

Studies on Dental Care Services for School Children

—Third and Fourth Treatment Series, Woonsocket, R. I.—

By FRANK E. LAW, D.D.S., M.P.H., CARL E. JOHNSON, D.D.S.,
and JOHN W. KNUTSON, D.D.S., Dr.P.H.

THE WOONSOCKET dental care study was designed to provide factual information on the problems of accumulated and maintenance dental service needs of school children in a fairly representative New England industrial town. Complete dental care, exclusive of orthodontics, was furnished all children enrolled in kindergarten through the ninth grade, provided treatment was requested by a parent or guardian. This long-term study, a cooperative project of the city of Woonsocket, the Rhode Island State Department of Health, and the Public Health Service, consisted of four consecutive treatment series. Study participants received in the course of each series an examination, a prophylaxis, topical fluoride applications, and treatment of dental defects. Data describing the organization and operation of the program and the results of the first and second treatment series have been previously reported (1). Performance

Dr. Law is regional dental consultant for Region III, Department of Health, Education, and Welfare; Dr. Johnson is a member of the staff of the Public Health Service Outpatient Clinic in New York City; and Dr. Knutson is chief dental officer of the Public Health Service.

data descriptive of the third and fourth series are the subject of the present paper.

Review of First Two Series

Examination findings disclosed that 84 percent of the participants in the first series had 1 or more permanent teeth needing filling; 22 percent had at least 1 missing permanent tooth; and 20 percent had 1 or more filled permanent teeth. In the 30 months required to complete the first series, the average child received 3.3 dentist man-hours of care. An average of 2.1 permanent teeth were treated per dentist man-hour.

Of children taking part in the second treatment series, 87 percent had 1 or more carious permanent teeth; 18 percent had 1 or more extracted permanent teeth; and 58 percent had at least 1 filled permanent tooth. The second series extended over a period of 24 months, with an average of 2.8 dentist man-hours devoted to each child. The number of permanent teeth treated per dentist man-hour averaged 1.9.

Followup Program

A followup program for children whose parents had not requested treatment in the school

clinic program was operated throughout the four series. Consisting largely of conferences with teachers and home visits, the program aimed at encouraging these parents to take their children to a private dentist regularly. Approximately 6 percent of the school population received care in private dental offices. Ten percent of the children would not accept treatment from any source during the period covered by this program.

Clinic Routine

At the beginning of each series, teachers distributed "request for treatment" forms to all children regardless of whether or not they had previously participated in the study project. In each school, the entire student body was examined prior to the beginning of treatment. Every effort was made to keep the sequence of schools the same in all treatment series.

The first series was devoted exclusively to the correction of accumulated dental needs. The following rounds represented, therefore, a periodic treatment of accruing, or incremental, defects. For example, the fourth treatment series consisted largely of treatment of dental defects which had arisen since completion of the third, or preceding series. In addition to incremental defects, however, there was a continuing backlog of dental care needs reflecting

the new enrollment of children in school during each series. In the third treatment series, 1,123 children, or 23 percent of those receiving clinic care, fell into this category. In the fourth series, the 950 newly enrolled children constituted about one-fifth of the entire group treated in school clinics.

To measure and express the work load accurately, all teeth needing fillings, whether or not they had previously been filled, were counted as "carious." Also rated as carious were teeth indicated for extraction. The examination, recording, and treatment procedures utilized in the first two series (1) were continued throughout the program.

This report, like that on the first two series, is basically concerned with dental care services. Consequently, baseline and performance data apply only to those children participating in the school clinic program.

During the third treatment series, 5,975 children, or 98 percent of those enrolled in kindergarten through the ninth grade, were examined. Treatment was provided 82 percent of this group. In the fourth series, 6,201 children, or more than 99 percent of the school population, were examined. Of this group, 81 percent subsequently received dental treatment. The age distribution of children examined and their patient status for the final two treatment series are shown in table 1.

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

Age last birthday	Third treatment series			Fourth treatment series		
	Patient status		All children	Patient status		All children
	Clinic	Private		Clinic	Private	
All ages.....	4, 912	1, 063	5, 975	5, 004	1, 197	6, 201
5.....	131	21	152	197	36	233
6.....	566	99	665	600	116	716
7.....	607	109	716	564	111	675
8.....	622	114	736	551	121	672
9.....	580	77	657	669	140	809
10.....	513	89	602	550	105	655
11.....	544	94	638	463	89	552
12.....	449	105	554	470	112	582
13.....	412	122	534	425	143	568
14.....	301	138	439	309	118	427
15.....	165	77	242	178	90	268
16.....	22	18	40	28	16	44

Caries Prevalence

The annual increment of decayed permanent teeth, estimated from the difference in prevalence rates at individual ages, averaged 1.3 teeth per child. The proportion of children with one or more carious permanent teeth declined from 87 percent in the second round to 77 percent and 65 percent in the third and fourth rounds, respectively.

Age-specific rates for filled permanent teeth in the third series ranged from 0 at age 5 to 10.47 at age 15; in the fourth, from 0 to 11.18 for the same age groups (table 2 and figs. 1 and

2). At the beginning of the first series the corresponding rates were 0 to 2.33 teeth per child. For all age groups, the average frequencies for carious and missing permanent teeth per child dropped steadily from the first to the fourth series (table 3). At the same time, the number of filled teeth per child increased from 1.32 in the first series to 5.63 in the fourth. Only 20 percent of the children had one or more filled permanent teeth at the start of the program. In the third and fourth series, however, the proportion of children having filled teeth had increased to 70 and 74 percent, respectively.

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

[Number of teeth per child]

Age last birthday	Cariou ¹	Filled	Cariou and/or filled ²	Missing			DMF ³
				Total	Extracted	Extractions indicated	
Third treatment series							
5-16 ⁴	3.37	5.19	7.54	0.47	0.43	0.04	7.97
5	.66	.00	.66	.00	.00	.00	.66
6	1.68	.05	1.70	.01	.00	.01	1.70
7	2.55	.64	2.98	.04	.02	.02	3.00
8	2.02	2.15	3.72	.06	.03	.03	3.75
9	2.13	3.22	4.58	.17	.13	.04	4.71
10	2.64	4.19	5.88	.25	.20	.05	6.08
11	4.24	4.49	7.97	.24	.21	.03	8.18
12	5.36	6.38	10.42	.52	.46	.06	10.88
13	5.65	8.07	12.03	.62	.57	.05	12.60
14	4.68	10.02	12.93	.90	.86	.04	13.79
15	5.34	10.47	13.87	1.36	1.24	.12	15.11
16	3.46	12.18	13.73	1.50	1.41	.09	15.14
Fourth treatment series							
5-16 ⁴	2.28	5.63	6.98	0.33	0.30	0.03	7.28
5	.31	.00	.31	.00	.00	.00	.31
6	.94	.14	1.04	.00	.00	.00	1.04
7	1.62	1.22	2.52	.03	.02	.01	2.54
8	1.47	2.67	3.56	.06	.05	.01	3.61
9	1.72	3.31	4.28	.09	.07	.02	4.35
10	2.06	4.35	5.52	.19	.16	.03	5.68
11	2.87	5.42	7.26	.22	.20	.02	7.46
12	3.37	7.23	9.27	.32	.27	.05	9.54
13	3.28	8.93	10.90	.52	.47	.05	11.37
14	3.65	10.66	12.48	.79	.72	.07	13.20
15	3.26	11.18	12.76	1.06	.98	.08	13.74
16	2.82	12.43	13.82	.64	.64	.00	14.46

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 Decayed, missing, and filled. ⁴ Average of the rates for ages 5-16.

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

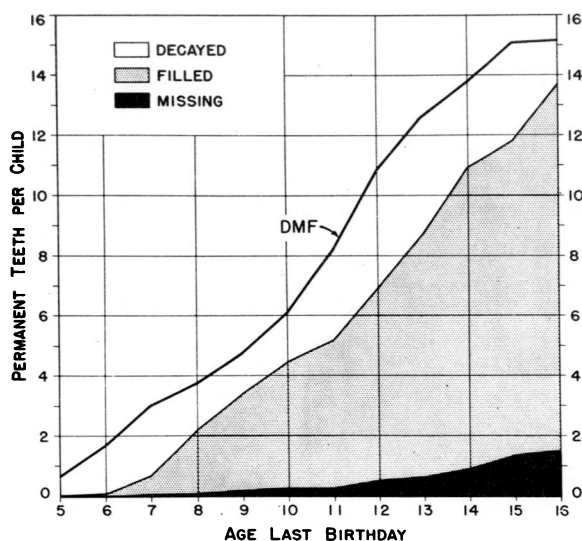
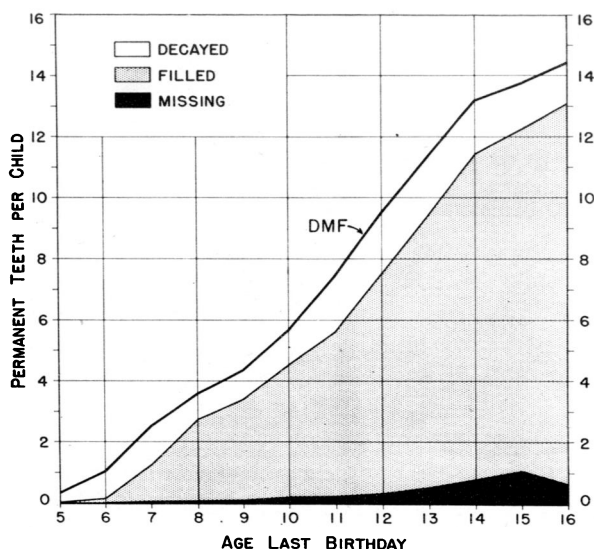


Figure 2. Dental caries prevalence in permanent teeth, fourth treatment series, Woonsocket, R. I., ages 5-16.



Waterman and Knutson (2) point out in a report on a comparable study project in Richmond, Ind., that "continued reduction of the number of teeth indicated for extraction reflects the regularity of complete care during the previous treatment series." This indication of the value of complete and continuing care in saving teeth is supported by the Woonsocket experience. More than 10 times as many permanent teeth per child were indicated for extraction at the start of the first series as in the fourth series (table 3). During the same interval the number of teeth that had been extracted decreased by more than 50 percent. Eleven percent of the children in the fourth series had 1 or more

extracted teeth, compared with 22 percent in the first.

Initial examination findings revealed that 47 percent of all primary teeth were carious. In addition, only 4 percent of the children had 1 or more primary teeth which had been filled prior to the first treatment series. Improvement in the status of the primary dentition was observed with each succeeding treatment series. The proportion of decayed primary teeth, for example, decreased to 33 percent in the fourth series, whereas that of children with filled primary teeth increased to 36 percent. For the first three series the average number of carious primary teeth per child was highest in 6-year-

Table 3. Average dental caries prevalence in permanent teeth of children aged 5-16, four treatment series, Woonsocket, R. I.

[Number of teeth per child]

Treatment series	Carious	Filled	Carious and/or filled	Missing			DMF ¹
				Total	Extracted	Extraction indicated	
1	6.39	1.32	7.09	0.99	0.66	0.33	7.76
2	5.30	3.87	7.84	.77	.66	.11	8.50
3	3.37	5.19	7.54	.47	.43	.04	7.97
4	2.28	5.63	6.98	.33	.30	.03	7.28

¹ Decayed, missing, and filled.

Table 4. Dental caries prevalence in primary teeth of children, third and fourth treatment series, Woonsocket, R. I.

[Number of teeth per child]

Age last birthday	Carious ¹	Filled	Carious and/or filled ²	Extractions indicated
Third treatment series				
5-16 ³	2.21	0.68	2.73	0.36
5-----	5.95	.63	6.38	.63
6-----	6.19	.71	6.64	1.02
7-----	4.62	1.87	6.08	.78
8-----	3.18	2.51	5.24	.50
9-----	2.85	1.54	4.08	.50
10-----	2.03	.66	2.50	.43
11-----	1.11	.21	1.27	.27
12-----	.36	.06	.39	.10
13-----	.08	.01	.09	.04
14-----	.05	.00	.05	.01
15-----	.02	.01	.02	.01
16-----	.05	.00	.05	.05
Fourth treatment series				
5-16 ³	2.04	1.04	2.84	.24
5-----	6.91	.69	7.35	.79
6-----	5.78	1.18	6.62	.67
7-----	3.67	3.04	6.08	.45
8-----	2.56	3.21	5.20	.30
9-----	2.36	2.59	4.37	.19
10-----	1.74	1.20	2.64	.21
11-----	.91	.40	1.20	.10
12-----	.37	.10	.43	.09
13-----	.11	.03	.13	.02
14-----	.04	.02	.05	.01
15-----	.02	.01	.03	.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.

old children, whereas in the fourth series, the 5-year-old group had the highest average (table 4). At the beginning of the program 8-year-old children averaged 0.29 filled primary teeth. In the fourth series, however, this figure had risen to 3.21 primary teeth per child—a tenfold increase.

Only children aged 10 years or over in the fourth series could have received treatment in the three preceding rounds. To emphasize the improvement in dental status resulting from regular care, one may compare the findings of the initial and the fourth examination for

10-year-old children, recognizing at the same time that the group involved in the fourth series also included newly enrolled individuals. At the beginning of the program the average 10-year-old had 5.30 carious, 0.83 filled, and 0.61 missing permanent teeth. In the fourth treatment series, on the other hand, the corresponding averages for children of the same age were 2.06, 4.35, and 0.19. These figures indicate that 10-year-old children in the fourth series had less than half as many carious, five times as many filled, and one-third as many missing permanent teeth as those of similar age in the first series.

Similarly, initial examination of the 14-year-old group showed 10.7 carious, 2.91 filled, and 2.21 missing permanent teeth per child. By contrast, the average 14-year-old in the fourth series had 3.65, 10.66, and 0.79 teeth in the carious, filled and missing categories, respectively. This represented one-third as many decayed, nearly four times as many filled, and one-third as many missing permanent teeth as were observed in children of this age at the start of the program.

Treatment Provided

Over 99 percent of the children treated in the school clinics during the third and fourth series received complete dental care, exclusive of orthodontics. Seventy-seven percent of those participating in the third series and 65 percent of those in the fourth round received fillings in 1 or more permanent teeth. These figures represent a considerable decline from the corresponding proportion noted in the second series—87 percent. The overall average of 0.32 permanent tooth per child extracted in the first series was reduced to 0.07 and 0.05 in the last two series (table 5.)

The major portion of care of the primary teeth was received by the 5-8-year group. The number of primary teeth filled for these children was essentially similar throughout the last three rounds, averaging about 2.49 teeth per child per series. This figure, compared with the average of 0.19 tooth per child for this group during the first round of treatment indicates a notable increase in care of the primary teeth. This increase was made possible by the large

Table 5. Dental treatment to permanent and primary teeth of children, third and fourth treatment series, Woonsocket, R. I.

[Number of teeth per child]

Age last birthday	Permanent teeth			Primary teeth		
	Filled	Filled surfaces	Extracted	Filled	Filled surfaces	Extracted
Third treatment series						
5-16 ¹	3.24	4.90	0.07	0.88	1.76	0.42
5.....	.62	.91	.00	3.72	7.59	.68
6.....	1.65	2.54	.01	3.64	7.30	1.08
7.....	2.50	3.90	.03	2.32	4.56	.87
8.....	2.00	3.07	.03	.80	1.56	.58
9.....	2.05	3.20	.05	.06	.11	.57
10.....	2.59	3.72	.07	.01	.01	.53
11.....	4.15	5.72	.07	.01	.01	.41
12.....	5.22	7.51	.12	.00	.00	.22
13.....	5.50	8.12	.08	.00	.00	.08
14.....	4.40	6.76	.08	.01	.02	.04
15.....	4.76	7.50	.15	.00	.00	.04
16.....	3.41	5.91	.09	.00	.00	.05
Fourth treatment series						
5-16 ¹	2.19	3.48	0.05	0.84	1.82	0.32
5.....	.30	.43	.01	3.71	8.24	.90
6.....	.95	1.38	.00	3.41	7.49	.78
7.....	1.60	2.43	.01	1.95	4.03	.53
8.....	1.45	2.22	.02	.88	1.85	.40
9.....	1.69	2.64	.03	.07	.16	.31
10.....	2.00	2.96	.04	.01	.02	.34
11.....	2.81	4.08	.03	.00	.00	.21
12.....	3.31	5.91	.07	.00	.00	.15
13.....	3.14	4.90	.06	.00	.00	.07
14.....	3.49	5.93	.15	.00	.00	.06
15.....	2.91	4.96	.11	.00	.00	.03
16.....	2.68	3.96	.04	.00	.00	.00

¹ Average of the rates for ages 5-16.

number of children on a maintenance basis upon completion of the first treatment series. The practicability of this approach is suggested by the continued decrease in primary teeth indicated for extraction in succeeding treatment series. Each primary tooth filled involved an average of 2 surfaces, compared with 1.5 surfaces for each permanent tooth. This pattern showed little variation throughout the program.

Additional treatment included 754 pulp cappings and 94 vital partial pulpectomies in permanent and primary teeth during the third round. The corresponding numbers for the fourth series were 815 and 86.

Dentist Man-Hours

During the 15 months required to complete the third treatment series, an average of 5.5 dentists were on duty, or a ratio of 1 dentist to 714 children per year. Complete treatment of each child required 1.7 dentist man-hours. An average of 1.9 permanent and 0.6 primary teeth were filled per dentist man-hour in addition to the miscellaneous treatments provided. During the fourth series, 5,004 children were treated by an average of 5.9 dentists, a ratio of 1 dentist to 848 children per year. During this series an average of 1.4 dentist man-hours was required for each completed case. For each dentist man-

hour, an average of 1.6 permanent and 0.7 primary teeth were filled. Table 6 summarizes the ratio of clinic to nonclinic patients; children treated per dentist; dentist man-hours per child; and teeth filled per dentist man-hour during the four series.

The number of teeth filled per dentist man-hour remained essentially constant in all four rounds. The effect of regular, complete dental care in reducing the needs for dental service is indicated by the increased number of children treated annually per dentist and the decrease in

Figure 3. Children treated annually per dentist and dental man-hours per completed case, four treatment series, Woonsocket, R. I., ages 5-16.

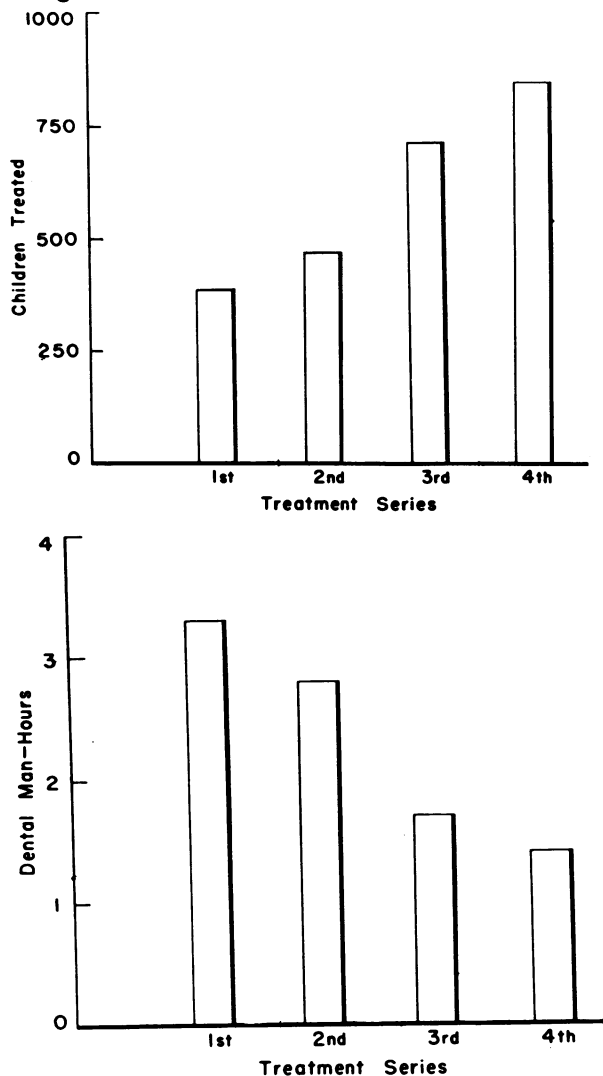


Table 6. Selected comparative data for the four treatment series, Woonsocket, R. I., children aged 5-16

Comparative data	Treatment series			
	1	2	3	4
Patients.....	6,848	6,107	5,975	6,201
Clinic.....	5,944	5,189	4,912	5,004
Nonclinic.....	904	918	1,063	1,197
Children treated per dentist.....	384	470	714	848
Dentist man-hours per child.....	3.3	2.8	1.7	1.4
Teeth filled per dentist man-hour.....	2.4	2.6	2.5	2.3
Permanent.....	2.1	1.9	1.9	1.6
Primary.....	.3	.7	.6	.7

dentist man-hours required to complete each case (fig. 3 and table 6). This continued reduction in need was also reflected in a steady decline in the overall time required to complete succeeding treatment series.

Summary of All Four Series

Over 80 percent of the total enrollment in kindergarten through the ninth grade, or an average of 5,100 school children, received complete dental care in each of the four treatment series of the Woonsocket dental care study. In addition, a small number participated to the extent of receiving partial clinic care. Six percent of the children were cared for regularly by their own dentists, whereas about 10 percent sought no care from any source.

The initial examination disclosed an average of 6.39 carious, 1.32 filled, and 0.99 missing permanent teeth per child for all age groups 5-16 years. During the fourth treatment series the corresponding rates were 2.28, 5.63, and 0.33 teeth per child.

Although care of the primary teeth was selective rather than complete, the filled tooth rate per child for children aged 5-8 years increased from an average of 0.19 teeth in the first series to 2.49 in the final series.

The effect of regular, complete dental treatment in reducing dental needs is indicated by the greater number of children treated annually per dentist, as well as by the decreased dentist

time required to complete each case. Whereas each dentist cared for 384 children during a year in the first series, he was able to extend his services to 848 patients by the fourth round. Only 1.4 dentist man-hours were needed to complete treatment per child in the final series, in contrast to the 3.3 man-hours in the first series. This figure includes the time required to care for the backlog needs of newly enrolled children who had not previously been treated in the program.

The number of months devoted to completing

each of the treatment series was 30, 24, 15, and 12, respectively.

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- (1) Law, F. E., Johnson, C. E., and Knutson, J. W.: Studies on dental care service for school children—First and second treatment series, Woonsocket, R. I. Pub. Health Rep. 68: 1192–1198, December 1953.
- (2) Waterman, G. E., and Knutson, J. W.: Studies on dental care services for school children—Third and fourth treatment series, Richmond, Ind. Pub. Health Rep. 69: 247–254, March 1954.

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