

Dental Health Status of Children 5 Years After Completing School Care Programs

DONALD J. GALAGAN, D.D.S., M.P.H., FRANK E. LAW, D.D.S., M.P.H.,
GEORGE E. WATERMAN, D.D.S., and GRACE SCHOLZ SPITZ

ONE OF THE major objectives of the comprehensive dental care programs carried on in the schools of Richmond, Ind., and Woonsocket, R.I., was to inculcate good oral health practices in participating children and in their parents (1-4). The educational phase of the projects, however, was directed not only to participants and their families but to a community-wide audience (5). Dental health education was conducted in all schools, and the public was alerted to the aims and objectives of the projects through various media. There was a sustained effort to encourage participation in the care programs, to influence nonparticipants to seek the services of private dentists, and to achieve a universal awareness of the importance of dental health.

What impact did these programs actually have? Followup dental examinations were conducted in the schools of Richmond and Woonsocket in 1956 and 1957 to evaluate the long-term effects of treatment and education on continuing oral health. This paper is an analysis of the results. Findings from the followup examinations are compared with data found among children examined at the initiation of the care programs and at their conclusion.

The Original Dental Care Projects

The Richmond-Woonsocket care projects sought to define and meet the problems of caring for the accumulative dental needs of elementary and junior high school children and of providing periodic maintenance care. These programs were designed to remove some of the common barriers to obtaining dental treatment, such as cost, inconvenience, and lack of interest

in or knowledge of the value of dental health. With parental approval, public and parochial school children from kindergarten through the ninth grade could receive treatment in school dental clinics. More than 85 percent of all eligible children actually participated.

The two projects, which were conducted for periods of 5 and 6 years, offered programs of comprehensive dental care, exclusive of orthodontics. Each consisted of four successive treatment series in which the children received an examination, a dental prophylaxis, dental treatment as required, and topical fluoride applications at appropriate intervals. Radiographs were included in the treatment procedure when indicated.

After completion of the study in Woonsocket, no attempt was made to continue dental treatment in its school clinics. In Richmond, however, a dental hygienist, under the supervision of a local dentist, conducted dental examinations, gave topical fluoride treatments, conducted chairside dental health education, and made referrals to private dentists for required treatment. At the end of 2 years, the Richmond program was also abandoned, and no further effort was made to conduct a formal dental program.

Dr. Galagan is chief, Division of Dental Public Health and Resources, Public Health Service. Dr. Law has retired, Dr. Waterman is Indian health area dental officer, Phoenix, Ariz., and Mrs. Spitz is chief statistician with the Nursing Homes and Related Facilities Branch, Division of Chronic Diseases, Public Health Service. All were with the Division of Dental Public Health and Resources at the time of the study.

The Followup Examination

In the followup study, dental examinations (including radiographs) were made of students enrolled in Richmond and Woonsocket schools approximately 5 years after completion of the dental care projects. In order to measure the impact of these earlier programs on all children in the community, a sample of children who had not participated in the original projects was included.

Four series of data have been selected for presentation, two from the earlier study and two from the followup. The first series includes examination findings at the start of the program for all children who later received any care at all in the school dental clinics. The second series includes findings at the conclusion of the program for children who had participated in all four treatment series. The third series includes findings for those children still in school who had participated in all four treatment series. The fourth includes the examination results for currently enrolled students who had never participated in the earlier dental program. The nonparticipating group is made up of children too young to have taken part and of children whose parents did not permit them

to participate, either because they preferred to have them continue seeing their own private dentists or for some other reason. It also includes some children who had moved into these communities too recently to take part in the program.

Findings

The age distributions of children examined at the beginning of the care phase of the original studies, at their conclusion, and at the time of the followup examinations are shown in table 1. Table 2 shows the caries experience in the permanent teeth of children examined in Richmond and table 3, of those in Woonsocket; table 4 gives similar data for primary teeth. The rates shown in the columns headed "Start of study" include all children who received care at least once through the school project. The rates shown in the columns headed "End of study" include only children who received care in each of the four treatment series. Rates from the more recent examinations are shown separately for participants and nonparticipants.

Average DMF rates and their components are shown at each age. Teeth which were both carious and filled are counted both ways, so that

Table 1. Distribution of selected groups of children examined, by age, Richmond, Ind., and Woonsocket, R.I.

Age last birthday	Richmond				Woonsocket			
	Clinic patients		Followup examinees		Clinic patients		Followup examinees	
	Start of study ¹	End of study ²	Participants in 4 series ²	Nonparticipants ³	Start of study ¹	End of study ²	Participants in 4 series ²	Nonparticipants ³
Total.....	3, 195	1, 615	352	1, 378	2, 950	1, 315	305	682
7.....	463	0	0	227	0	0	0	0
8.....	467	43	0	0	0	0	0	0
9.....	445	140	0	230	574	17	0	132
10.....	390	259	0	0	545	84	0	74
11.....	329	286	0	240	547	215	0	108
12.....	302	259	0	107	450	318	0	92
13.....	336	257	0	186	373	292	0	69
14.....	293	227	74	158	276	225	33	88
15.....	145	121	144	116	147	134	137	82
16.....	25	23	133	114	38	30	135	37

¹ Includes only children who later received care in first treatment series.

² Includes only children who received care in all four treatment series.

³ Too young to have participated in the program, elected not to participate, or new in community.

Table 2. Dental caries prevalence in permanent teeth of selected groups of Richmond, Ind., children, by age examined, during a dental care study and 5 years later

Age last birthday	Clinic patients		Followup examinees	
	Start of study	End of study	Participants in 4 series	Nonparticipants
Cariou teeth per child				
7-----	2.04			1.48
8-----	2.50	0.16		
9-----	3.26	.16		2.42
10-----	3.79	.14		
11-----	4.88	.33		3.47
12-----	6.70	.36		4.99
13-----	7.28	.26		6.54
14-----	8.96	.33	7.96	7.82
15-----	9.23	.40	7.76	7.04
16-----	9.44	.57	7.86	8.38
Missing teeth per child				
7-----	(¹)			0.05
8-----	0.03	0.00		
9-----	.05	.01		.11
10-----	.10	.02		
11-----	.19	.07		.25
12-----	.37	.17		.17
13-----	.49	.22		.42
14-----	.82	.33	0.23	.64
15-----	1.17	.60	.47	.52
16-----	1.00	.65	.77	.89
Filled teeth per child				
7-----	0.12			0.26
8-----	.26	2.86		
9-----	.40	3.23		1.27
10-----	.51	3.59		
11-----	.67	4.65		1.80
12-----	1.11	5.82		2.87
13-----	1.46	8.16		4.35
14-----	1.80	9.16	4.28	3.78
15-----	1.42	10.14	5.51	5.17
16-----	1.40	8.87	6.83	7.43
DMF teeth per child ²				
7-----	2.14			1.67
8-----	2.73	3.00		
9-----	3.55	3.32		3.18
10-----	4.26	3.66		
11-----	5.53	4.95		4.82
12-----	7.61	6.19		6.65
13-----	8.67	8.52		9.23
14-----	10.75	9.66	10.14	10.37
15-----	11.10	10.95	11.02	10.87
16-----	11.32	9.74	12.12	13.32

¹ Less than .005.

² Teeth which are both decayed and filled are counted in each category.

Table 3. Dental caries prevalence in permanent teeth of selected groups of Woonsocket, R.I., children, by age examined, during a dental care study and 5 years later

Age last birthday	Clinic patients		Followup examinees	
	Start of study	End of study	Participants in 4 series	Nonparticipants
Cariou teeth per child				
9-----	4.02	0.18		3.18
10-----	5.12	1.05		3.34
11-----	6.28	1.01		3.76
12-----	8.27	1.15		5.71
13-----	9.71	.95		6.54
14-----	10.47	.85	8.12	7.27
15-----	11.46	1.04	8.64	7.28
16-----	12.63	.47	7.30	5.59
Missing teeth per child				
9-----	.14			0.24
10-----	.33	0.07		.38
11-----	.54	.17		.33
12-----	.80	.38		.39
13-----	.98	.44		.68
14-----	1.54	.77	0.91	.87
15-----	1.83	.72	1.05	1.66
16-----	1.69	.47	1.12	1.03
Filled teeth per child				
9-----	.50	3.71		1.41
10-----	.83	5.73		1.53
11-----	.98	5.98		2.61
12-----	1.31	7.64		3.87
13-----	2.21	9.71		5.54
14-----	2.91	11.59	9.18	5.69
15-----	2.33	13.37	9.18	6.57
16-----	4.24	13.77	10.18	9.81
DMF teeth per child				
9-----	4.35	3.76		4.33
10-----	5.70	6.43		4.72
11-----	7.23	6.86		5.79
12-----	9.71	8.81		8.51
13-----	11.38	10.70		10.59
14-----	13.20	12.83	14.79	11.70
15-----	14.12	14.46	15.04	13.23
16-----	15.47	14.40	15.08	13.73

age specific totals for the components exceed the DMF rates by the number of teeth both decayed and filled. This procedure was followed in previous published reports on these programs (1,5), and all the data are therefore

presented in the same way here for easier comparison. In graphic presentations, where the components cannot exceed the total DMF rate, teeth both decayed and filled have been counted as filled only.

Results of the examinations conducted during the followup study attest to the fact that continuing benefits did accrue to all children, participants and nonparticipants, in both communities. At the same time, however, these data provide striking evidence of the importance of an uninterrupted program of regular care if the dental health needs of school children are to be fully and promptly met. For 5 years after termination of the clinic programs, substantially larger numbers of carious teeth and substantially fewer filled teeth were present in children of every age (tables 2 and 3, figs. 1 and 2). This was the pattern even among those children who had been on a maintenance basis 5 years before. When examined on followup, these children (now 14 to 16 years old) had considerably more untreated carious lesions than children of the same age had had at the conclusion of the care program (tables 2 and 3, figs. 1 and 2).

Figure 3 shows the change which had taken place in the 5-year interval for 15-year-old

children. Because there were larger numbers of children available for analysis, this age was chosen to illustrate the pattern of change in dental health status occurring from the time the projects were undertaken until the followup 10 years later.

At the time of the reexamination, decayed teeth accounted for almost half of the DMF rate in Richmond and almost one-third in Woonsocket. In both communities, one-quarter of all DMF teeth were both decayed and filled. Filled tooth rates therefore constituted but 25 percent of the Richmond and 35 percent of the Woonsocket DMF rates 5 years after the basic care program had ended.

While it is true that the Woonsocket children had apparently received more care than those in Richmond, the smaller accumulation of uncared-for teeth in Woonsocket may be accounted for in part by the relatively high caries rate that prevails there. Because of the higher rate, it is likely that a larger number of teeth decayed early enough in a Woonsocket child's life to be filled during the care project than would have been the case in Richmond. Tables 2 and 3 show that those Woonsocket children who were 10 years old at the conclusion of the care program had twice as many filled teeth when it ended as Richmond children of the same age.

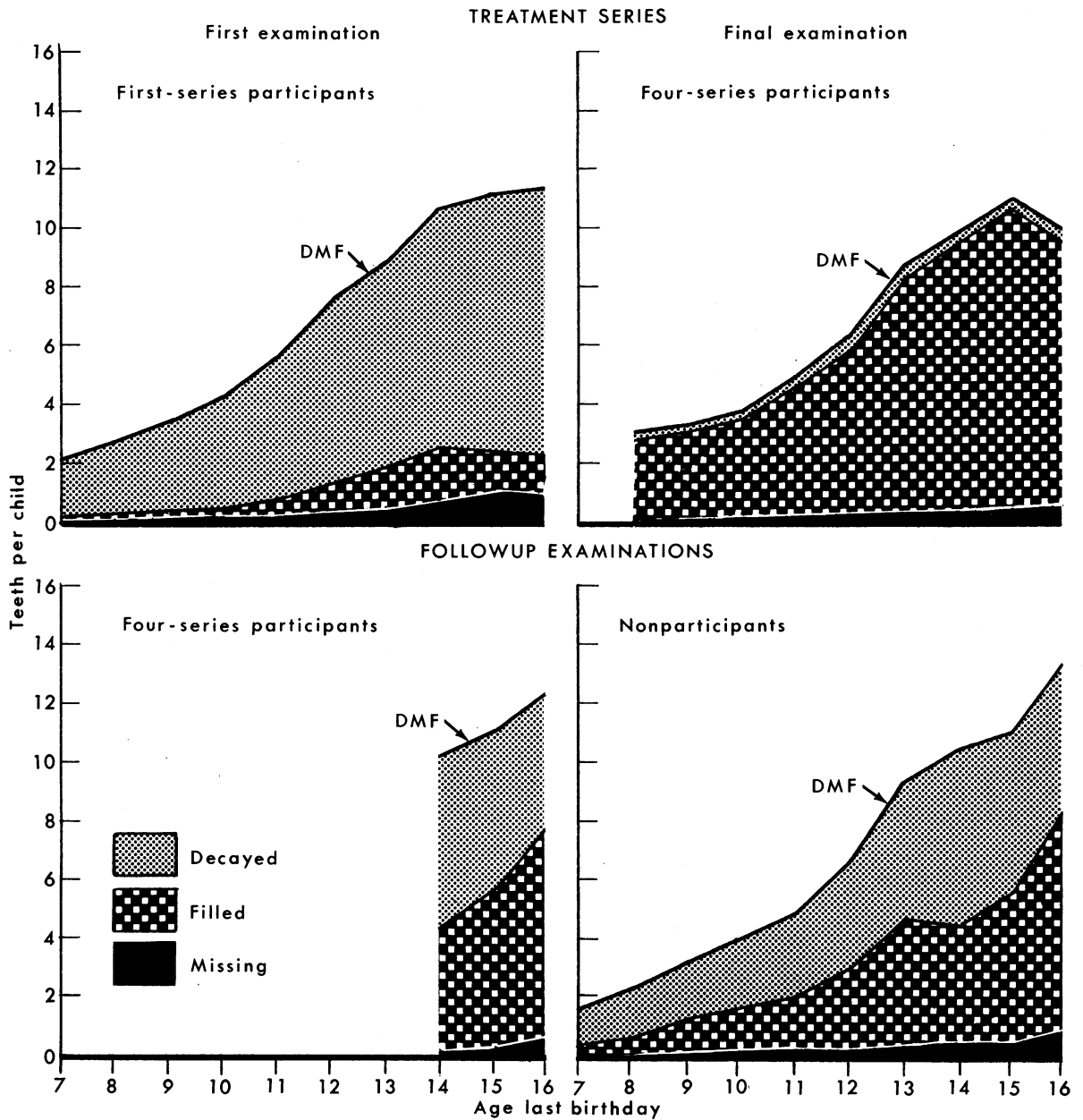
However, neither in Richmond nor in Woonsocket did the filled tooth rates at followup approximate the rates which existed at the end of the treatment program. At that time, filled teeth accounted for about 90 percent of the total DMF rates in both communities.

Even though this to-be-expected backsliding did occur, 5 years after the care program had ended the oral health status of children in both communities—not only those who participated in the clinic phase of the program but also the larger numbers who did not take part in it—was substantially improved over that of children of the same age when that program was initiated 10 years earlier. Every age-specific rate for carious teeth was smaller, and every rate for filled teeth larger than at the start of the clinic program. For missing permanent teeth, there was an overall reduction in the number per child, although a few age-specific rates for younger children had increased slightly. Among older children, especially among those

Table 4. Dental caries prevalence in primary teeth, first round and followup examinations, Richmond, Ind., and Woonsocket, R.I.

Age (years)	First round examination (all patients)		Followup examination (nonparticipants)	
	Cariou	Filled	Cariou	Filled
Richmond, Ind.				
7.....	4.99	0.46	4.77	1.96
9.....	3.93	.46	3.55	1.91
10.....	2.72	.27	2.73	1.73
11.....	1.70	.16	1.22	.75
12.....	.73	.15	.42	.18
Woonsocket, R.I.				
9.....	4.59	0.18	3.81	0.76
10.....	2.82	.08	2.61	.45
11.....	1.58	.03	1.39	.74
12.....	.79	.02	.40	.22

Figure 1. Dental caries prevalence in permanent teeth, first and final treatment series and followup examinations, Richmond, Ind.



who had participated in the care program, missing permanent tooth rates tended to approximate the low level reached 5 years before.

Evidence of Improved Health Habits

These data suggest that some portion of the improvement found in the health status of children in these two communities resulted from a

change in their habits of seeking care. No wholly satisfactory measure is available to assess the amounts of care sought by children before and after the care program, since the data are not longitudinal. Yet, it is possible to arrive at comparisons of treatment levels before and after the program which, while imprecise, are both useful and significant. For example,

the extent to which children's needs were cared for during the 5 years preceding and the 5 years following the dental care program can be shown by a comparison of the increments observed at the end of each of these periods in the DMF and component rates for children 5 years apart in age. The increment in the total DMF rate

over a 5-year age span is in effect a measure of the dental needs arising over 5 years in time, while increments in the component rate are a reflection of the care sought in response to these and earlier needs.

Figure 4 shows the 5-year increment in rates observed between the ages of 10 and 15 for

Figure 2. Dental caries prevalence in permanent teeth, first and final treatment series and followup examinations, Woonsocket, R.I.

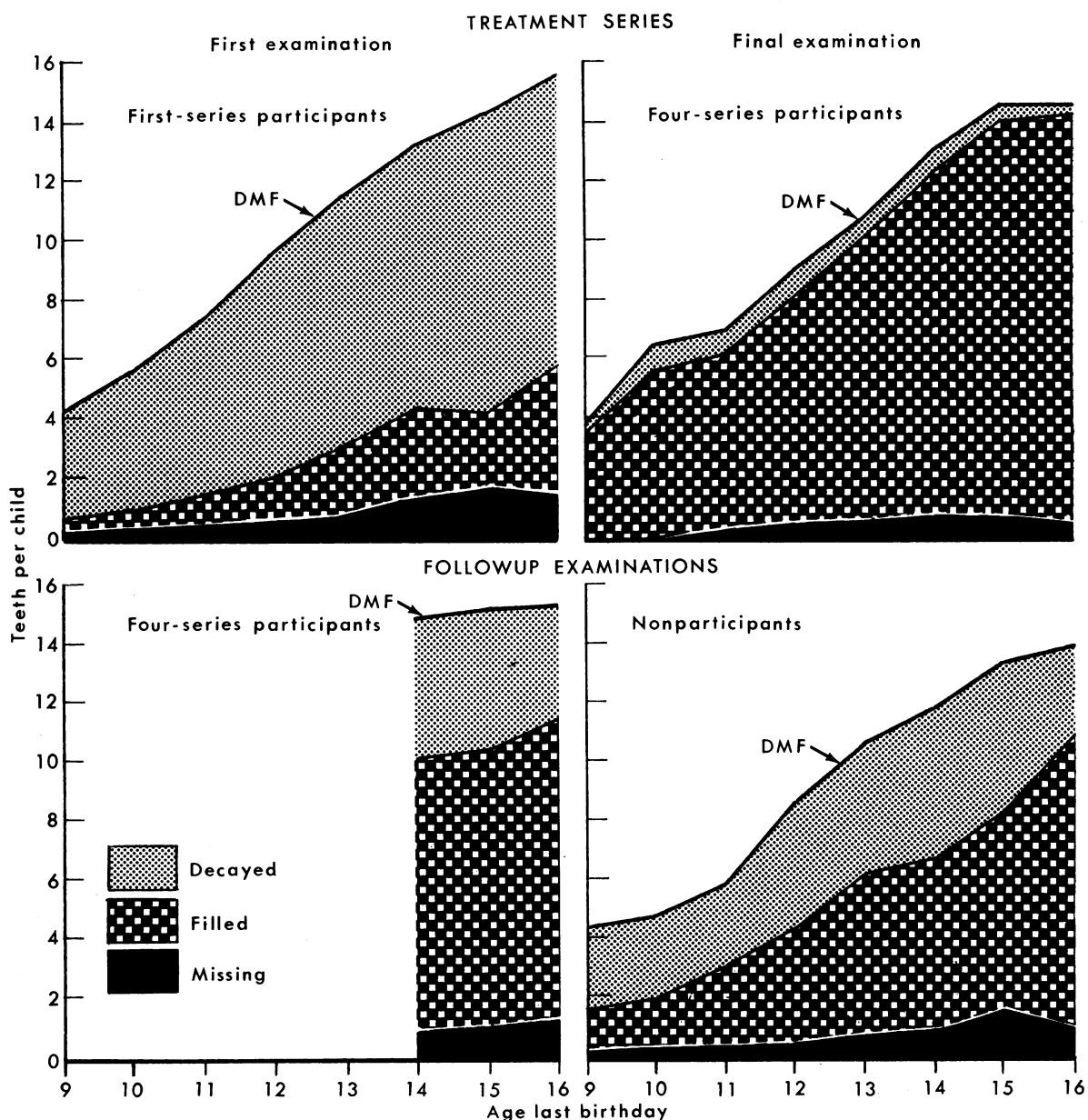
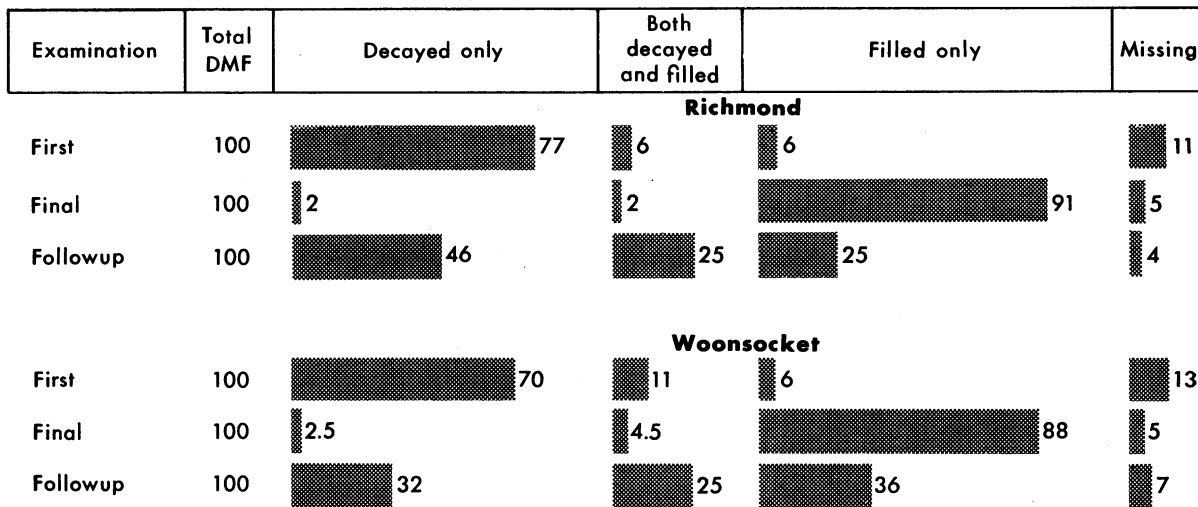


Figure 3. Percentage distribution of component parts of DMF rates, first examination and four-series participants at age 15 in final and followup examinations, Richmond, Ind., and Woonsocket, R.I.



children examined at the start of the care project, together with similar figures for nonparticipating children examined in the followup study. It shows, in addition, the increments between rates for children 10 years old when the care project ended and those for 15-year-old participants at followup, since for participating children these are more direct measures of the care needed and sought after the program ceased.

It is evident from the comparisons presented that relatively more of the needs arising among children in the 5 years following the program were met than of those arising in the years before the project was undertaken. This was true in Richmond and in Woonsocket and for both participating and nonparticipating children. However, the experience of children who had participated in the care program differed somewhat from that of nonparticipating children. Having just completed their fourth maintenance cycle, participants were essentially free of backlog needs at the start of the period, and they had fewer teeth needing fillings after the project than the nonparticipating children. At the same time, they suffered less permanent tooth loss, again perhaps because all children in the group had had the advantage of prompt and regular treatment while the care project was underway. In general, children who had participated in the care project had about twice

as many carious teeth filled during the 5 years after the program as children who had not participated, three times as many filled as children of comparable age in the 5 years preceding the school care program. The increment in missing permanent teeth followed a reverse pattern. Missing tooth rates for nonparticipating children were reduced significantly from what they had been before the care project, and the missing tooth rates for participating children were reduced by even more.

For younger children, changes in dental care habits can be illustrated by a direct comparison of DMF rates and their components before and 5 years after the project. Children who were 9 either at the start of the care project or at followup, for example, had undoubtedly received virtually all of their previous dental care during the 5 preceding years. All children who were 9 at followup were too young to have participated in the care project had they wanted to and, in this respect, comparisons of their behavior with that of children before the study are perhaps more valid than those based on older nonparticipants among whom nonparticipation was a matter of choice.

In the followup, both in Richmond and in Woonsocket, the number of filled permanent teeth in 9-year-olds showed a threefold increase over the fillings rate in the initial examination. The number of carious permanent teeth had

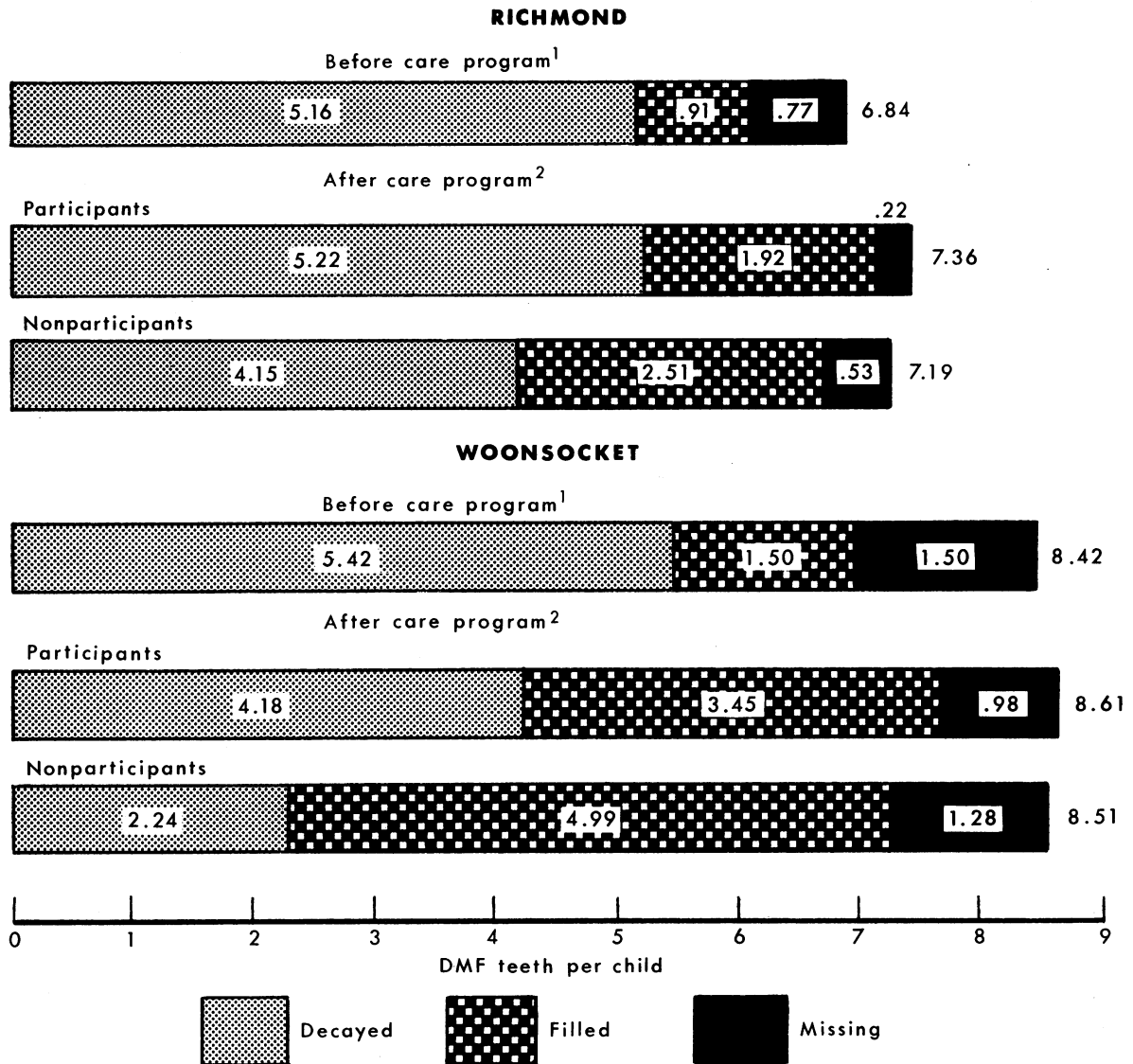
decreased by about one-fourth in Richmond and by one-fifth in Woonsocket. Missing tooth rates were not improved, but the numbers were small.

The percentage distribution of the compo-

nents of the DMF rates is shown in figure 5. The relationship is similar to that observed by direct comparison of the rates just mentioned.

The extent to which this greater dental health

Figure 4. Five-year increments in DMF and component rates before and after dental care programs in Richmond, Ind., and Woonsocket, R.I.



¹ DMF increment observed during the 5-year period preceding start of dental care program.

² DMF increment between age 10 at conclusion of dental care program and age 15 at followup.

NOTE: The increments at the start of the program were accepted as the difference between the rates for ages 10 and 15. The increments after the program were measured in two ways: for participants, the increments were accepted as the difference between

the rates at age 10 at the end of the program and at age 15 at followup; for nonparticipants, the increments were accepted as the difference between the rates at ages 10 and 15 in Woonsocket and at ages 9 and 14 in Richmond, where no 10-year-olds were examined.

Figure 5. Percentage distribution of component parts of DMF rates, first and followup examinations of nonparticipants at age 9, Richmond, Ind., and Woonsocket, R.I.

Examination	Total DMF	Decayed only	Both decayed and filled	Filled only	Missing
Richmond					
First	100	87.3	4.5	6.8	1.4
Followup	100	56.6	19.5	20.4	3.5
Woonsocket					
First	100	85.3	7.1	4.4	3.2
Followup	100	62.0	11.5	21.0	5.5

awareness was caused by the clinic project, with its treatment and health education programs, by changes in the economy that have brought the purchase of dental care within the reach of more families, or by other factors is not known. However, there have not been comparable changes in the rate of dental care purchases for children observed in long-term evaluations of dental health status in other communities (6-10). It seems obvious, therefore, that although the lasting benefits of the care project were not as great as they could have been if the school clinics had continued in operation, the exposure of children to a regimen of regular dental treatment and health education did inspire large numbers of families in both communities to pursue a voluntary program of dental care for their children after the experimental projects themselves were concluded.

Summary

Five years after completion of school dental care programs in Richmond, Ind., and Woonsocket, R.I., participants and nonparticipants in the clinic programs in both communities were examined. Proportionately less dental care was obtained during the 5 years immediately following the termination of the projects by those children who had participated in the programs than had been obtained during the project itself. The data also show that participants and nonparticipants alike sought and received considerably more dental care during the 5 years after cessation of the projects than had children

of the same age during the 5 years preceding the clinic programs.

While no cause-and-effect relationship can be demonstrated between the continuing availability of care and of concentrated dental health education on changed dental health status and dental behavior, comparisons of these data with other available long-term evaluations of dental health suggest that the habit patterns established during the Richmond and Woonsocket clinic programs did carry over to a considerable degree into the succeeding 5 years.

REFERENCES

- (1) Waterman, G. E., and Knutson, J. W.: Studies on dental care services for school children—First and second treatment series, Richmond, Ind. Public Health Rep 68: 583-589, June 1953.
- (2) Law, F. E., Johnson, C. E., and Knutson, J. W.: Studies on dental care services for school children—First and second treatment series, Woonsocket, R.I. Public Health Rep 68: 1192-1198 December 1953.
- (3) Waterman, G. E., and Knutson, J. W.: Studies on dental care services for school children—Third and fourth treatment series, Richmond, Ind. Public Health Rep 69: 247-254, March 1954.
- (4) Law, F. E., Johnson, C. E., and Knutson, J. W.: Studies on dental care services for school children—third and fourth treatment series, Woonsocket, R.I. Public Health Rep 70: 402-409, April 1955.
- (5) Waterman, G. E.: The Richmond-Woonsocket studies on dental care services for school children. J. Amer Dent Assoc 52: 676-684, June 1956.

- (6) Arnold, F. A., Jr., Dean, H. T., and Knutson, J. W.: Effect of fluoridated public water supplies on dental caries prevalence: Seventh year of Grand Rapids-Muskegon study. *Public Health Rep* 68: 141-148, February 1953.
- (7) Arnold, F. A., Jr.: Grand Rapids fluoridation study—Results pertaining to the 11th year of fluoridation. *Amer J Public Health* 47: 539-545 (1957).
- (8) Arnold, F. A., Jr., Likins, R. C., Russell, A. L., and Scott, D. B.: Fifteenth year of the Grand Rapids fluoridation study. *J Amer Dent Assoc* 65: 780-785, December 1962.
- (9) Erlenbach, F. M., and Tracy, E. T.: Tenth year of New Britain, Connecticut, fluoride study. *Conn Health Bull* 75: 371-381, December 1961.
- (10) Klein, H., and Palmer, C. E.: The disparity between dental need and dental care in school children of Hagerstown, Md., and environs. *J. Amer Dent Assoc* 28: 1489-1498, September 1941.

Survey of Acute Illnesses and Injuries

An estimated 401 million acute illnesses and injuries occurred in the civilian noninstitutional population of the United States from July 1962 through June 1963. This total represents an incidence rate of 2.2 cases per person and accounts for an average of about 9 days of restricted activity and approximately 4 bed-days per person.

These are some of the health data highlighted in "Current Estimates From the Health Interview Survey, United States, July 1962-June 1963," the first in an intended annual series of reports by the Public Health Service's National Center for Health Statistics to provide provisional information on selected health characteristics of the civilian noninstitutional population of the United States.

An estimated 81 million persons in this population (45 percent) reported one or more chronic illnesses, according to the publication.

About 49 million persons were injured (a rate of 27 per 100 persons in the population), resulting in 255 days of activity restriction and 6 days of bed disability for each 100 persons.

An estimated 23 million persons (12 discharges per 100 population per year) were discharged from short-stay hospitals.

The average person experienced about 16 days of reduced activity; 7 were bed-days and 6 were days lost from work or school. Females reported more disability per person than did males. Both sexes had a high rate of disability during the January-March 1963 quarter, reflecting the high incidence rate of acute conditions during that period.

Copies of the report, PHS Publication No. 1000, Series 10-No. 5, may be obtained for 35 cents from the U.S. Government Printing Office, Washington, D.C., 20402.