

Studies on Dental Care Services For School Children

—*First and Second Treatment Series, Woonsocket, R. I.*—

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THE WOONSOCKET, R. I., school dental service program provides information on how the problems of accumulated and maintenance dental care needs of school children were met in a specific segment of the population. A cooperative study project of the city of Woonsocket, the Rhode Island State Department of Health, and the Public Health Service, the program was designed to supply complete dental services, except orthodontics, to all school children enrolled in kindergarten through the ninth grade of the public and parochial schools, provided treatment was requested by a parent or guardian.

The Woonsocket study was similar in purpose and procedures to a study conducted in

Richmond, Ind., between December 1946 and December 1951 (1). Possible regional variations in the size of the dental care problems and in the resources available suggested comparative studies to determine the magnitude of these variations and methods of overcoming them. Dental caries prevalence proved to be one-third greater in Woonsocket than in Richmond and missing tooth rates almost twice those in Richmond. About the same amount of dental care in proportion to need (F/DMF) had been received by the children in each city prior to the initiation of the programs.

Woonsocket, a fairly representative New England industrial community in northern Rhode Island, was chosen as the location for this study for several reasons. Its relatively stable population of approximately 50,000, 99 percent of whom are white with French-Canadian stock predominating, provided between 6,000 and 7,000 school children for the study. The program had the official approval and cooperation of the Rhode Island State Department of Health, the city authorities, the State and local dental societies, and the public and parochial school systems. A relatively high dental caries attack rate is common in this region (2).

Planning of the program, purchase of equip-

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ment, selection of space, and preparation of clinic rooms were begun in the fall of 1945. The first clinics were opened on January 14, 1946, and the study was concluded 6¾ years later.

Since the majority of dental defects in any group of children results directly from dental caries, this study, like the one in Richmond, was concerned principally with caries prevalence and the treatment services required to correct carious defects. To facilitate comparison between the studies in the two cities, the data on the Woonsocket study are presented in a pattern similar to that used in the Richmond report.

Clinic Facilities and Personnel

Dental clinic rooms were selected and prepared with the necessary plumbing and electrical outlets in 24 of the city's 27 schools: 15 public, 8 parochial, and 1 orphanage. The size of the clinics varied from 2 to 7 dental chairs, depending upon school enrollment and the space available. In most schools, attractive, well-lighted rooms were provided, although in two small elementary schools, it was necessary to put up temporary partitions in classrooms.

Two modern standard dental units, 2 junior chairs, 2 operating stools, and an instrument cabinet containing duplicate sets of instruments were the basic equipment for each dentist. Operating lights on the units, an X-ray machine, sterilizer, and additional equipment completed each dental clinic. The arrangement of the equipment and the provision of adequate auxiliary personnel encouraged each dentist to work from a seated position at all times. These working conditions were designed to reduce fatigue and to improve the quality and quantity of the dentists' services (3).

Organization and scheduling was planned to maintain 3 clinics in operation throughout the school system at one time. When dental treatment was completed in one school, the equipment, supplies, and personnel were transported to the clinic room in another school. The average clinic was dismantled, transported, and set up ready for use in the next school in approximately 1½ days.

Project personnel included 4 to 7 dentists, 1 or 2 dental hygienists, 8 dental assistants, 1 fol-

Table 1. Age distribution of all children examined, by patient status, first and second treatment series, Woonsocket, R. I.

[Number of children]

Age last birthday	1st treatment series			2d treatment series		
	Patient status		All children	Patient status		All children
	Clinic	Private		Clinic	Private	
All ages...	5, 944	904	6, 848	5, 189	918	6, 107
5.....	464	53	517	220	35	255
6.....	696	81	777	624	88	712
7.....	669	69	738	634	94	728
8.....	594	61	655	613	94	707
9.....	624	77	701	559	75	634
10.....	573	57	630	608	87	695
11.....	580	82	662	482	67	549
12.....	544	85	629	500	115	615
13.....	467	96	563	419	110	529
14.....	439	135	574	344	93	437
15.....	265	90	355	160	52	212
16.....	29	18	47	26	8	34

lowup worker, 1 secretary, and 3 clerks. The dental hygienists gave prophylaxis and topical fluoride applications. The followup worker checked on treatment certificates from patients of private dental practitioners, encouraging these as well as clinic patients to obtain complete treatment. In addition, she transported to a clinic children needing emergency treatment or children whose treatment had not been completed when the clinic was moved, and she delivered supplies. The secretary cared for the central office and supply room. A clerk was assigned to each clinic to handle records, maintain the flow of patients, and perform related duties as required. An average of 1½ dental assistants for each dentist was on duty in each clinic.

The 8 dental assistants employed at the start of the study received 10 weeks of intensive training at the Naval Dental School in Bethesda, Md. They in turn helped to train assistants employed as replacements from time to time as the study progressed. The entire staff received inservice training at irregular intervals from each of the seven dental consultants

to the program, who also served the Richmond project. The consultants were experts in pedodontics, dental materials, and the use of auxiliary personnel.

Clinic Routine

Before a clinic was installed in a school, dental examination records were obtained for the entire school population. Teachers issued "request for treatment" slips to all pupils with instructions to return them signed by a parent or guardian, indicating whether he wanted the child's dental care provided in the school clinics or in the offices of the family dentist. Care in the school clinics was requested for about 85 to 87 percent of the children enrolled.

The dental-care program was divided into four consecutive treatment series. A treatment series consisted of dental examination of the total enrollment, kindergarten through junior high school, and completed treatment of all children whose parents requested treatment. This report is limited to the first and second treatment series for children receiving care in the school dental clinics.

Examination

Complete dental examinations of all children were made in each school. Examinations were made with a No. 4 plain mouth mirror and sharp No. 5 double-end explorers. X-rays were used whenever there was any doubt about clinical diagnosis.

The following information was recorded on examination records maintained for each child during each treatment series:

Number of primary and permanent teeth erupted and unerupted.

Number of teeth missing because of extraction.

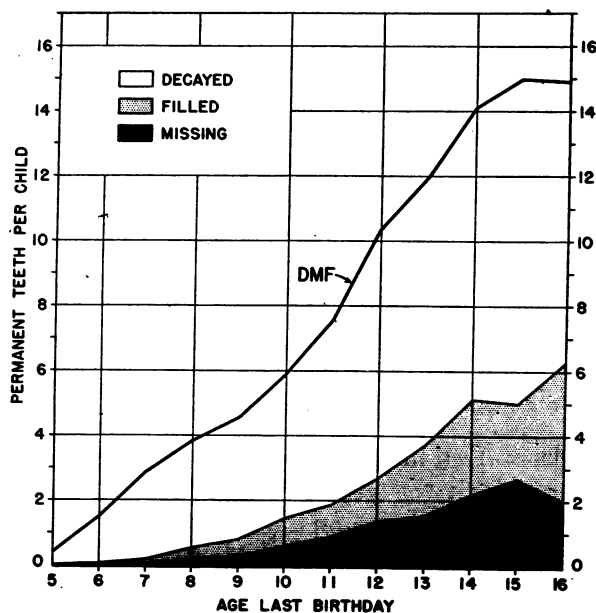
Number of teeth indicated for extraction.
Number of roots remaining.

Number of unfilled carious teeth and the surfaces involved.

Number of filled teeth and the surfaces restored.

Observations were made on all teeth present in the mouth. Teeth recorded as carious were those which showed actual cavities, no matter

Figure 1. Dental caries prevalence in permanent teeth, first treatment series, Woonsocket, R. I., ages 5-16.



how small, as well as deep pits and fissures in which the explorer penetrated with pressure and resisted removal.

A dental assistant recorded the information on the record cards in code to facilitate transfer to punch cards for processing and analysis. A serial number was assigned to each child for the duration of the study project. A master card index system was maintained to simplify reference to a child's previous dental record.

Treatment

Once the examinations had been completed, clinical treatment was given to all children whose parents had signed consent slips. During treatment the children received chairside instruction in oral hygiene.

Clinics were operated on a year-round basis, with appointments for treatment continuing during vacations and holidays. Young children were treated in the early forenoon and the older children received the later appointment times. Extractions were generally avoided during a child's first dental experience. Efforts were made to complete all operative treatment in the teeth of at least 1 mouth quadrant during a single sitting. Treatment periods varied from 15 to 30 minutes for younger chil-

dren and from 15 minutes to 1 hour for the older children.

The types of treatment included:

Permanent fillings (amalgam and silicate cement).

X-rays as required during treatment.

Vital partial pulpectomies of permanent and primary teeth.

Root canal therapy of permanent anterior teeth.

Extractions.

Treatment of periodontal diseases.

Prophylaxis.

Topical fluoride applications.

Polishing of fillings.

The amount and type of treatment given each child were noted on the record cards. Each dentist and dental hygienist recorded all of their clinical services on daily work sheets. At the end of each 10-day working period these sheets were combined in a biweekly report showing an accurate running account of services performed during the study project.

During the first treatment series, a total of 6,848 children, 5 through 16 years of age, representing 96.5 percent of all children in kindergarten through the ninth grade, received dental examinations; 5,944, or 87 percent of those examined, requested and received dental treatment in the school clinics. In the second treatment series 6,107 children in the above age groups, or 99.7 percent of the total, were examined; 5,189, or 85 percent, of these requested treatment in the dental clinics. About 2,500 children received initial care in the second treatment period. The number of children not receiving care in the school clinics was essentially the same in both series (table 1).

Comparison of Caries Prevalence

The average annual increment of decayed permanent teeth, estimated from the difference in prevalence rates at individual ages, was 1.31 teeth per child in the first treatment series and 1.43 teeth per child in the second.

To measure and express the workload for this study adequately, all teeth requiring fillings, whether or not they had previously been filled, were counted as "carious." Teeth indi-

Table 2. Dental caries prevalence in permanent teeth of children, first and second treatment series, Woonsocket, R. I.

[Number of teeth per child]

Age last birthday	Carious ¹	Filled	Carious and/or filled ²	Missing			DMF
				Total	Ex-tracted	Ex-tractions indicated	
1st treatment series							
5-16 ³	6.39	1.32	7.09	0.99	0.66	0.33	7.76
5-----	.41	.00	.41	.00	.00	.00	.41
6-----	1.51	.03	1.53	.01	.00	.01	1.53
7-----	2.79	.14	2.85	.04	.02	.02	2.87
8-----	3.62	.33	3.77	.21	.08	.13	3.85
9-----	4.25	.50	4.43	.29	.14	.15	4.57
10-----	5.30	.83	5.59	.61	.33	.28	5.92
11-----	6.57	.98	7.03	.89	.54	.35	7.57
12-----	8.85	1.31	9.56	1.38	.80	.58	10.36
13-----	9.90	2.21	11.03	1.54	.98	.56	12.01
14-----	10.70	2.91	12.56	2.21	1.54	.67	14.10
15-----	11.88	2.33	13.16	2.67	1.83	.84	14.99
16-----	10.90	4.24	13.21	2.00	1.69	.31	14.90
2d treatment series							
5-16 ³	5.30	3.87	7.84	0.77	0.66	0.11	8.50
5-----	.48	.00	.48	.00	.00	.00	.48
6-----	1.82	.04	1.83	.01	.01	.00	1.83
7-----	3.24	.26	3.33	.07	.01	.06	3.34
8-----	3.56	1.17	4.15	.12	.03	.09	4.18
9-----	3.96	2.17	5.08	.16	.08	.08	5.16
10-----	4.90	3.06	6.64	.33	.22	.11	6.85
11-----	6.14	3.56	8.29	.46	.34	.12	8.65
12-----	7.68	4.50	10.53	.81	.64	.18	11.16
13-----	8.72	5.85	12.52	1.15	.96	.19	13.47
14-----	8.52	7.24	13.49	1.38	1.20	.18	14.67
15-----	8.31	8.62	14.12	2.05	1.88	.17	16.00
16-----	6.23	9.92	13.65	2.70	2.58	.12	16.23

¹ Includes teeth carious only, those both carious and filled, and those indicated for extraction. ² Based on actual number of teeth carious, filled, or carious and filled. Teeth that are both carious and filled are counted only once. ³ Average of the rates for ages 5-16.

cated for extraction were also counted as "carious." (Data shown in the charts, figures 1 and 2, are cumulative and, therefore, do not

necessarily correspond with figures given in table 2. "Decayed," on the charts, shows the number of teeth that were decayed only and does not include teeth decayed and filled or teeth indicated for extraction.) Approximately 84 percent of the children in the first treatment series had one or more carious permanent teeth; in the second series about 87 percent were so

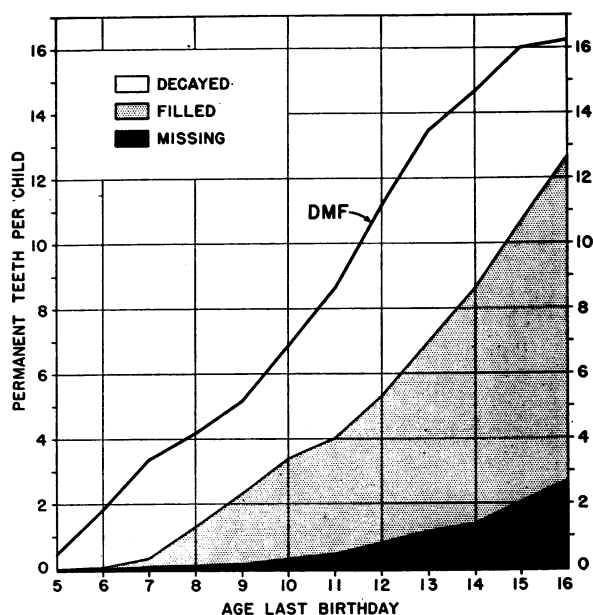
Table 3. Dental caries prevalence in primary teeth of children, first and second treatment series, Woonsocket, R. I.

[Number of teeth per child]

Age last birthday	Carious ¹	Filled	Carious and/or filled ²	Extractions indicated
1st treatment series				
5-16 ³	2.86	0.10	2.91	0.40
5	6.21	.16	6.28	.36
6	6.69	.19	6.79	.50
7	6.30	.23	6.43	.86
8	5.66	.29	5.83	1.07
9	4.36	.16	4.46	.87
10	2.67	.07	2.70	.49
11	1.38	.03	1.39	.30
12	.67	.02	.69	.20
13	.27	.01	.27	.10
14	.05	.00	.05	.01
15	.05	.00	.05	.02
16	.00	.00	.00	.00
2d treatment series				
5-16 ³	2.69	0.17	2.78	0.52
5	5.81	.24	5.93	.56
6	6.32	.27	6.45	.93
7	6.16	.40	6.36	1.40
8	5.42	.43	5.65	1.28
9	4.24	.40	4.47	.96
10	2.42	.16	2.51	.61
11	1.16	.07	1.20	.31
12	.49	.01	.50	.10
13	.16	.01	.17	.07
14	.08	.00	.08	.03
15	.01	.00	.01	.00
16	.00	.00	.00	.00

¹ Includes teeth carious only, those both carious and filled, and those indicated for extraction. ² Based on actual number of teeth carious, filled, or carious and filled. Teeth that are both carious and filled are counted only once. ³ Average of the rates for ages 5-16.

Figure 2. Dental caries prevalence in permanent teeth, second treatment series, Woonsocket, R. I., ages 5-16.



affected. In the two rounds, there were totals of 32,359 and 25,544 carious teeth involving about 58,318 and 41,376 surfaces, respectively.

As shown in table 2 and figures 1 and 2 the age specific DMF (decayed, missing, and filled) rates for permanent teeth increased in the first series from 0.41 at age 5 to 14.99 at age 15; in the second, from 0.48 to 16. At the start of the first series the average 15-year-old had 11.88 carious teeth, 2.67 missing teeth, and 2.33 filled teeth. The examination for the second series showed a decrease in carious teeth (8.31) and missing teeth (2.05) and a significant increase in filled teeth, from 2.33 to 8.62, for the average 15-year-old.

Twenty-two percent of the children in the first treatment series had one or more extracted permanent teeth; the corresponding figure for the second series examination was 18 percent.

Only 20 percent of the children had one or more filled permanent teeth on examination in the first round, but the percentage increased to 58 in the second series.

Of the primary teeth examined, 47 percent were found carious in the first series. The average 7-year-old had 12.7 primary teeth, of which 6.30, or nearly 50 percent, were decayed

(table 3). Only 4 percent of the group had one or more primary teeth which had been filled prior to the first treatment series. Examination prior to the second treatment series demonstrated only minor improvement in care of the primary dentition. The number of primary teeth filled increased from 709 in the initial round to 1,107 in the second.

During the initial treatment series the main concern was care of the accumulated defects of the permanent teeth; primary teeth received only emergency or very selective treatment. In spite of the high caries attack rate and the time required to complete the first treatment series (30 months), this policy was modified to a considerable extent in the second round. As shown in table 4, the number of primary teeth filled per child during the second round was more than 10 times as large as the number during the first.

Of the children requesting clinic care, 88 percent in the first series and 98.6 percent in the second received complete treatment; 78 percent and 87 percent of the children treated received fillings in one or more permanent teeth. More than 17 percent had at least one or more permanent teeth extracted during the first series, but only 9 percent of the children required extractions the second time around. The 684 permanent teeth which were extracted in the second series indicate considerable improvement over the 1,778 extracted during the initial treatment series.

The total number of permanent teeth filled in the first and second series was 25,939, and 24,682, respectively, averaging 4.60 and 5.08 teeth per child for all age groups. The average 15-year-old had 9.60 surfaces on 5.72 teeth restored during the initial treatment and 7.77 teeth involving 12.67 surfaces received fillings in the second series (table 4).

Selective treatment of primary teeth resulted in a total of 530 primary teeth filled in the first series and 4,140 in the second. Extractions of primary teeth numbered 5,131 and 4,391.

Additional treatment included 900 pulp cap-pings and 29 vital partial pulpectomies on permanent and primary teeth during the first period. These treatments numbered 1,163 and 214, respectively, during the second series.

Table 4. Dental treatment to permanent and primary teeth of children, first and second treatment series, Woonsocket, R. I.

[Number per child]

Age last birthday	Number of permanent teeth			Primary teeth		
	Teeth filled	Filled surfaces	Teeth extracted	Teeth filled	Filled surfaces	Teeth extracted
1st treatment series						
5-16 ¹	4.60	7.79	0.32	0.07	0.12	0.58
5-----	.37	.57	.00	.25	.43	.37
6-----	1.47	2.40	.02	.20	.37	.64
7-----	2.70	4.56	.04	.21	.35	1.03
8-----	3.32	6.16	.16	.10	.16	1.35
9-----	3.97	7.29	.19	.07	.11	1.26
10-----	4.78	8.57	.36	.04	.05	.86
11-----	6.03	10.25	.43	.00	.00	.63
12-----	7.68	12.31	.67	.01	.02	.43
13-----	7.63	12.50	.62	.01	.01	.22
14-----	6.49	10.55	.54	.00	.00	.08
15-----	5.72	9.60	.63	.00	.01	.05
16-----	5.07	8.76	.21	.00	.00	.00
2d treatment series						
5-16 ¹	5.08	8.35	0.15	0.86	1.75	0.66
5-----	.50	.77	.00	3.29	6.62	.64
6-----	1.82	3.21	.00	3.02	6.18	1.07
7-----	3.15	6.04	.06	2.42	4.91	1.60
8-----	3.45	6.57	.12	1.25	2.49	1.54
9-----	3.83	6.91	.10	.33	.66	1.24
10-----	4.70	7.58	.13	.04	.09	.78
11-----	5.93	9.18	.17	.00	.01	.47
12-----	7.48	11.26	.21	.00	.01	.27
13-----	8.40	12.87	.28	.01	.03	.16
14-----	8.18	12.67	.24	.00	.00	.07
15-----	7.77	12.67	.28	.00	.00	.03
16-----	5.69	10.46	.23	.00	.00	.00

¹ Average of the rates for ages 5-16.

Every child received at least 1 dental prophylaxis during each round. In the second period an attempt was made to provide every child with a series of 4 topical fluoride applications; a total of 5,016 children received this treatment.

Dentist Man-Hours

During the first treatment series a ratio of 1 dentist to 384 children treated per year resulted from an average of 6.2 dentists on duty in the program. During the second series an average of 5.5 dentists operating produced a ratio of 1 dentist to 470 children treated per year. This staffing average is based on a full 65-hour, biweekly period for all dentists assigned during both series with no deductions made for administrative work, vacations, illness, training, or other nonclinical activities.

Dentist man-hour rates were determined from the total clinic time actually worked by all dentists during the 30 months required for the first treatment series and the 24 months for the second. During the first round 3.3 dentist man-hours were required to complete the treatment of each child, but in the second round only 2.8 dentist man-hours, or 86 percent as much time as in the first, were needed for this work. The average number of permanent teeth treated per dentist man-hour was about the same in both series: 2.1 in the first and 1.9 in the second. However, the 0.7 primary teeth treated per dentist man-hour in the second series was an increase of 140 percent over the number treated per dentist man-hour in the first period.

The reduction in the second treatment series of 0.5 dentist man-hour required to complete the treatment of each child resulted primarily from the lower prevalence of carious teeth and to improved operating and clinical procedures. This reduction would undoubtedly have been greater had there not been constant addition of new patients with practically no previous dental treatment and had the time (2½ years) between the two treatment series been less.

Summary

Dental examination and complete dental treatment were given 5,944 children in kindergarten through the ninth grade in the first treatment series and 5,189 children in the second

treatment series of the Woonsocket, R. I., dental care study.

The first treatment series, covering a total of 30 months, was designed to care for the accumulated dental needs of the group, with primary emphasis on care of defects in permanent teeth.

The second treatment series, requiring 24 months, was designed to treat the increment of defects occurring between treatment periods and to provide substantially more care for the primary dentition. The proportion of children requiring fillings during the second round was no less than in the initial series. In addition to the increment of defects occurring subsequent to treatment in the first series, about 2,500 children received initial care in the second series.

Only 20 percent of the children had any permanent teeth filled prior to the first series; this figure increased to 58 percent at the start of the second.

Examinations for the second treatment period demonstrated that the average 15-year-old had 8.62 filled teeth, compared to only 2.33 at the start of the first series.

In all age groups, 1,778 permanent teeth were extracted in the first series and only 684 in the second.

There was a reduction of 14 percent in the number of dentist man-hours required to complete the treatment of each child: 3.3 dentist man-hours were required in the first series and 2.8 in the second series.

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