do provide for transportation for needy patients, dentists report that transportation remains a problem for some patients.³¹ In the past few years, efforts have been launched on the part of state, local, and private agencies to increase dentists' participation in and children's use of Medicaid dental programs. However, evaluations of

the effectiveness of these efforts are not yet available.

Conclusion

The data presented in this article support several broad generalizations about children's dental health. First, on average, children's dental health has improved substantially over the past two decades, with the average child suffering fewer caries than in the past and with few differences among racial/ethnic groups in the average number of caries experienced or in the percentage of the population who are caries-free. Second, the distribution of dental disease is extremely uneven. More than 50% of 5- to 17-year-olds are caries-free in their permanent teeth, while the balance of the population in this age group have experienced on average three to four decayed, missing, or filled teeth and have one untreated decayed tooth. Last, racial and ethnic minority children (specifically, blacks and Mexican Americans) have more untreated dental disease and receive fewer dental services than their white peers.

The findings suggest several actions that may improve children's dental health. First, more research is needed to better identify the populations of U.S. children with poor dental health and to develop strategies to improve dental health among the minority of children who bear a disproportionate burden of untreated dental disease. Second, to the extent that there are still children who are not regularly exposed to fluoride at the appropriate concentrations or who are not adequately informed about dental hygiene practices, there is a potential for public health interventions to improve children's dental health. Third, because many children remain uninsured, there may be a potential for improving children's dental health through expanded insurance coverage. Finally, although the law requires that most children living in poverty be provided with free dental services, in reality many poor children do not receive these services, in some cases because their families have not enrolled them in Medicaid, and in others because enrollment does not necessarily ensure that services will be received as needed. Thus, within the existing public dental insurance system, there appear to be opportunities for improving children's dental health.

1. Sacks, M. Dental program fills a need. *San Jose Mercury News*. July 15, 1997, at 1E.
2. More than 600,000 school days were missed nationwide because of acute dental conditions in 1993. See U.S. Department of Health and Human Services. *Current estimates from the National Health Interview Survey, 1993*. Vital and Health Statistics, Series 10, No. 190. Hyattsville, MD: National Center for Health Statistics, December 1994.
3. Miller, R.E., and Rosenstein, D.I. Children's dental health: Overview for the physician. *Pediatric Clinics of North America* (1982) 29,3:429-38.
4. Press release issued by the Public Information and Reports Branch, National Institute of Dental Research, National Institutes of Health, Department of Health and Human Services. Results of National Oral Health Survey. Monday, March 11, 1996. Available online at <http://www.nidr.nih.gov/news/i.htm>.
5. Frazier, P.J., and Horowitz, A.M. Prevention: A public health perspective. In *Disease prevention and oral health promotion*. L.K. Cohen and H.C. Gift, eds. Copenhagen, Denmark: Munksgaard, 1995, pp. 109-52.
6. U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration. *Health status of minorities and low-income groups*. Third edition. Washington, DC: U.S. Government Printing Office, 1991, Chapter VIII, p. 222.
7. In practice, DMFT and DMFS indicators are highly correlated. Because each tooth has five surfaces, the DMFS indicator takes on higher values than the DMFT measure.
8. Kaste, L.M., Selwitz, R.H., Oldakowski, R.J., et al. Coronal caries in the primary and permanent dentition of children and adolescents ages 1 to 17 years: United States, 1988-1991. *Journal of Dental Research* (February 1996) 75, Spec. No.: 631-41, Table 9.
9. Missing teeth are a very small fraction of the total DMFT. See note no. 8, Kaste, Selwitz, Oldakowski, et al., p. 640, Table 9. The mean %M/DMFT, or the ratio of missing teeth to the total count of decayed, missing, and filled teeth, for children ages 5 to 17 years was 1.3%.
10. See note no. 8, Kaste, Selwitz, Oldakowski, et al., pp. 631-32.
11. U.S. Department of Health and Human Services. *Oral health of United States children: National and regional findings*. NIH Publication No. 89-2247. Bethesda, MD: DHHS, 1989, pp. 3-4.
12. See note no. 8, Kaste, Selwitz, Oldakowski, et al., p. 639, Figure 2.
13. See note no. 11, U.S. Department of Health and Human Services, p. 6, Table D.
14. See note no. 8, Kaste, Selwitz, Oldakowski, et al., p. 637, Table 6.
15. Brunelle, J.A., and Carlos, J.P. Recent trends in dental caries in U.S. children and the effect of water fluoridation. *Journal of Dental Research* (February 1990) 69, Spec. No.: 723-27, 820-23.
16. Eleven percent of the U.S. population uses private water supplies (for example, wells). Fifty-six percent of the total U.S. population receives fluoridated water from public and private sources. Of those on public water supply systems, approximately 4% receive water that is "naturally" fluoridated, rather than supplemented with fluoride. See *Fluoridation Fact Sheet*. FL-141, December 1993, Centers for Disease Control and Prevention, Division of Oral Health. Obtained from Tom Reeves, Division of Oral Health, July 31, 1997.
17. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Oral Health. *Fluoridation Census*. Bethesda, MD: DHHS, September 1993.
18. Wagener, D.K., Nourjah, P., and Horowitz, A. Trends in childhood use of dental care products containing fluoride: United States, 1983-89. In *Advance data from vital and health statistics*. No. 219. Hyattsville, MD: U.S. Department of Health and Human Services, National Center for Health Statistics, 1992, Table 5.
19. U.S. Department of Health and Human Services. *Dental services and oral health: United States, 1989*. Vital and Health Statistics, Series 10, No. 183. Hyattsville, MD: National Center for Health Statistics, December 1992, p. 59, Table 17.
20. See note no. 8, Kaste, Selwitz, Oldakowski, et al., p. 637, Table 6.
21. See note no. 8, Kaste, Selwitz, Oldakowski, et al., p. 639, Figure 2, and p. 640, Table 9.
22. See note no. 19, U.S. Department of Health and Human Services, Table 13.
23. Since children less than five years of age tend to see the dentist less frequently than older children, they are not included here.

24. See note no. 19, U.S. Department of Health and Human Services, Table 20.
25. U.S. Department of Commerce, Bureau of the Census. *Statistical abstract of the United States 1994*. Washington, DC: U.S. Government Printing Office, 1994, Table 738.
26. See note no. 19, U.S. Department of Health and Human Services, Table 14.
27. Office of Inspector General, U.S. Department of Health and Human Services. *Children's dental services under Medicaid—Access and utilization*. OEI-09-93-00240. San Francisco: Office of Evaluation and Inspections, April 1996, p. 1.
28. Preventive dental services were defined as instruction in self-care oral hygiene procedures, a teeth cleaning by a dental professional, and when appropriate, an application of dental sealants to prevent decay. Children requiring dental services for acute problems may be seen at higher rates. In addition, the Health Care Financing Administration data reported here may underreport the care actually given because of changes in reporting conventions, and may also be unreliable because of reporting variation among states. See note no. 27, Office of Inspector General, U.S. Department of Health and Human Services, p. 6.
29. See note no. 27, Office of Inspector General, U.S. Department of Health and Human Services, p. 2.
30. See note no. 27, Office of Inspector General, U.S. Department of Health and Human Services, p. 7.
31. U.S. Congress, Office of Technology Assessment. *Children's dental services under the Medicaid Program—Background paper*. OTA-BP-H-78. Washington, DC: U.S. Government Printing Office, October 1990, p. 18.