Studies on Dental Care Services For School Children

— *First and Second Treatment Series, Richmond, Ind.* —

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IN A COMPREHENSIVE analysis (*1*) of a dental survey of school children in Hagerstown, Md., Klein, Palmer, and Knutson distinguished between the accumulated and annual increment of dental needs. They concluded that the basic problem of caring for caries in the teeth of school children is that of caring for the annual increment.

The purpose of this report is to provide actual performance data on the accumulated and maintenance dental care needs of school children.

The Richmond study was a cooperative project of the Indiana State Board of Health, the city of Richmond, and the Public Health Service. Beginning December 23, 1946, it extended over a 5-year period.

The project was designed to give dental care services to all school children enrolled in kindergarten through the ninth grade, provided treatment was requested by their parents.

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Richmond was chosen for this study primarily because it provided a group of between 4,000 and 6,000 school children for a treatment and followup program, and because the project had the full approval and cooperation of the Indiana State Health Department and of dental societies and school authorities at both the State and local levels.

The city is a fairly typical midwestern community of about 40,000 people, 98 percent of whom are white and native-born. The total enrollment for all schools—kindergarten through senior high school—was 6,929 at the beginning of this study.

Situated near the eastern border of Indiana, Richmond is a railroad center and a major distribution terminal for the rich farm produce of eastern Indiana and western Ohio. It also has several small and medium-sized industries.

Clinical Facilities and Personnel

Dental clinics were set up in each of Richmond's 16 elementary and junior high schools: 14 public and 2 parochial. Wherever possible, school authorities provided attractive clinic rooms with good lighting and ventilation.

Two modern standard dental units and chairs were available to each dentist. For each 2 chairs there was 1 dental instrument cabinet containing duplicate sets of instruments. The type and arrangement of equipment, and the

provision of adequate auxiliary personnel enabled each dentist to work from a seated position at all times. These working conditions reduced the dentist's fatigue and helped to improve the quantity and quality of his services (*2, 3*).

The clinics varied in size from 4 chairs for schools of 300 children or less to 6 chairs for the larger schools. Two or three clinics operated at one time. As dental treatment was completed in one school, the staff dismantled equipment and packed supplies for transportation, and in less than a day later the equipment was in use again in the next school.

Personnel for the study project included between 3 and 5 dentists, a dental health educator, a secretary, and a dental hygienist to give prophylaxis and topical fluoride treatments. In addition 1 clerk was assigned to each operating clinic, and an average of 1½ dental assistants was provided each dentist.

The 5 dental assistants employed at the start of the project underwent 10 weeks of intensive training at the Naval Dental School in Bethesda, Md. They in turn helped to train assistants added to the staff later during the study.

Inservice training was provided for the entire staff once every 3 months by 1 of 7 specialists in various phases of pedodontics and in the efficient use of auxiliary personnel.

Clinical Routine

Dental record cards were prepared for the entire school population from census sheets provided by the teachers of each grade. Teachers issued "request for treatment" slips to all pupils with instructions to return them signed by a parent or guardian, indicating whether or not they wanted the child's dental care provided in the school clinics.

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.

Since the majority of dental defects in any group of children results directly from dental caries, this report is concerned principally with caries prevalence and the treatment services required to correct carious defects.

This report is limited to the first and second treatment series.

Examination

Complete dental examinations of all children were conducted 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 in examination and treatment 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 missing due to other causes.

Number of roots remaining.

Number of filled and unfilled carious teeth and the surfaces involved.

Number of filled teeth and the surfaces restored.

Number of hypolastic teeth.

Observations were made on all teeth present in the mouth. Teeth recorded as carious were those which showed actual cavities, no matter how small, as well as deep pits and fissures in which the explorer hung and penetrated with pressure.

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. A few days before treatment was started in a particular school, the children heard a brief talk by the dental health educator, who explained the importance of early and adequate dental care. He told why the clinic was coming to the school

and urged those receiving treatment in private dental offices to do so regularly. This introduction to the clinic program helped promote understanding and friendly cooperation among the children, the teachers, and the clinic staff. During actual treatment, the children received chair-side 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 early afternoon, with treatment periods limited to 15 to 30 minutes. The late morning and late afternoon appointments were usually reserved for the older age groups. Their treatment periods varied from 20 minutes to 1 hour.

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. Fillings were polished as the sittings progressed.

The types of treatment included:

Permanent fillings (amalgam and silicate cement).

Restoration of fractured anterior teeth with full and partial crowns.

Vital partial pulpectomies of permanent and primary teeth.

Root canal therapy of permanent anterior teeth.

Treatment for 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.

First Treatment Series

A total of 5,523 children between 5 and 16 years of age, representing 96 percent of all Richmond children in kindergarten through the 9th grade, were given dental examinations. A total of 4,569, or 84 percent of the group, requested and received dental treatment (see table 1).

Caries Prevalence

Since this report is concerned mainly with dental care service, baseline and performance data are limited to those children who took part in the clinical care program.

The average annual increment of decayed permanent teeth, estimated from the difference in prevalence rates at individual ages, was 1.1 teeth per child. The total estimated annual increment was 5,100 decayed permanent teeth.

To establish an adequate means of measuring and expressing workload for this dental care study, all teeth requiring fillings, whether or not they had previously been filled, are counted as "carious." Also counted as carious are teeth for which extraction is indicated. Approximately 75 percent of the children had 1 or more decayed permanent teeth. There was a total of 18,542 decayed teeth involving about 30,000 surfaces.

The age specific DMF (decayed, missing, and filled) rate of permanent teeth increased from 0.31 at age 5 to 11.47 at age 15 (see table 2 and figure 1). The average 15-year-old child had 9.42 decayed teeth, 1.72 missing teeth, and only 1.60 filled teeth.

More than 13 percent of the children had 1

Table 1. Age distribution of all children examined, by patient status, 1st and 2d treatment series, Richmond, Ind.

Age last birthday	1st treatment series			2d treatment series		
	Patient status		All children	Patient status		All children
	Clinic	Private		Clinic	Private	
All ages	4, 569	954	5, 523	4, 797	798	5, 595
5	565	105	670	479	69	548
6	528	110	638	574	79	653
7	507	92	599	555	64	619
8	440	89	529	524	74	598
9	495	88	583	503	63	566
10	422	75	497	457	80	537
11	358	69	427	426	70	496
12	359	72	431	347	55	402
13	370	78	448	364	88	452
14	334	86	420	331	93	424
15	161	72	233	195	47	242
16	30	18	48	42	16	58

or more missing permanent teeth, and only 17 percent had 1 or more filled permanent teeth.

More than 34 percent of the primary teeth examined were found to be carious. The average 7-year-old had 13.58 primary teeth, of which 5.11, or more than 38 percent, were decayed (see table 3). Only 9 percent of the group had 1 or more primary teeth which had been filled prior to the first treatment series.

Treatment Provided

Since the first evidence of dental caries in permanent teeth is closely associated with the beginning of school attendance—at age 5 or 6—a school dental program of the type described here is ideal for caring for the annual increment of defects in permanent teeth. Such a program cannot, however, insure annual or maintenance care of primary teeth, inasmuch as caries usually begins to accumulate in these teeth before age 3. Therefore, during the first treatment series, when the main concern was to care for the accumulated defects of the permanent teeth, primary teeth received only emergency, or very selective, treatment.

Ninety percent of the clinical program group received complete dental care during the first treatment series; and 70 percent of the children

Figure 1. Dental caries prevalence in permanent teeth, first treatment series, Richmond, Ind., ages 5–16.

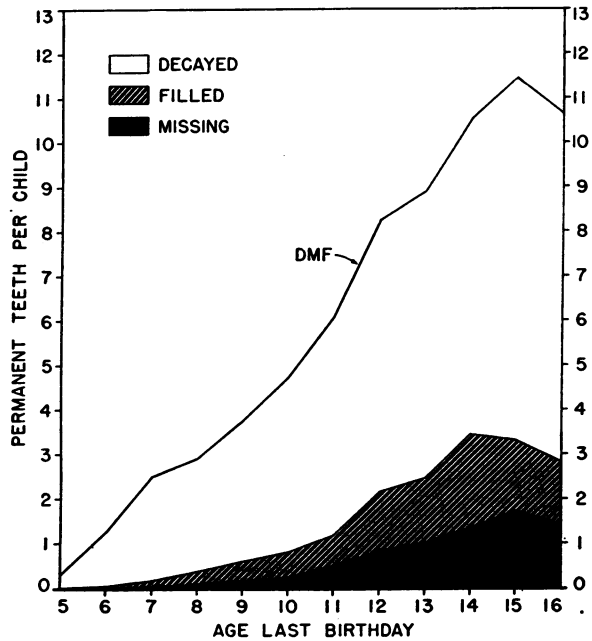


Table 2. Dental caries prevalence in permanent teeth of children, 1st and 2d treatment series, Richmond, Ind.

Age last birthday	Number of teeth per child						
	Carious	Filled	Carious and/or filled	Missing			DMF
				Total	Extracted	Extractions indicated[1]	
1st treatment series							
5–16[2]	5.08	0.83	5.58	0.61	0.37	0.24	5.95
5	.31	.00	.31	.00	.00	.00	.31
6	1.23	.04	1.26	.00	.00	.00	1.26
7	2.38	.14	2.48	.03	.02	.01	2.50
8	2.68	.28	2.88	.09	.03	.06	2.91
9	3.45	.42	3.71	.18	.06	.12	3.77
10	4.24	.56	4.60	.25	.14	.11	4.75
11	5.51	.67	5.90	.51	.20	.31	6.10
12	7.10	1.31	7.79	.84	.47	.37	8.26
13	7.41	1.46	8.30	1.00	.61	.39	8.90
14	8.36	2.11	9.67	1.34	.88	.46	10.54
15	9.42	1.60	10.30	1.72	1.16	.56	11.47
16	8.83	1.40	9.73	1.43	.90	.53	10.63
2d treatment series							
5–16[2]	2.87	3.32	5.59	0.48	0.43	0.05	6.02
5	.17	.00	.17	.00	.00	.00	.17
6	1.05	.06	1.10	.00	.00	.00	1.10
7	2.01	.45	2.35	.00	.00	.00	2.35
8	2.16	1.32	3.13	.03	.02	.01	3.15
9	2.38	2.08	3.89	.08	.06	.02	3.95
10	2.78	2.67	4.83	.19	.15	.04	4.98
11	3.55	3.17	5.95	.25	.20	.05	6.15
12	4.65	3.85	7.71	.55	.44	.11	8.15
13	4.50	4.87	8.45	.69	.64	.05	9.09
14	3.80	6.79	9.49	1.01	.95	.06	10.44
15	3.80	7.20	9.87	1.28	1.18	.10	11.05
16	3.64	7.38	10.19	1.62	1.48	.14	11.67

[1] Also included in "Carious" and "Carious and/or filled."
[2] Average of the rates for ages 5–16.

treated received fillings in 1 or more permanent teeth. More than 11 percent of the children had at least 1 permanent tooth extracted.

A total of 16,015 permanent teeth were filled, at an average rate of 4.20 teeth per child for all age groups. The average 15-year-old had 7.20 teeth involving 11.69 surfaces restored (see table 4).

Selective treatment of primary teeth included 2,898 primary teeth filled, and 3,341 extractions.

In addition to teeth filled and extracted, a total of 367 pulps were capped, and 151 vital

partial pulpectomies were performed on permanent and primary teeth.

Each child received at least 1 dental prophylaxis. Topical fluoride applications totaled 12,329; a serious attempt was made to provide each child with a series of 4 topical fluoride applications.

Dentist Man-Hours

There was an average of 4.3 dentists on duty during the first treatment series, or a ratio of 1 dentist to 530 children treated per year. This dentist-staffing average is based on a full 65-hour, biweekly period for all dentists assigned to the project during the first treatment series with no deductions made for administrative work, vacations, illness, training, and so forth.

Dentist man-hour rates were determined from the total clinic time actually worked by all dentists during the 24 months of the first treatment series. The number of dentist man-hours required to complete treatment of each child in the first round was 2.88. The average number of permanent and primary teeth treated per dentist man-hour was 2.17. This number included 1.50 permanent teeth filled.

Second Treatment Series

During the second treatment series, a total of 5,595 children, 93 percent of all Richmond children in kindergarten through the 9th grade, were given dental examinations. A total of 4,797, or 86 percent of the group, elected to receive treatment in the school clinics (see table 1). This number included 1,688 who had not been enrolled in school during the first treatment series, largely kindergarten and 1st grade children.

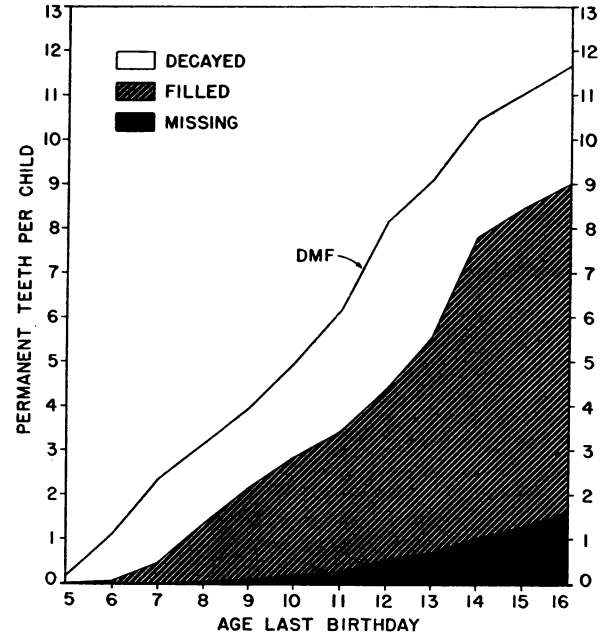
Caries Prevalence

Approximately 68 percent of the children had 1 or more decayed permanent teeth. There was a total of 12,523 decayed teeth, about 6,000 less than in the first treatment series.

The average annual increment of decayed permanent teeth during the interval between the beginning of the 2 rounds was 1.19 teeth per child.

The average number of untreated carious teeth per child at age 15 was 3.80 compared to

Figure 2. Dental caries prevalence in permanent teeth, second treatment series, Richmond, Ind., ages 5–16.



9.42 in the same age group in the first treatment series (see table 2 and figure 2). The average 15-year-old now had 7.20 filled teeth, whereas 24 months earlier the average had been only 1.60 for the same age group. The average DMF rates were essentially the same for all age groups in both series.

Only 167 permanent teeth were indicated for extraction in all age groups, compared to the 815 which had needed extraction during the first series. Approximately 52 percent of the children now had at least 1 filled tooth as compared with only about 16 percent at the beginning of the initial series.

There was a slight decrease in the number of carious primary teeth. The average 7-year-old had 4.75 carious primary teeth, compared to 5.11 for the same age group in the first treatment series (see table 3). This relatively slight reduction in the number of carious primary teeth can be attributed to the limited treatment provided during the first treatment series, plus the enrollment of a new crop of children in the kindergarten and first grades. During the second treatment series, however, 24 percent of the children had at least 1 filled primary tooth, compared to only 9 percent in the first round.

Table 3. Dental caries prevalence in primary teeth of children, 1st and 2d treatment series, Richmond, Ind.

Age last birthday	Number of teeth per child			
	Carious	Filled	Carious and/or filled	Extractions indicated [1]
1st treatment series				
5–16 [2]	2. 31	0. 22	2. 47	0. 37
5	4. 75	. 37	5. 02	. 32
6	4. 91	. 52	5. 28	. 51
7	5. 11	. 43	5. 41	. 89
8	4. 53	. 48	4. 90	. 86
9	3. 84	. 47	4. 21	. 77
10	2. 26	. 17	2. 37	. 47
11	1. 33	. 11	1. 38	. 35
12	. 59	. 13	. 67	. 12
13	. 33	. 01	. 34	. 08
14	. 07	. 01	. 07	. 02
15	. 04	. 00	. 04	. 01
16	. 00	. 00	. 00	. 00
2d treatment series				
5–16 [2]	2. 09	0. 53	2. 48	0. 25
5	4. 62	. 40	4. 90	. 24
6	4. 83	. 94	5. 52	. 41
7	4. 75	1. 28	5. 70	. 53
8	3. 96	1. 44	4. 98	. 51
9	3. 21	1. 10	4. 06	. 53
10	2. 09	. 74	2. 64	. 42
11	1. 03	. 34	1. 28	. 18
12	. 34	. 09	. 40	. 07
13	. 14	. 03	. 15	. 04
14	. 04	. 01	. 04	. 02
15	. 03	. 00	. 03	. 00
16	. 02	. 00	. 02	. 00

[1] Also included under "Carious" and "Carious and/or filled."
[2] Average of the rates for ages 5–16.

Treatment Provided

Complete dental care was given to 98 percent of the clinical program group with 69 percent getting at least 1 permanent tooth filled. Only 2 percent of the children required any extractions.

A total of 12,354 permanent teeth were filled, at an average rate of 2.83 teeth per child for all age groups, compared to 4.20 in the first round of treatment. The average 15-year-old had 3.47 teeth restored, compared to 7.20 for the same age group 20 months earlier (see table 4).

Since the bulk of the accumulated needs had been cared for during the first treatment series, it now becomes possible to devote more time to treating defects in primary teeth. The number of primary teeth filled rose from 2,898 in the initial round to 5,569 in the second series.

Aside from fillings and extractions, there was no substantial change in the type or amount of other dental treatment services.

Dentist Man-Hours

There was an average of 3.9 dentists on duty during the second treatment series, or a ratio of 1 dentist to 743 children treated per year. The number of dentist man-hours required to complete treatment of each child in the second round

Table 4. Dental treatment to permanent and primary teeth of children, 1st and 2d treatment series, Richmond, Ind.

Age last birthday	Number of teeth per child					
	Permanent teeth			Primary teeth		
	Filled	Filled surfaces	Extracted	Filled	Filled surfaces	Extracted
1st treatment series						
5–16 [1]	4. 20	6. 65	0. 24	0. 48	0. 88	0. 61
5	. 27	. 38	. 00	1. 38	2. 51	. 40
6	1. 15	1. 63	. 00	1. 31	2. 52	. 69
7	2. 16	3. 38	. 02	1. 21	2. 23	1. 21
8	2. 46	4. 00	. 08	. 98	1. 79	1. 33
9	3. 01	4. 84	. 12	. 49	. 84	1. 26
10	3. 81	6. 19	. 21	. 23	. 39	. 96
11	4. 85	7. 59	. 30	. 08	. 13	. 63
12	6. 23	9. 68	. 36	. 03	. 05	. 48
13	6. 75	10. 40	. 41	. 02	. 03	. 26
14	6. 52	10. 27	. 43	. 00	. 01	. 08
15	7. 20	11. 69	. 45	. 02	. 03	. 02
16	5. 93	9. 70	. 53	. 00	. 00	. 03
2d treatment series						
5–16 [1]	2. 83	4. 28	0. 05	0. 88	1. 65	0. 45
5	. 18	. 28	. 00	2. 84	5. 23	. 38
6	1. 15	1. 18	. 00	2. 80	5. 21	. 65
7	2. 08	3. 40	. 02	2. 43	4. 66	. 91
8	2. 18	3. 56	. 01	1. 44	2. 75	. 92
9	2. 29	3. 76	. 04	. 72	1. 28	1. 03
10	2. 77	4. 26	. 05	. 24	. 43	. 77
11	3. 58	5. 34	. 05	. 04	. 07	. 42
12	4. 72	6. 81	. 05	. 01	. 01	. 20
13	4. 63	6. 93	. 08	. 01	. 02	. 09
14	3. 72	5. 69	. 12	. 01	. 03	. 04
15	3. 47	5. 33	. 10	. 00	. 01	. 03
16	3. 21	4. 79	. 05	. 02	. 05	. 00

[1] Average of the rates for ages 5–16.

was 1.86. The average number of permanent teeth treated per dentist man-hour was about the same as in the first series. There was an increase, however, in the amount of treatment provided per dentist man-hour for primary teeth: 0.61 teeth filled as compared with 0.31. The second treatment series was completed in 20 months.

There was a reduction of 1.02 dentist man-hours in time required to complete treatment of each child. This drop may be attributed to the lower prevalence of carious teeth due to dental treatment, and improved operating and clinical procedures.

The reduction in completed dentist man-hours per child would undoubtedly have been greater except for the constant influx of children who had had little or no previous dental treatment.

Summary

An average of 4,600 school children in kindergarten through 9th grade were given dental examinations and complete dental treatment during the first 2 treatment series of the Richmond, Ind., dental care study project.

The first treatment series was designed to care for the accumulated dental needs of the group. Primary emphasis was placed on caring for defects in permanent teeth.

The second treatment series, which started 24 months after the beginning of the first, was designed to treat the increment of defects occurring during that 24-month period, and to provide more complete care for the primary dentition.

Before the first series, only 17 percent of the children had had any permanent teeth filled. This figure rose to more than 52 percent at the start of the second series.

At the beginning of the second series, it was found that the average 15-year-old had 3.80 unfilled carious teeth, compared to 9.42 in the same age group at the start of the first series.

Only 167 permanent teeth were indicated for extraction in all age groups in the second series, compared to 815 needing extraction during the first round of treatment.

The number of dentist man-hours required to complete treatment of each child in the first and second rounds was 2.88 and 1.86, respectively. This represents a reduction of 1.02 dentist man-hours, or 35 percent, for each child.

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