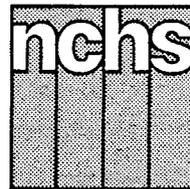


# Advance Data



From Vital and Health Statistics of the CENTERS FOR DISEASE CONTROL/National Center for Health Statistics

## Trends in Childhood Use of Dental Care Products Containing Fluoride: United States, 1983–89

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### Introduction

The correlation between the concentration of fluoride in community drinking water and prevalence of dental caries (tooth decay) observed in the early 1940's resulted in a public health effort to encourage communities to add fluoride to their water supply as a means of preventing dental caries. Essentially all water contains at least trace amounts of fluoride. Thus, community water fluoridation is the adjustment of the amount of fluoride that occurs naturally in a community's water supply to the optimal level for preventing tooth decay. In the United States, the optimal level of fluoride ranges from 0.7 to 1.2 parts per million (ppm). In 1945, 1.7 percent of the American population was served by optimally or greater than optimally naturally fluoridated drinking water (1). A 1989 survey indicated that 54 percent of the American public and 61 percent of the population on central water systems are now being served by optimally fluoridated drinking water (2). Neither the percent of the population served by

fluoridated drinking water nor the percent of the population on community water systems that received fluoridated water has changed since 1985 (2).

In addition to optimally fluoridated drinking water, other sources of fluoride for public use have been developed and marketed. These include dietary fluoride supplements, fluoride toothpaste, fluoride mouthrinse, and professionally applied fluorides. Dietary fluoride supplements are designed for children—infants through teen years—and are used in communities in which the drinking water is fluoride deficient. Dietary fluoride supplements by prescription, fluoride-containing toothpastes sold over the counter, and professionally applied fluorides have been available for over three decades. More recently, mouthrinses containing fluoride have been marketed and sold over the counter.

Early school-based fluoride programs consisted of operator-applied fluoride regimens. Later, other kinds of fluoride administration

were developed and used in schools. Today, school-based, fluoride rinse and/or tablet programs have been implemented in most States. Fluoride mouthrinsing is the fluoride regimen most frequently used, followed by fluoride tablet programs. Professionally applied fluoride treatments are offered in only a few school systems.

The widespread availability of community water fluoridation and use of fluoride products in the United States have contributed to a dramatic reduction of dental caries among school-age children in recent years (figure 1). For example, among 9 year olds, the prevalence of dental caries has declined from 71 percent during 1971–74 to 34 percent during 1985–86 (3). There are some groups of children that are at higher risk than others of developing dental caries (4). These groups are mainly black and live in the Northeast and Pacific regions.

The decline in dental caries has occurred at the same time that there has been an increase in the prevalence of dental fluorosis. Dental



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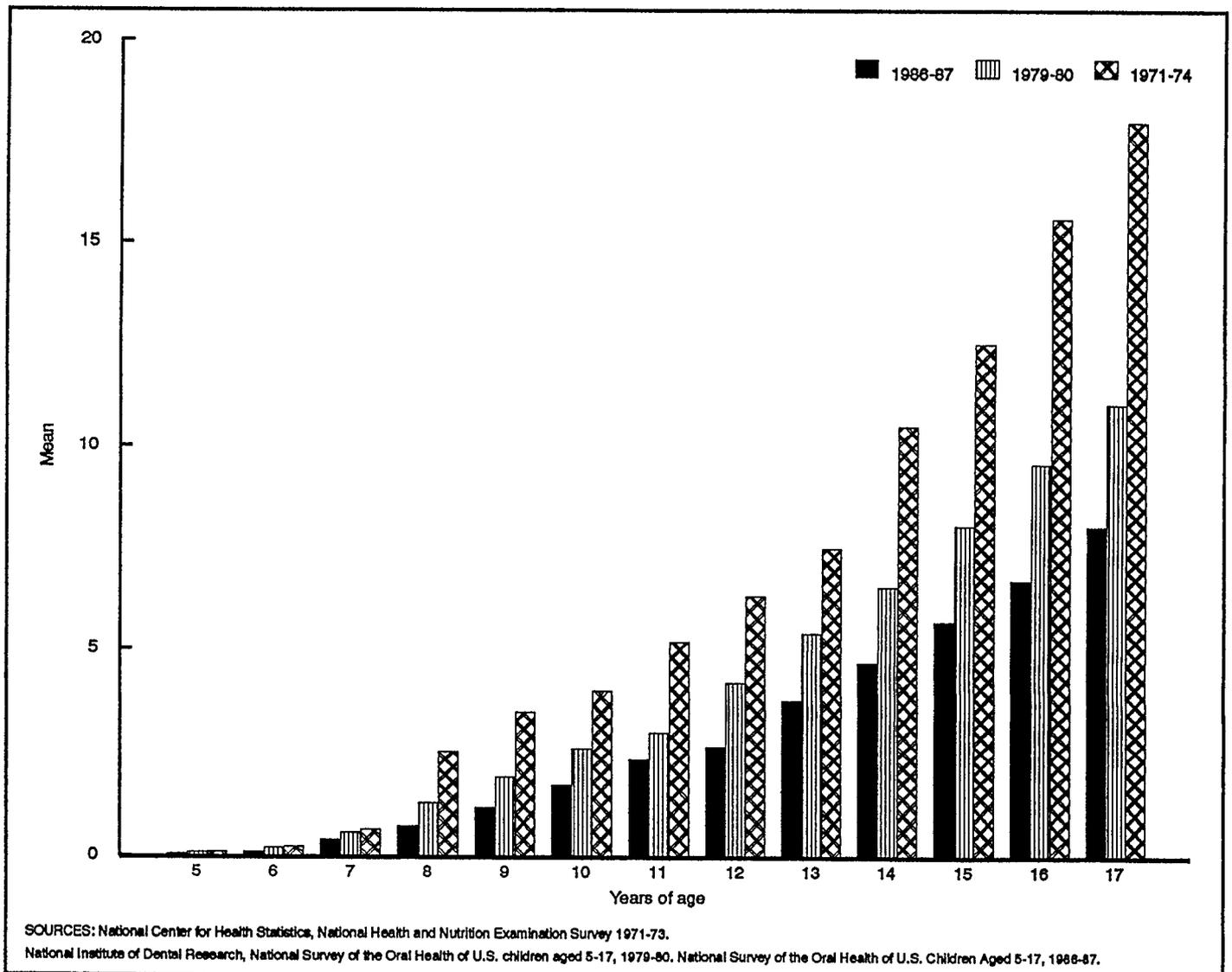


Figure 1. Age-specific mean decayed, missing, or filled permanent tooth surfaces from three national surveys: United States, 1971-87

fluorosis is a hypomineralization of enamel of the teeth that may range in appearance from a few white flecks or spots to discrete or confluent pitting and brown staining. Dental fluorosis occurs when children below the age of 6 years ingest more than the recommended amounts of fluoride. In the early 1940's, Dean estimated that only 10 percent of the children who were born and reared in communities with optimally fluoridated water (0.7 to 1.2 ppm) would demonstrate some signs of mild forms of fluorosis (5,6). Recent surveys, however, indicate that the prevalence of mild and moderate forms of fluorosis is about 22 percent (7). This degree of fluorosis is considered mild, which does not call for public health concern, although it may be

important cosmetically to individuals.

To monitor the use of fluoride products, this report describes the trend in the use of selected fluoride-containing dental products and dietary fluoride supplements among infants, children, and youth younger than 18 years of age during the period 1983-89.

### Data and methods

The National Health Interview Survey (NHIS) is conducted by the National Center for Health Statistics, Centers for Disease Control. It is composed of two parts: (a) a general health characteristic questionnaire that remains the same each year and is completed for each household member; and (b) a special topic

questionnaire that varies from year to year and is conducted on all or a sample of the interviewed individuals. Special topics on oral health were administered in 1983, 1986, and 1989. The questions contained in these surveys were developed in collaboration with the National Institute of Dental Research, National Institutes of Health, and other Federal agencies. The information on dental care was collected on all individuals in the selected households. When possible, information was obtained from all adults in the household. Information on children and members of the family who were not at home at the time of the interview was obtained from the responsible individual of the household. These supplements

**Table 1. Number of interviews, by age and selected demographic characteristics for children 0–17 years of age: United States, 1983, 1986, and 1989**

Characteristic	Under 2 years			2–4 years			5–17 years		
	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total	3,284	1,996	3,785	5,095	3,004	5,590	21,405	12,393	22,982
Race									
Black	483	420	665	771	581	1,005	3,063	2,574	4,196
White	2,703	1,508	2,997	4,187	2,326	4,361	17,737	9,443	17,958
Hispanic									
Hispanic	383	240	518	562	341	693	2,290	1,195	2,634
Non-Hispanic	2,902	1,756	3,267	4,533	2,663	4,897	19,115	11,198	20,348
Poverty status									
At or above poverty threshold	2,490	1,366	2,710	3,817	2,121	4,099	16,340	9,080	17,354
Below poverty threshold	491	463	759	839	650	1,069	2,783	2,304	3,813
Education of head of household									
Some college	1,253	922	1,826	1,874	1,452	2,720	7,472	5,580	10,995
High school or less	1,987	1,065	1,929	3,174	1,538	2,838	13,736	6,737	11,838
Region									
Northeast	641	401	682	973	543	961	4,355	2,433	4,082
Midwest	854	450	927	1,362	757	1,431	5,669	3,182	5,847
South	1,082	731	1,295	1,718	1,069	1,889	7,213	4,413	7,882
West	708	414	881	1,042	635	1,309	4,168	2,365	5,171

NOTE: See the appendix for the definition of variables.

contained questions on home use of fluoride products (including toothpaste and mouthrinse), dietary fluoride supplements (in the form of drops or tablets, with and without vitamins), and participation in school-based fluoride mouthrinse

programs. Information about the latter fluoride regimen was collected only in the 1986 and 1989 surveys. Information on dental visits also was assessed for individuals 2 years of age and older. The numbers of individuals from whom an interview was obtained

each year by age and some selected variables are displayed in table 1. The corresponding estimated numbers that the sample represents nationally are displayed in table 2.

The present analyses are restricted to information obtained on

**Table 2. Estimated population size in thousands, by age and selected demographic characteristics for children 0–17 years of age: United States, 1983, 1986, and 1989**

Characteristic	Under 2 years			2–4 years			5–17 years		
	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total	7,109	7,314	7,674	10,743	10,861	11,094	44,761	44,957	45,235
Race									
Black	1,120	1,170	1,179	1,737	1,565	1,702	6,652	6,914	7,077
White	5,780	5,881	6,188	8,710	8,911	8,922	36,826	36,584	36,440
Hispanic									
Hispanic	813	932	1,095	1,173	1,306	1,484	4,722	4,551	5,364
Non-Hispanic	6,296	6,382	6,579	9,569	9,555	9,610	40,039	40,406	39,871
Poverty status									
At or above poverty threshold	5,371	5,199	5,604	8,028	8,006	8,289	34,077	34,050	34,702
Below poverty threshold	1,066	1,528	1,456	1,782	2,054	2,007	5,855	7,435	7,126
Education of head of household									
Some college	2,678	3,514	3,789	3,927	5,476	5,483	15,579	20,984	22,041
High school or less	4,319	3,765	3,821	6,715	5,331	5,555	28,746	23,701	22,927
Region									
Northeast	1,376	1,477	1,381	2,027	1,939	1,904	9,021	8,927	8,047
Midwest	1,799	1,596	1,779	2,788	2,643	2,745	11,715	11,312	11,260
South	2,355	2,684	2,691	3,673	3,899	3,873	15,218	15,826	15,852
West	1,578	1,557	1,823	2,255	2,380	2,572	8,807	8,892	10,076

NOTE: See the appendix for the definition of variables.

children younger than 18 years of age. Three age groups were defined as follows: younger than 2 years (infants and toddlers), 2–4 years (preschool children), and 5–17 years (school children). Information regarding dental health care was not collected for infants and toddlers younger than 2 years of age, and information about the use of fluoride mouthrinse in school-based programs was collected on 2–16 year olds but data are reported only on school children 5–16.

In all surveys, the use of fluoride-containing products is based on self-report. The method of collecting information on fluoride-containing toothpaste changed between 1983 and 1986. In 1983 the respondents were asked if the toothpaste contained fluoride. No validation of the respondent's knowledge or perception was obtained. In contrast, in 1986, the brand name of toothpaste was collected. The name of the toothpaste was then compared with brands that were approved either by the Food and Drug Administration or the American Dental Association as containing fluoride. (Brand names are confidential information and are not available on the computer tapes.) The dental care supplement in 1986 also asked questions regarding respondent's perception about the presence of fluoride in their drinking water and knowledge of the purpose of fluoridation of the community water supply. Therefore, data from this year were analyzed to examine the association of the use of fluoride-containing dental products, with the knowledge of the purpose of community water fluoridation, and whether they thought their water supply was fluoridated.

In this report, terms such as "no difference" or "similar" mean there is not a statistical significant difference. Whereas terms like "greater," "more likely," "more frequently," "less likely," or "less frequently" implies a statistical significant difference.

## Findings

Figure 2 shows the reported use of each of the four fluoride-

containing dental products by age in 1986. The year 1986 was chosen because this was the only year that all four sources of fluoride were considered, and it was also the mid-year in the period evaluated in this report. In this figure, 17 year olds were excluded in order to have comparable age groups across the different panels. Panel 1 shows a decline in reported use of dietary fluoride supplements by children as they age. However, participation in school mouthrinsing programs shows a different pattern, noticeably increasing between children in the age groups 5–7 and 8–10 and decreasing thereafter (panel 2). As shown in panel 3, the use of fluoride mouthrinse at home is not a common practice among infants and toddlers

(1.2 percent). The practice increases to 1 out of 11 children 2–4 years of age and then doubles to about 1 out of 5 children by age 5; thereafter, the percentage is unchanged. The fourth panel shows that more than 90 percent of children 2 years of age and older use a fluoride toothpaste. Among infants and toddlers, this proportion was 30 percent.

In the following, the changes in these patterns of usage over the period 1983–89 are discussed separately for infants and toddlers (under 2 years of age), preschool children (ages 2–4 years), and school-age children (ages 5–17 years).

## Infants and toddlers

Table 3 shows that among children under 2 years of age, the

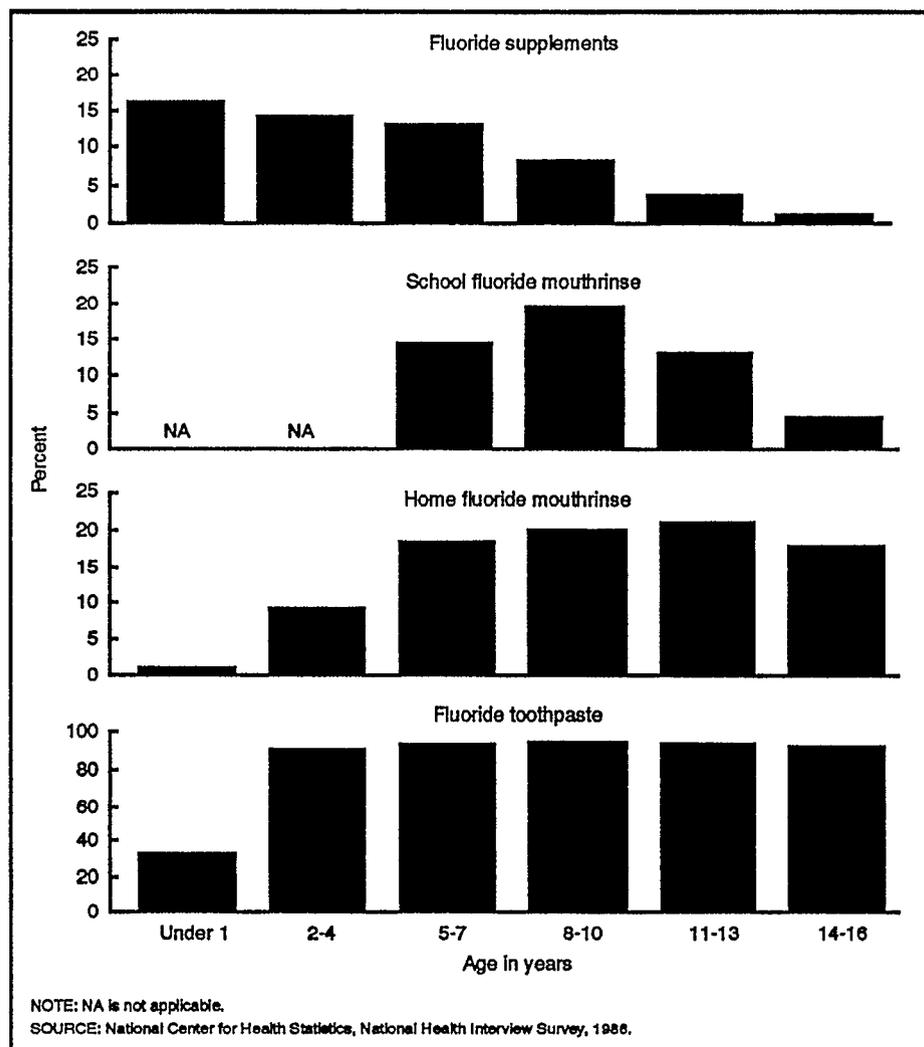


Figure 2. Percent of children using dental care products containing fluoride by age, fluoride supplements, school fluoride programs, fluoride mouthrinse, and toothpaste: United States, 1971–87

consumption of fluoride supplements had not changed significantly since 1983. It was reported that about 14 percent of these children took fluoride supplements in 1983, whereas 15 percent took fluoride supplements in 1989. In each year the use of fluoride supplements was greater among white children than black children; among non-Hispanic children than Hispanic children; among children not living in poverty than living in poverty; and among children living in households headed by persons with some college education than children in households headed by persons with lower educational attainment. In addition, more children living in the West and

Northeast regions were reportedly taking fluoride supplements than in the Midwest and South. The largest increases in fluoride supplement usage occurred among children in the West, among black children, and among Hispanic children. The statistically-significant difference between Hispanic and non-Hispanic percentages disappeared between 1983 and 1989 due to the increased usage among Hispanic children.

The use of toothpaste containing fluoride by infants and toddlers did not change much between 1983 and 1986 (31 and 33 percent, respectively). However, there was an increase but not statistically significant in use reported by blacks,

Hispanics, and children living in poverty.

Figure 3 indicates that the use of fluoride supplements is less among infants and toddlers of adults who reported their drinking water was fluoridated (32 percent versus 11 percent). Figure 4 shows that infants and toddlers were more likely to be receiving fluoride supplements if the responding adults knew the purpose of fluoridation. The use of toothpaste containing fluoride was also more frequent if the informant knew the purpose of community water fluoridation. However, neither the use of fluoride toothpaste nor mouthrinse was related to perception of drinking water fluoride status.

**Table 3. Percent of infants and toddlers under 2 years of age using selected fluoride-containing dental care products at home, by selected sociodemographic characteristics: United States, 1983, 1986, and 1989**

[Standard errors are given in parentheses]

Characteristics	Fluoride supplement			Mouthrinse			Toothpaste		
	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total . . . . .	14.0 (0.7)	16.3 (1.3)	15.1 (0.7)	0.6 (0.1)	1.2 (0.3)	1.2 (0.2)	31.0 (0.9)	33.4 (0.1)	---
Race									
Black . . . . .	3.9 (1.0)	2.3 (0.9)	6.5 (1.2)	0.3 (0.3)	1.7 (0.8)	2.8 (0.7)	26.1 (2.1)	33.2 (2.5)	---
White . . . . .	16.1 (0.8)	19.4 (1.6)	16.6 (0.8)	0.7 (0.2)	1.1 (0.3)	0.9 (0.2)	32.1 (1.0)	33.4 (1.3)	---
Hispanic									
Hispanic . . . . .	7.9 (1.4)	9.6 (2.1)	12.9 (1.7)	1.0 (0.5)	0.7 (0.6)	1.4 (0.6)	25.6 (2.3)	34.1 (2.9)	---
Non-Hispanic . . . . .	14.8 (0.8)	17.3 (1.4)	15.5 (0.8)	0.5 (0.1)	1.3 (0.3)	1.1 (0.2)	31.7 (1.0)	33.3 (1.4)	---
Poverty status									
At or above poverty threshold . . . . .	16.8 (0.9)	19.9 (1.6)	18.2 (0.9)	0.6 (0.2)	1.2 (0.3)	1.1 (0.3)	32.3 (1.0)	34.4 (1.4)	---
Below poverty threshold . . . . .	5.0 (1.1)	7.9 (1.7)	6.4 (1.1)	0.2 (0.2)	1.2 (0.5)	1.3 (0.5)	26.3 (2.2)	32.4 (2.7)	---
Education of head of household									
Some college . . . . .	19.5 (1.2)	21.5 (1.9)	19.8 (1.2)	0.5 (0.2)	1.0 (0.3)	0.9 (0.2)	32.5 (1.3)	35.6 (1.5)	---
High school or less . . . . .	10.9 (0.8)	11.6 (1.3)	10.8 (0.8)	0.6 (0.2)	1.5 (0.4)	1.5 (0.4)	30.2 (1.2)	31.4 (1.5)	---
Region									
Northeast . . . . .	22.8 (1.9)	23.9 (2.3)	20.6 (1.7)	0.5 (0.3)	1.9 (0.8)	2.5 (0.7)	29.3 (2.0)	36.0 (2.5)	---
Midwest . . . . .	9.1 (1.3)	9.8 (1.8)	7.9 (0.9)	0.2 (0.2)	0.7 (0.4)	0.8 (0.4)	30.2 (1.7)	28.0 (2.2)	---
South . . . . .	8.8 (1.0)	11.0 (1.5)	10.4 (1.0)	0.7 (0.3)	1.3 (0.4)	1.3 (0.4)	32.4 (1.6)	34.7 (2.2)	---
West . . . . .	19.8 (1.8)	24.9 (4.7)	25.1 (2.0)	0.8 (0.4)	1.1 (0.6)	0.4 (0.2)	31.2 (2.2)	34.2 (2.0)	---

NOTES: See the appendix for the definition of variables. Unknown is included in total.

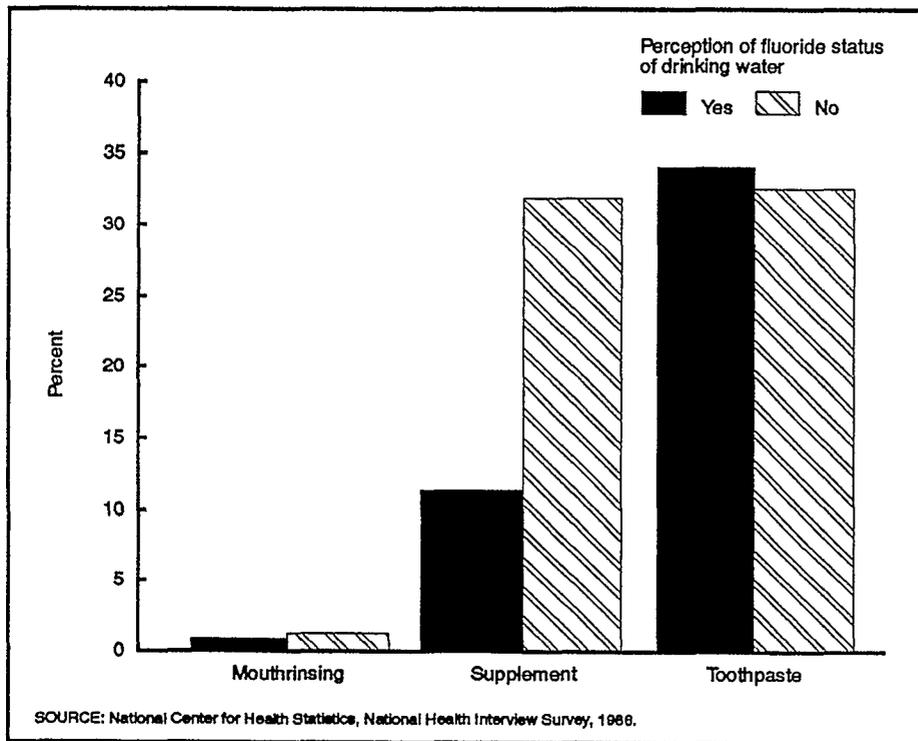


Figure 3. Percent of infants and toddlers under 2 years of age using dental care products containing fluoride by respondent's perception of fluoride status of drinking water: United States, 1986

**Pre-school age children**

Table 4 shows the fluoride-containing dental product

usage patterns for children 2-4 years of age. The use of dietary fluoride supplements has increased 3.7 percent between 1983 and 1989. The

pattern of use is similar to that of children under 2 years of age. That is, children who are white, non-Hispanic, living above the poverty threshold, and living in homes with a college educated head of household were more likely to use fluoride supplements. Further, children living in the Northeast and West were more likely to have reported usage. The differences between sociodemographically defined subgroups remained about the same between the 1983-89 period because there was almost an equal increase in use in all subgroups.

In 1983 more black children than white and more children living in the South than any other region were reported to use a fluoride-containing mouthrinse. This practice appears to be more common in recent years but the degree of change is not similar across subgroups. There is a disproportional increase in the use of fluoride mouthrinse among black children, children living in poverty, and children whose head of household had no college education. In recent years, when comparing the Northeast region with other regions, a different pattern was observed between subgroups. In 1983 children in the Northeast reported the lowest use of fluoride mouthrinse among all regions. In 1989 the Northeast ranked the second highest with respect to this practice. Also in 1989, the gap between black and white pre-school children with respect to their use of fluoride mouthrinse widened. The difference was 4 percent in 1983 compared with 8 percent in 1989.

Figure 5 indicates that the children in households in which the respondent thought that their drinking water was fluoridated reported to use dietary fluoride supplements less frequently than those in households in which the respondent thought that their drinking water was not fluoridated. Children's use of fluoride toothpaste or fluoride mouthrinse did not appear to be related to the respondent's perceived presence or absence of fluoride in the drinking water.

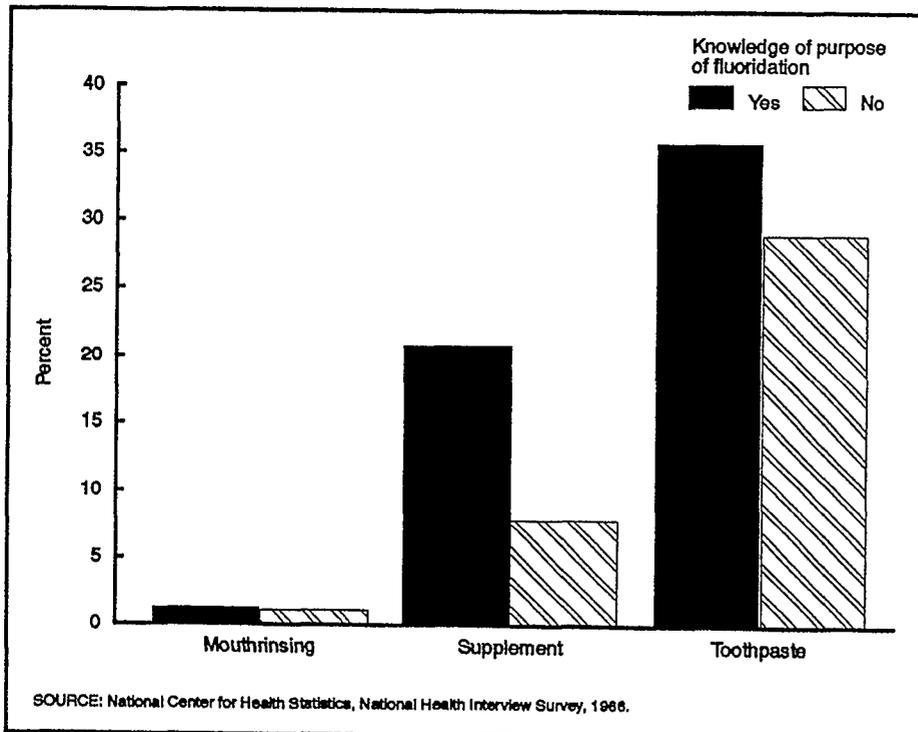


Figure 4. Percent of infants and toddlers under 2 years of age using dental care products containing fluoride by respondent's knowledge of the purpose of fluoridation: United States, 1986

**Table 4. Percent of pre-school-age children (2–4 years of age) using selected fluoride-containing dental care products, by selected sociodemographic characteristics: United States, 1983, 1986, and 1989**

[Standard errors are given in parentheses]

Characteristic	Fluoride supplement			Mouthrinse			Toothpaste		
	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total . . . . .	12.7 (0.6)	14.4 (1.3)	16.4 (0.6)	7.9 (0.4)	9.4 (0.7)	9.2 (0.5)	91.9 (0.5)	91.2 (0.6)	---
Race									
Black . . . . .	3.9 (0.9)	4.4 (1.1)	8.6 (1.1)	11.6 (1.2)	13.4 (2.1)	16.3 (1.5)	89.2 (1.4)	89.8 (1.6)	---
White . . . . .	15.0 (0.7)	16.3 (1.6)	17.9 (0.7)	7.4 (0.5)	8.8 (0.7)	8.0 (0.5)	92.4 (0.5)	91.7 (0.7)	---
Hispanic									
Hispanic . . . . .	8.1 (1.4)	9.8 (2.1)	11.1 (1.5)	6.5 (1.1)	6.9 (1.8)	9.6 (1.2)	87.0 (1.6)	94.3 (1.4)	---
Non-Hispanic . . . . .	13.3 (0.7)	15.1 (1.4)	17.2 (0.7)	8.1 (0.5)	9.7 (0.7)	9.2 (0.5)	92.5 (0.5)	90.7 (0.7)	---
Poverty status									
At or above poverty threshold . . . . .	14.8 (0.8)	16.8 (1.5)	18.9 (0.7)	8.4 (0.5)	9.6 (0.7)	9.2 (0.5)	93.7 (0.5)	92.7 (0.7)	---
Below poverty threshold . . . . .	5.8 (0.9)	8.1 (1.6)	8.3 (1.0)	6.5 (1.0)	9.4 (1.5)	10.5 (1.4)	87.3 (1.4)	89.4 (1.4)	---
Education of head of household									
Some college . . . . .	18.8 (1.1)	18.9 (1.8)	21.3 (0.9)	8.0 (0.7)	9.5 (0.9)	8.2 (0.6)	93.8 (0.6)	91.1 (0.9)	---
High school or less . . . . .	9.2 (0.7)	9.9 (1.2)	11.7 (0.8)	8.0 (0.5)	9.3 (0.9)	10.3 (0.7)	91.2 (0.6)	91.8 (0.8)	---
Region									
Northeast . . . . .	23.5 (1.7)	25.0 (2.8)	27.8 (1.8)	5.8 (0.8)	10.2 (1.6)	10.1 (1.2)	91.6 (1.1)	92.7 (1.2)	---
Midwest . . . . .	7.9 (1.2)	8.3 (1.6)	10.1 (1.2)	8.4 (0.8)	9.0 (1.0)	7.2 (0.8)	91.8 (0.9)	90.3 (1.3)	---
South . . . . .	7.2 (0.9)	8.0 (1.3)	10.8 (0.9)	9.8 (0.8)	10.3 (1.3)	12.2 (0.9)	92.7 (0.8)	91.5 (1.0)	---
West . . . . .	17.9 (1.5)	23.1 (4.6)	23.1 (1.4)	6.1 (0.9)	7.7 (1.4)	6.3 (0.8)	91.0 (1.0)	90.3 (1.5)	---

NOTES: See the appendix for the definition of variables.  
Unknown is included in total.

Figure 6 shows that when the informant knew that fluoride provided protection against dental caries, the pre-school children were more likely to be using dietary fluoride supplements than their counterparts. A similar tendency is observed regarding the use of fluoride toothpaste or mouthrinse. However, the difference in usage of mouthrinse between these two groups of children is not statistically significant.

### School-age children

Table 5 shows information on usage among school-age children. Participation in school-based fluoride mouthrinse programs did not change

significantly between 1986 and 1989. During this period, about 1 out of 10 children reported participation in a school-based fluoride mouthrinse program. There were, however, substantial changes among some subpopulations. In 1986 more children living in poverty or in households with less educated responsible adults reported participation in these programs. By 1989, the gap had widened. Also by 1989, significantly more black children participated in school mouthrinsing activities than white children. In the earlier year, the highest participation rates were noted in the West and Northeast. By 1989, the participation rates in the South surpassed those of

the Northeast, which actually decreased.

Dietary fluoride supplements was the fluoride regimen least used by school-age children. The slight change in the percent of children using supplements is primarily due to an increase in reported consumption since 1986. The only subpopulations to steadily increase the usage over the entire period were school-age children who were black, poor, or from the Northeast or the West. The remaining subpopulations primarily increased their usage after 1986 such that white, nonpoor, non-Hispanic, or children living in homes with college educated heads of household were

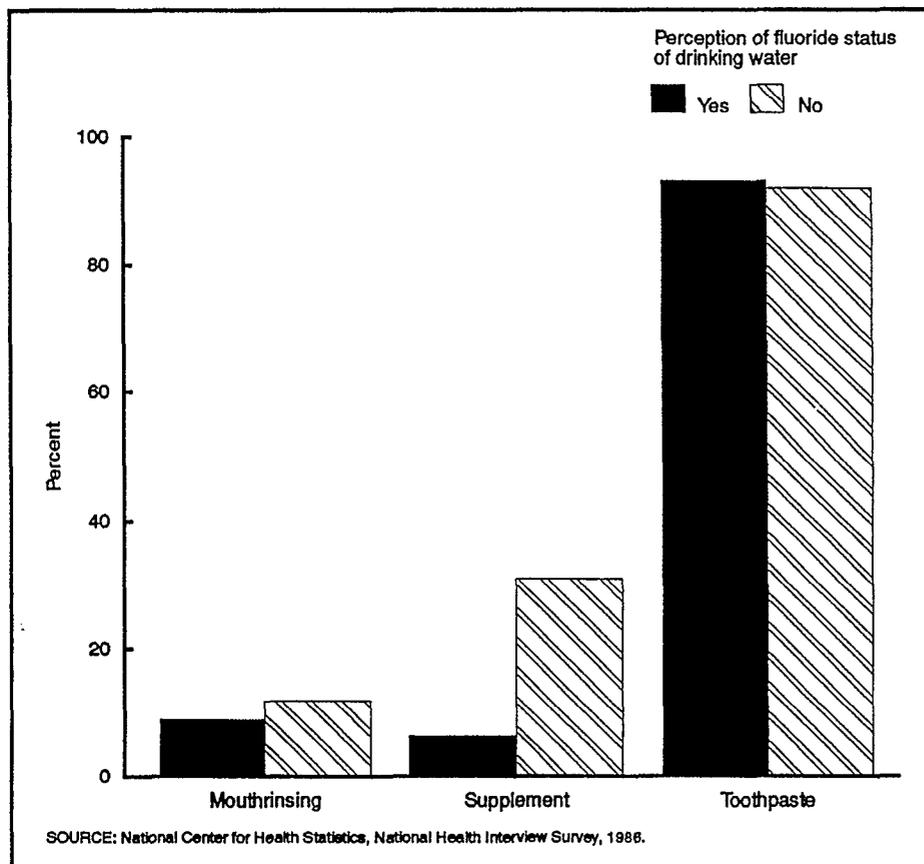


Figure 5. Percent of children 2–4 years of age using dental care products containing fluoride by respondent's perception of fluoride status of drinking water: United States, 1986

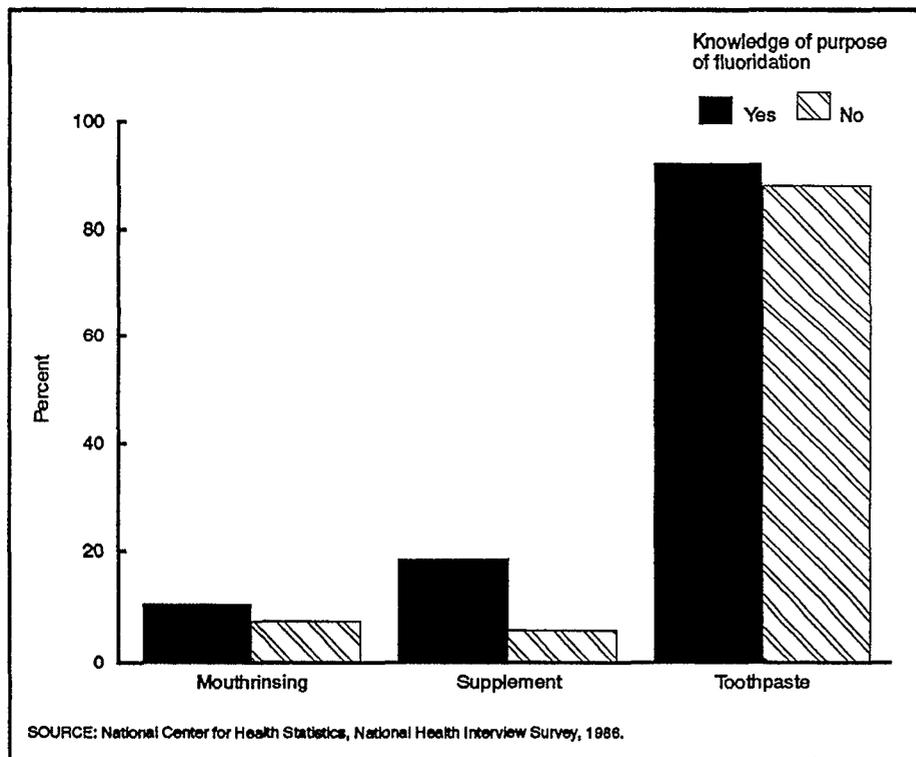


Figure 6. Percent of children 2–4 years of age using dental care products containing fluoride by respondent's knowledge of the purpose of water fluoridation: United States, 1986

more likely to use dietary fluoride supplements.

Approximately 20 percent of school-age children use fluoride-containing mouthrinse and this has increased, especially since 1986. In 1983 the use of fluoride mouthrinse was more often reported among non-Hispanic and among non-poor children. There was also more use by children living in the South than any other region. However, due to a disproportional increase in this activity throughout the decade, a different pattern was observed in 1989. Black children increased their usage more than white children, resulting in a widening of the 1 percentage point difference observed in 1983 to 8 percent in 1989. Both Hispanic and poor children reported an increase in mouthrinsing in recent years. Consequently, in 1989 there is not much difference between poor and non-poor and between Hispanic and non-Hispanic school-age children.

Figure 7 illustrates the use of fluoride dental products among school-age children in relation to the responding adult's perception of fluoride status of their drinking water. Use of fluoride toothpaste is unrelated to perception of drinking water status. However, use of fluoride mouthrinse is slightly, but nonsignificantly, more frequent among children whose responding adult thought that their drinking water was not fluoridated. Participation in school-based fluoride mouthrinse programs and use of fluoride supplements were more likely to occur when adults thought that the drinking water was not fluoridated. As shown in figure 8, children were more likely to use fluoride-containing dental care products at home if the informant knew the purpose of community water fluoridation. Participation in school-based fluoride mouthrinse programs, however, was not significantly different.

School-age children, therefore, had four potential sources of fluoride from dental-care product usage—school programs, home dietary fluoride supplements, home

**Table 5. Percent of school-age children (5–17 years of age) using selected fluoride-containing dental products, by selected sociodemographic characteristics: United States, 1983, 1986, and 1989.**

[Standard errors are given in parentheses]

Characteristic	School programs			Fluoride supplement			Mouthrinse			Toothpaste		
	1983	1986	1989	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total . . . . .	---	12.8 (0.8)	13.9 (0.6)	6.0 (0.3)	6.2 (0.6)	8.1 (0.3)	16.7 (0.4)	19.2 (0.6)	25.2 (0.5)	95.1 (0.3)	93.7 (0.4)	---
Race												
Black . . . . .	---	14.4 (1.4)	19.1 (1.4)	2.6 (0.5)	3.3 (0.6)	4.6 (0.5)	17.4 (1.1)	19.3 (1.3)	32.2 (1.3)	92.5 (1.0)	92.7 (0.8)	---
White . . . . .	---	12.5 (0.9)	13.0 (0.6)	6.7 (0.3)	6.9 (0.8)	8.8 (0.4)	16.8 (0.4)	19.3 (0.6)	24.0 (0.5)	95.9 (0.2)	93.9 (0.4)	---
Hispanic												
Hispanic . . . . .	---	11.5 (1.3)	12.8 (1.1)	3.8 (0.6)	5.2 (1.0)	7.2 (0.8)	11.4 (1.0)	16.1 (1.5)	23.0 (1.2)	92.1 (0.9)	95.1 (0.8)	---
Non-Hispanic . . . . .	---	13.0 (0.8)	14.1 (0.6)	6.3 (0.3)	6.3 (0.6)	8.2 (0.3)	17.3 (0.4)	19.5 (0.6)	25.5 (0.5)	95.5 (0.3)	93.5 (0.4)	---
Poverty status												
At or above poverty threshold . .	---	12.0 (0.7)	12.3 (0.5)	6.9 (0.3)	6.8 (0.8)	8.9 (0.4)	17.5 (0.4)	20.3 (0.6)	26.3 (0.5)	96.5 (0.2)	94.8 (0.3)	---
Below poverty threshold . . . . .	---	16.6 (1.5)	20.6 (1.5)	3.3 (0.6)	4.3 (0.7)	5.3 (0.6)	14.1 (1.2)	15.0 (1.3)	24.0 (1.2)	92.4 (0.8)	92.3 (1.0)	---
Education of head of household												
Some college . . . . .	---	11.3 (0.7)	11.0 (0.6)	8.3 (0.5)	8.4 (1.0)	10.2 (0.5)	17.6 (0.6)	19.2 (0.8)	24.6 (0.6)	96.4 (0.3)	94.5 (0.5)	---
High school or less . . . . .	---	14.3 (1.1)	16.9 (0.8)	4.9 (0.3)	4.3 (0.5)	6.2 (0.4)	16.3 (0.5)	19.3 (0.7)	26.0 (0.7)	94.8 (0.4)	93.6 (0.5)	---
Region												
Northeast . . . . .	---	13.8 (2.1)	10.3 (0.8)	9.7 (0.7)	10.4 (1.2)	11.9 (0.8)	14.5 (0.8)	21.4 (1.5)	23.5 (1.1)	95.1 (0.5)	93.8 (0.8)	---
Midwest . . . . .	---	10.7 (1.3)	12.0 (1.1)	3.1 (0.4)	2.9 (0.5)	5.9 (0.7)	16.6 (0.7)	20.1 (0.9)	24.5 (0.9)	95.9 (0.4)	93.3 (0.8)	---
South . . . . .	---	12.2 (1.4)	16.0 (1.2)	5.1 (0.4)	4.1 (0.5)	5.8 (0.4)	19.0 (0.8)	19.6 (0.9)	30.0 (0.9)	94.7 (0.5)	93.8 (0.5)	---
West . . . . .	---	15.8 (1.6)	15.7 (1.1)	7.8 (0.7)	10.0 (2.7)	11.2 (0.7)	14.8 (0.8)	15.0 (1.2)	19.7 (0.9)	94.8 (0.6)	93.8 (0.8)	---

NOTES: See the appendix for the definition of variables.

Unknown is included in total.

Children 17 years of age are excluded in analyses of school mouthrinsing programs.

mouthrinse, and toothpaste. The use of fluoride toothpaste was approximately 95 percent of the children. Therefore, many of the children received fluoride from more than one product. The percent of children using at least three fluoridated dental-care products was 4.0 percent among families for which the responding adult thought that the drinking water was fluoridated and 8.9 percent among families for which the responsible adult thought that the drinking water was not fluoridated.

### Dental health care

As table 6 shows, during 1983–89, pre-school-age children who did not

visit a dentist in the previous year were less likely to use dietary fluoride supplements than children who visited a dentist the previous year. Fluoride supplements can be obtained only when prescribed by a health provider such as a physician or dentist, and in some States by a pharmacist or physician assistant. In 1983 the number of dental visits was related to the use of dietary fluoride supplements. That is, the more frequent the visits the greater the use of dietary fluoride supplements. In recent years, however, this association has disappeared.

In 1983 there was a relation between fluoride supplement use and

the interval since the last dental visit. That is, the shorter the interval since the last visit the higher the percent of reported use of fluoride supplements. Although the same pattern exists in recent years, the difference in supplement intake between the children with a 6-month interval or 6 months to 1-year interval disappeared.

Between 1983 and 1989, mouthrinsing with fluoride was related to having a dental visit during the past year, the number of dental visits, and the interval since the last dental visit. This pattern did not change over time. Brushing with fluoride toothpaste was more

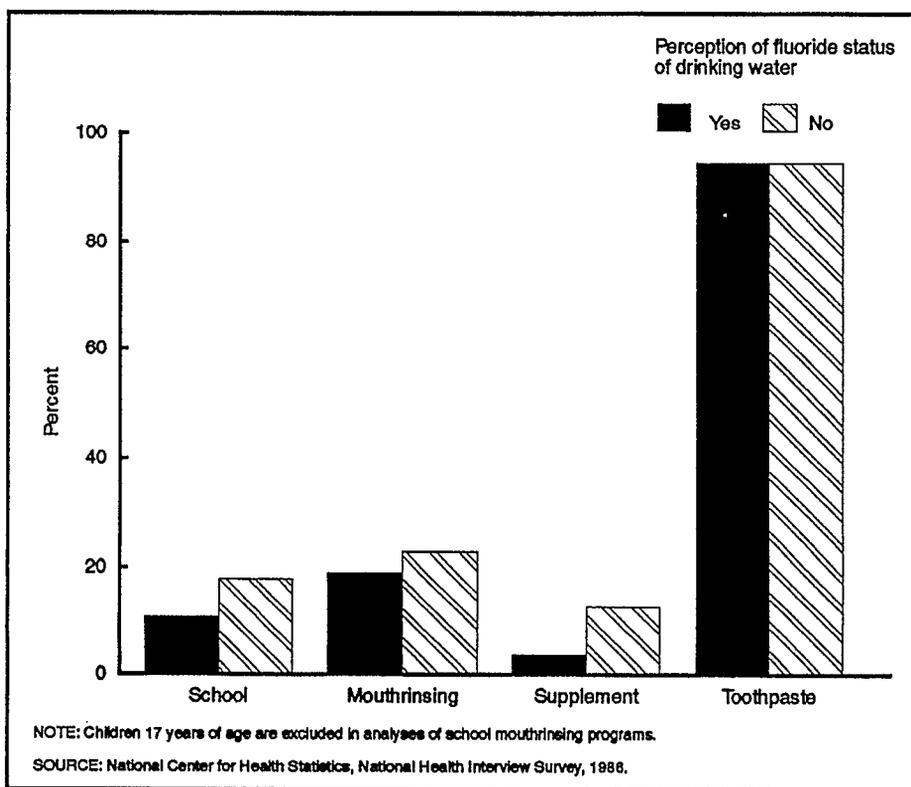


Figure 7. Percent of school children using dental care products containing fluoride by respondent's perception of fluoride status of drinking water: United States, 1986

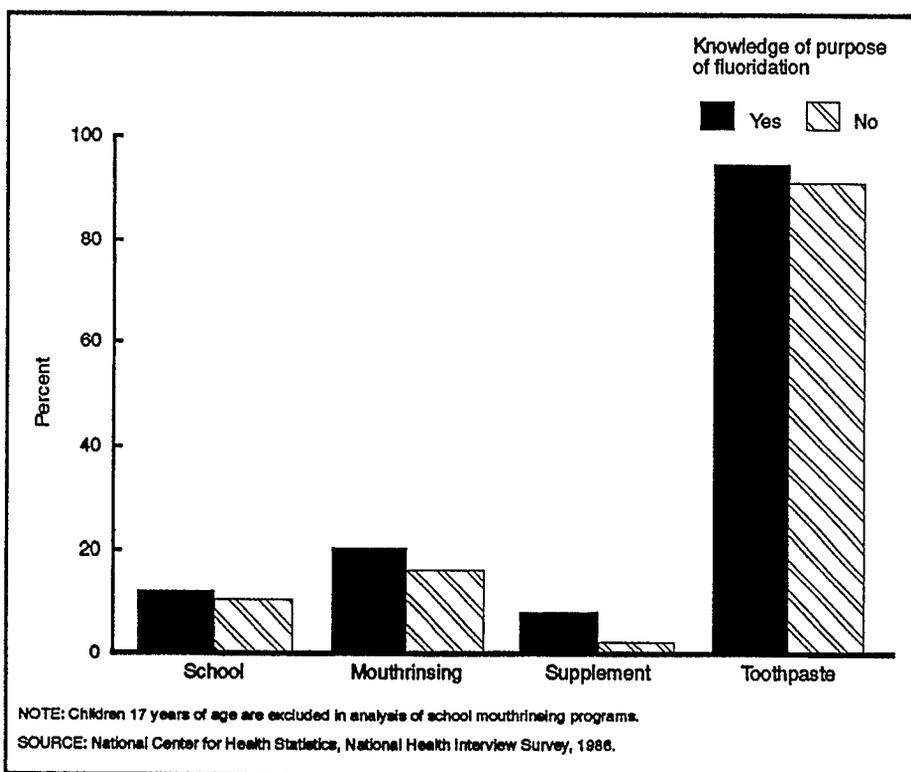


Figure 8. Percent of school children 5-17 years of age using dental care products containing fluoride by respondent's knowledge of the purpose of water fluoridation: United States, 1986

frequently reported among children who had a dental visit during the previous year. However, the number of dental visits and the interval since the last visit did not appear to be related to the use of a fluoride toothpaste.

As table 7 shows, in 1986 among school-age children, the participation in school-based fluoride mouthrinse programs did not appear to be related to dental health care utilization. However in 1989, due to increased participation in school-based fluoride mouthrinse programs among those with no dental visit or with few dental visits, an inverse relationship between dental health care and participation in fluoride mouthrinsing school program was observed. This observation is due to the increase in the number of lower income participants in these programs. Concomitantly, lower income groups are less likely to report dental visits.

During this period, school-age children who had any dental visits reported taking fluoride supplements more frequently than those who did not have any dental visits. In these children, those with two visits per year were more likely to use dietary supplements than those with one visit or with three or more visits. The length of interval since the previous visit appeared to be related to the use of fluoride supplements. That is, the shorter the interval the more frequently this activity was reported.

Similarly, mouthrinsing with a fluoride-containing solution at home was related to dental visits. Children who had no visits or who had fewer visits were less likely to rinse with fluoride. The relation of the length of interval since the last visit and rinsing with fluoride was more pronounced in 1983. In recent years, the apparent relationship between this activity with length of interval was diminished among those who reported a year or longer interval since their last dental visit.

There was no statistically different likelihood of participating in school-based fluoride programs

**Table 6. Percent of pre-school-age children (2 to 4 years of age) using selected fluoride-containing dental care products, by dental care variables: United States, 1983, 1986, and 1989**

[Standard errors are given in parentheses]

Dental care variables	Fluoride supplement			Mouthrinse			Toothpaste		
	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total	12.7 (0.6)	14.4 (1.3)	16.4 (0.6)	7.9 (0.4)	9.4 (0.7)	9.2 (0.5)	91.9 (0.5)	91.2 (0.6)	---
Had a dental visit in past year									
Yes	17.6 (1.1)	20.1 (1.9)	22.3 (1.2)	13.4 (1.0)	15.0 (1.3)	14.4 (1.0)	95.8 (0.6)	94.0 (0.8)	---
No	10.9 (0.6)	11.9 (1.3)	14.2 (0.7)	5.8 (0.4)	7.1 (0.7)	7.3 (0.5)	90.7 (0.6)	91.8 (0.7)	---
Number of visits in past year									
0	10.9 (0.7)	11.9 (1.3)	14.2 (0.7)	5.8 (0.4)	7.1 (0.8)	7.3 (0.5)	90.7 (0.6)	91.8 (0.7)	---
1	15.2 (1.3)	18.8 (2.3)	21.5 (1.4)	10.9 (1.1)	13.1 (1.6)	11.5 (1.2)	95.8 (0.8)	95.4 (0.9)	---
2	21.4 (2.4)	23.8 (3.5)	24.4 (2.3)	15.2 (1.9)	17.3 (2.7)	18.6 (2.0)	95.2 (1.3)	90.2 (2.1)	---
3 or more	22.4 (3.4)	18.9 (3.8)	21.8 (4.1)	23.9 (3.7)	22.6 (3.7)	23.3 (4.0)	97.6 (1.2)	95.2 (2.4)	---
Interval since last dental visit									
Less than 6 months	19.2 (1.4)	19.2 (2.1)	22.3 (1.4)	14.3 (1.2)	14.5 (1.6)	14.7 (1.2)	96.0 (0.7)	94.6 (1.0)	---
6 to 11 months	14.1 (1.9)	20.7 (2.8)	22.2 (2.0)	11.4 (1.7)	15.8 (2.2)	14.0 (1.7)	95.5 (1.3)	94.3 (1.4)	---
1 year to 2 years	7.8 (2.4)	12.0 (3.7)	14.6 (2.9)	10.7 (2.6)	8.0 (3.6)	15.3 (2.9)	93.6 (2.1)	93.8 (3.8)	---
Never	10.6 (0.7)	11.8 (1.2)	14.2 (0.7)	5.7 (0.5)	7.1 (0.8)	6.9 (0.5)	91.2 (0.6)	91.8 (0.7)	---

NOTE: Unknown is included in total.

between children who did or did not have dental sealants.

## Discussion

The U.S. Public Health Service recently reviewed the public health risks and benefits of fluorides in drinking water and other sources (7). The report concluded the need for "continued use of fluoride to prevent dental caries and continued support for optimal fluoridation of drinking water." It also recommended, however, that "in accordance with prudent health practice of using the appropriate amount to achieve a desired effect, ... health professionals and the public should avoid excessive and inappropriate fluoride exposure" (7). Since the 1940's, when the inverse association between fluoride intake and dental caries was noted, many different sources of fluoride have become available. Therefore, it is important to characterize the distribution of total exposure in

individuals. Although the data described in this report cannot comprehensively address the issue of total exposure, reported use of fluoride containing products is an important source of information regarding fluoride exposure. Among 2-year-old children, more than one-half of the estimated fluoride exposure in communities with fluoride deficient drinking water and one-third in communities with optimally fluoridated drinking water are thought to be due to dietary fluoride supplements, fluoride dentifrice, or both (7).

The practice of giving children daily dietary fluoride supplements was developed for use in areas where optimally fluoridated drinking water is not available. The current recommendations for prescribing dietary fluoride supplements depends on the age of the child and the concentration of fluoride in the drinking water (8).

In 1990 the U.S. Public Health Service published *Healthy People 2000* (9). One of the objectives contained in this document is to increase to at least 75 percent the proportion of people served by community water systems providing optimal levels of fluoride. Another objective is to increase the use of dietary fluoride supplements to at least 85 percent of those children not receiving optimally fluoridated drinking water. The areas currently less likely to be served by fluoridated community water systems include rural areas throughout the United States and the West. In the West in 1989, only 23 percent of the population had access to fluoridated public water supplies, whereas 78 percent in the Midwest, 63 percent in the South, and 50 percent in the Northeast had access to fluoridated public water supplies (calculated based on data derived from CDC Fluoridation Census 1989-Summary (2)).

**Table 7. Percentage of school-age children (5 to 17 years of age) using selected fluoride-containing dental products, by selected dental health care variables: United States, 1983, 1986, and 1989**

[Standard errors are given in parentheses]

Dental care variables	School programs			Fluoride supplement			Mouthrinse			Toothpaste		
	1983	1986	1989	1983	1986	1989	1983	1986	1989	1983	1986	1989
Total	---	12.8 (0.8)	13.9 (0.6)	6.0 (0.6)	6.2 (0.6)	8.1 (0.3)	16.7 (0.4)	19.2 (0.6)	25.2 (0.5)	95.1 (0.3)	93.7 (0.4)	---
Had a dental visit in past year												
Yes	---	13.1 (0.8)	13.6 (0.6)	7.4 (0.3)	7.4 (0.8)	9.6 (0.4)	18.8 (0.5)	21.8 (0.7)	27.6 (0.6)	96.7 (0.2)	94.8 (0.4)	---
No.	---	12.5 (1.1)	16.3 (1.0)	3.3 (0.3)	3.4 (0.4)	5.1 (0.4)	12.5 (0.6)	13.3 (0.8)	22.2 (0.8)	93.2 (0.5)	93.9 (0.5)	---
Number of visits in past year												
0.	---	12.5 (1.1)	16.3 (1.0)	3.3 (0.3)	3.4 (0.4)	5.1 (0.4)	12.5 (0.6)	13.3 (0.8)	22.2 (0.8)	93.2 (0.5)	93.9 (0.5)	---
1.	---	13.1 (1.0)	14.8 (0.7)	6.5 (0.4)	7.0 (0.8)	8.5 (0.5)	16.2 (0.7)	19.0 (0.9)	26.4 (0.8)	96.1 (0.4)	94.8 (0.5)	---
2.	---	13.0 (1.0)	13.4 (0.8)	9.4 (0.6)	9.3 (1.2)	11.2 (0.6)	18.7 (0.8)	22.7 (1.0)	25.7 (0.8)	96.9 (0.3)	94.4 (0.7)	---
3 or more	---	13.3 (1.3)	11.8 (0.8)	6.6 (0.5)	5.6 (0.7)	9.4 (0.6)	22.5 (0.8)	25.6 (1.1)	33.0 (1.0)	97.2 (0.4)	95.4 (0.6)	---
Interval since last dental visit												
Less than 6 months	---	13.8 (0.9)	12.7 (0.6)	8.1 (0.4)	7.7 (0.8)	10.6 (0.5)	20.1 (0.6)	22.9 (0.8)	28.0 (0.6)	96.8 (0.3)	94.6 (0.5)	---
6 to 11 months	---	12.0 (1.0)	15.5 (0.8)	5.9 (0.5)	6.5 (1.0)	8.3 (0.6)	16.4 (0.8)	19.9 (1.0)	27.5 (0.9)	96.2 (0.4)	95.2 (0.6)	---
1 year to 2 years	---	13.4 (1.5)	15.6 (1.2)	3.2 (0.5)	2.8 (0.6)	5.2 (0.6)	14.8 (1.0)	16.5 (1.4)	26.1 (1.4)	95.6 (0.6)	94.5 (0.9)	---
2 years to 5 years	---	12.0 (1.6)	18.2 (1.6)	3.4 (0.6)	2.9 (0.7)	4.4 (0.6)	13.4 (1.2)	12.7 (1.3)	22.9 (1.4)	95.5 (0.7)	93.9 (0.9)	---
5 years or more	---	9.1 (2.3)	18.9 (2.9)	0.6 (0.4)	1.4 (0.9)	3.6 (1.1)	10.2 (1.7)	10.3 (2.1)	24.7 (2.6)	92.8 (2.5)	92.8 (1.9)	---
Never	---	13.1 (1.8)	14.9 (1.5)	4.1 (0.6)	5.0 (0.9)	5.7 (0.7)	9.8 (0.8)	11.6 (1.3)	16.7 (1.5)	90.7 (1.1)	93.6 (0.9)	---
Had dental sealants												
Yes	---	13.5 (1.5)	13.5 (0.9)	---	10.6 (1.9)	13.1 (0.9)	---	24.8 (1.9)	29.1 (1.2)	---	95.4 (0.9)	---
No.	---	12.9 (0.8)	14.5 (0.6)	---	5.9 (0.6)	7.6 (0.3)	---	18.8 (0.6)	25.4 (0.5)	---	94.2 (0.3)	---

NOTES: Unknown is included in total.

Children 17 years of age are excluded in analyses of school mouthrinsing programs.

Children living in the West, which has the lowest percent of the population served by fluoridated water systems, were the most likely to receive fluoride supplements or participate in school-based fluoride mouthrinse programs. As many as one in four children may receive these in all age groups. However, in the Northeast, which has a higher percent of the population receiving fluoridated water, the percent of children receiving other types of fluoride also was about one in four, except in school-age children for whom there were fewer children served by school-based programs than in the West. In the Midwest, which had the highest percent of the population receiving fluoridated

community drinking water, the reported use of dietary fluoride supplements was the lowest of all the regions. It is not possible to determine from the interview data whether the children also had access to optimally fluoridated drinking water. Hence, the appropriate use of dietary fluoride supplements is suggestive only.

During the interview, the adult informant was asked whether they thought that their drinking water was fluoridated. These data likely include a great deal of false positive and false negative information. However, this question and the question on the informant's knowledge of the purpose of water fluoridation tend to reflect the informant's understanding of the

public health importance of fluoride. In both instances, the children who use fluoride supplements are more likely to live in households where responding adults either thought that their water was not fluoridated or who understood the purpose of community water fluoridation. In all age groups, the percent of children receiving supplements from these adults was about triple the percent of the remainder of the children.

Knowledge is correlated with education of the head of the household, poverty status, and utilization of dental health care. As would be expected, children of higher educated parents, living in above poverty level homes, and receiving regular dental care are more likely to

receive dietary fluoride supplements in some form. A multivariate analysis is required to determine whether parents are willing to continue providing supplements if they have appropriate knowledge of the purpose of the supplement or knowledge of why their children may be lacking the optimal amount of fluoride otherwise.

The greater increase in the use of fluorides, either dietary fluoride supplements or school-based fluoride rinse programs, occurred among minority groups—either black or Hispanic. In all age groups over these 6 years, the percent of children receiving dietary fluoride supplements increased to more than 150 percent of the level in 1983. Children participating in school-based rinse programs also increased slightly. There also were notable increases, almost doubling, among school-age minority groups in the use of fluoride mouthrinse.

One issue that should be addressed by public health officials is the use of toothpaste among infants and toddlers and children below 5 years of age. These data indicate that almost one in three of these children are brushing with a fluoride toothpaste. Given the propensity of young children to swallow toothpaste, the impact of this practice in light of other possible sources of fluoride in the water, food, and possibly through fluoride supplements should be studied (10).

These data indicate that among children there has been an increase

in use of fluoride products, in addition to fluoride toothpaste. Use of fluoride toothpaste is almost ubiquitous. However, increases occurred in all age groups for all other forms of fluoride, including dietary fluoride supplements and fluoride mouthrinse at home and in school-based programs. The increases during the 6 years covered by these surveys have been moderate or slight. Whether all of these increases are in accordance with prudent health practices or whether some children might be receiving more than optimal exposure to fluoride should be studied.

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**Symbols**

- - - Data not available
  - . . . Category not applicable
  - Quantity zero
  - 0.0 Quantity more than zero but less than 0.05
  - Z Quantity more than zero but less than 500 where numbers are rounded to thousands
  - \* Figure does not meet standard of reliability or precision
-

## Technical notes

### Source of data and sample design

This report is based on data from the National Health Interview Survey (NHIS), an ongoing survey of households in the United States conducted by the National Center for Health Statistics. It has been conducted continuously since 1957. Each week, a probability sample of the civilian noninstitutionalized population of the United States is interviewed by personnel of the U.S. Bureau of the Census. Interviewers obtain information about the health and other characteristics of the households included in the NHIS sample.

NHIS consists of two parts: (a) a basic health questionnaire that remains the same each year and is completed for each household member and (b) special topics questionnaires that vary from year to year and usually are asked of selected persons in each family. The estimates presented in this report are based on special oral health questions included in the 1983, 1986, and 1989 surveys.

In 1983 the interviewed sample consisted of 41,000 households containing 106,000 individuals. The total nonresponse rate was 3.3 percent; 2 percent was due to respondent refusal, and the remainder was primarily due to failure to locate an eligible respondent at home after repeated calls. In 1986 the number of households interviewed was 23,838 containing 62,502 individuals. The total nonresponse rate was 3.5 percent; 2.3 percent was due primarily to failure to locate an eligible respondent at home after repeated calls. In 1989 the number of households interviewed was 45,711 households containing 116,929 individuals. The total nonresponse rate was 5.1 percent; 3.0 percent was the result of respondent refusal, and the remainder was primarily the result of failure to locate an eligible respondent at home after repeated calls.

Special attention should be given when comparing statistics between survey years because the design of the sample of the NHIS changes following each decennial census. For example, the sampling design in the 1983 NHIS is different from the sampling design used in 1986 and 1989 NHIS. The basic sampling design for 1986 and 1989 is similar, however, due to budgetary constraints, only 50 percent of the original sample was collected in 1986. Therefore, the standard errors of the estimates of 1986 are generally larger than the other years. The information on survey design and the method used in estimation and other NHIS specifications are published elsewhere (11,12).

Because the estimates presented in this report are based on a sample of the population, they are subject to sampling errors. Standard errors of most estimates have been included in the tables in parentheses. The standard errors for this report were calculated using SUDAAN, a SAS-based software package designed to produce standard errors for estimates based on complex multistage sample designs (13).

### Definition of terms

*Age*—The age recorded for each person is the age at last birthday. Age is recorded in single years.

*Education*—The categories of educational status refer to years of school completed. Only years completed in regular schools in which persons are given a formal education are included. A regular school is one that advances a person toward an elementary or high school diploma or a college, university, or professional school degree. Thus, education in vocational, trade, or business schools outside the regular school system is not counted in determining the highest grade of school completed.

*Race*—The population is divided into three racial groups: “white,” “black,” and “all other.” “All other” includes Aleut, Eskimo, or American Indian; Asian or Pacific Islander; and any other races. Although the data base identifies these three groups, the

sample size for “others” is too small to analyze them separately. Characterization of race is based on the respondent’s description of his or her racial background.

*Hispanic or non-Hispanic*—A respondent was classified as Hispanic origin if he or she was self-identified as Puerto Rican, Cuban, Mexican-Mexican, Mexican-American, Chicano, Other Latino American, or Other Spanish. Non-Hispanic are all other individuals.

*Poverty index*—The poverty index is based on U.S. Bureau of the Census poverty threshold matrix. This matrix lists poverty threshold levels by age of the head of the household, family size, and the number of children. Detailed information on the derivation of poverty threshold is published elsewhere (14).

*Geographic region*—The classification of regions in the National Health Interview Survey corresponds to those used by the U.S. Bureau of the Census. The States are grouped into four regions as follow:

- Northeast—Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Pennsylvania.
- Midwest—Ohio, Illinois, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Kansas, and Nebraska.
- South—Delaware, Maryland, District of Columbia, West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Oklahoma, Arkansas, and Texas.
- West—Washington, Oregon, California, Nevada, New Mexico, Arizona, Idaho, Utah, Colorado, Montana, Wyoming, Alaska, and Hawaii.

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