

Cost-Effectiveness of Bussing Pupils to a Dental Clinic

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INCREASED competition for funds to be used for health programs has placed greater responsibility on health administrators in validating the cost and effectiveness of their programs (1). Unless studies are conducted on the various alternative methods of delivering care, funds cannot be allocated rationally.

The delivery of dental services in a community health center was studied to evaluate the cost and effectiveness of a program in which bussing was provided for school children to a dental clinic as a replacement for the system of scheduled appointments for each child. A review of literature indicated that although bussing programs are not uncommon, cost-effectiveness data are not available (2).

This study was conducted in the dental clinic of the Martha M. Eliot Family Health Center, a facility in Boston, Mass., supported by funds from the

Maternal and Child Health Service, Health Services and Mental Health Administration. The center, located in a housing development in a low-income area, provides comprehensive health care to approximately 600 women and 4,100 children residing in the 4.5 census tracts surrounding the center. The dental clinic of the center supplied care to 1,632 patients during 1968 or approximately 35 percent of the census tract population.

Dental Services

The dental clinic is in two renovated first-floor apartments adjacent to the medical clinic. In addition to the six dental treatment rooms, there is a waiting room, an office for the clinic director, and an office for the dental hygiene educators. The professional staff consists of one full-time dentist, who functions both as clinical dentist and as a clinic administrator, and three part-time dentists, whose combined hours equal one additional full-time dentist. The auxiliary staff consists of two dental assistants, a clerk-receptionist, a clinical dental hygienist, and two dental hygiene educators, who provide chairside care but also are involved in school health and community programs and in the supervision of student dental hygienists.

The clinic offers basic dental services: examinations, radiographs, dental prophylaxis, topical fluoride treatments, silver amalgam restorations, silicate restorations, stainless steel crowns, oral surgery, and root canal treatment for anterior teeth. In 1968 there were 6,101 patient visits, during which 11,295 individual dental services were provided. In addi-

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tion to clinic services, the center provides dental screening and dental health education in the neighboring schools.

Bussing of Children

During the fall of 1968, discussions between area school officials, school nursing personnel, and the staff of the Martha M. Eliot dental clinic elicited several problems: (a) parents were keeping children away from school for the entire day in order for the child to keep a dental appointment, (b) schools were legally unable to release children from the school except to a "responsible" adult—it was extremely difficult for mothers to provide escort service from the school to the dental clinic—and (c) the dental clinic was experiencing a high rate (35 percent) of patients who missed their scheduled appointment.

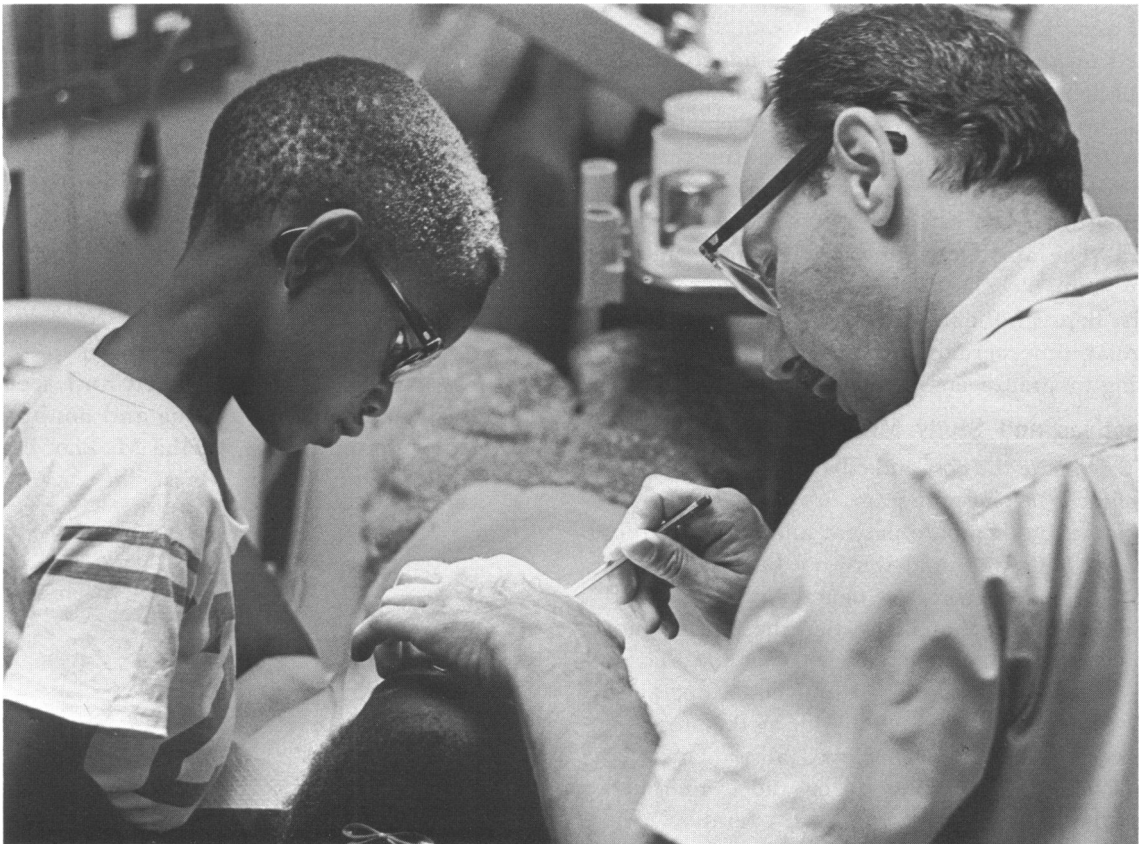
The staff decided to experiment with a bussing program and proposed that the minibus owned by the center be made available at certain times during the week to transport school children to and from the dental clinic. Two of six neighboring schools

(3) were chosen to participate in the program. Selections were based on personnel available and space limitations at the dental clinic, time available for a bussing program, and potential number of eligible children.

Children were eligible for dental care if they resided within the 4.5 census tracts served by the clinic and if a parent had registered them during a visit to the clinic.

The parents of 467 children (4) consented to their transportation to and from the clinic for dental care. Of these 467 children, 234 had not yet visited the clinic. After registration, 233 children, 6 to 13 years old, were enrolled in the program.

Scheduling the patients was the responsibility of the two dental hygiene educators. Each child was scheduled first with a hygienist for prophylaxis, topical fluoride treatment, radiographs, oral hygiene instruction, and examination by a dentist. If additional dental care was needed, the child was assigned to a specific dentist for completion of all remaining work. Before a scheduled appointment, the child received an appointment card from the



Dentist with young school patients, Martha M. Eliot Family Health Center Dental Clinic, Boston, Mass.

school nurse to inform the parents of the forthcoming visit, and each week the school nurse received a list of children's names with appointments at the clinic for a specified day. The list also contained the names of several children designated as substitutes—in the event the child scheduled was absent on the day of his appointment.

The program, conducted Wednesday and Friday mornings from November 27, 1968, to June 18, 1969, was operational for 43 mornings of this 30-week period. Lost days included school holidays, snow emergencies, and occasional breakdowns of the bus.

Two dentists and three hygienists were scheduled to work the mornings of the bussing program from 9 a.m. to 12:30 p.m. Dentists worked 259 hours during the program, and hygienists, 319 hours. Hours were lost because of sickness, vacations, and administrative needs of the program.

Each dentist was scheduled with two patients per hour, and each hygienist with one patient per hour. The potential number of patient visits was 518 with the dentists and 319 with the hygienists.

Children were scheduled for appointments at 9:30 a.m., 10:30 a.m., and 11:30 a.m. The driver picked up the first group of seven students at the school at 9:20 a.m. and returned them at the end of an hour. Before he returned these children to the school, however, the driver picked up the second group of children, and they were at the clinic waiting to be seen when he picked up the previous group. The amount of time spent by the student away from the classroom was approximately 1½ hours. Between 9 a.m. and 9:30 a.m. and at other irregular time periods, patients not served in the bussing program were seen.

Objectives and Study Method

To evaluate the cost and effectiveness of the dental clinic's bussing program, it was necessary to determine and compare patient and staff activities when students were and were not bussed, to compare the dollar value of the dental services received by all patients at the clinic when the bussing program was operating and when it was not, and to determine the cost of the dental clinic operation and cost of operating a minibus during the program.

The study population included all patients seen from 9 a.m. to 12:30 p.m. during the 43 mornings when the bussing program was in operation. The control group included all patients who were seen from November 26, 1968, to June 17, 1969, on Tuesday and Thursday mornings from 9 a.m. to

12:30 p.m., or 49 nonbussing mornings. In addition, data were gathered on a second control group—all patients seen at the clinic from September 18, 1968, to November 22, 1968, on Wednesday and Friday from 9 a.m. to 12:30 p.m., or 18 nonbussing mornings—in order to determine if there were any differences between patient activities on Tuesday-Thursday and Wednesday-Friday mornings. The dental clinic was not fully operational during the 1967-68 school year.

Clinical data were extracted from the daily records of each dentist and hygienist who provided the dental services for a specific day. Information concerning the cost of operating the minibus was obtained from the accounting section of the central office of the Boston Maternity and Infant Care Project. The dollar value of dental services was based on the current Massachusetts Medicaid fee schedule. All data were collected manually. Compared data were subjected to significance by the chi-square test, with acceptance at the 0.05 level.

Results—Patient Activity

The activity outlined in table 1 includes those patients scheduled and seen by the dentists (5) during the bussing period (87 percent) and during the nonbussing period (60 percent). Comparison of activity between the bussed and nonbussed patients showed a significant decrease in the percentage of patients who missed their scheduled appointment (bussed, 9 percent, and nonbussed, 35 percent; $P < 0.001$). However, the percentage of appointments canceled by the clinic (bussed and nonbussed, 5 percent) and the percentage of "walk-ins"

Table 1. All patients scheduled and seen by dentists alone during bussing and nonbussing periods, dental clinic, Martha M. Eliot Family Health Center, Boston, Mass.

Activity	Bussing period		Nonbussing period	
	Number	Percent	Number	Percent
Total patients seen.....	510	-----	349	-----
Patients scheduled.....	479	-----	449	-----
Patients scheduled and seen.....	416	87	268	60
Patients missing a scheduled appointment.....	41	9	158	35
Scheduled appointments canceled by clinic.....	22	5	23	5
Walk-in patients.....	94	16	81	15

NOTE: 98 percent of 518 available scheduled appointments were used during bussing period and 67 percent of 518 available during nonbussing period.



**Hygienist explaining care of teeth to school child, Martha M. Eliot
Family Health Center Dental Clinic, Boston, Mass.**

(bussed, 16 percent, and nonbussed, 15 percent) were reasonably similar; these differences were not significant. All "walk-in" patients were seen by a dentist.

Percent utilization of scheduled appointments available with the dentists was 98 percent for bussed patients and 67 percent for nonbussed patients, based on the number of hours worked by the dentists and the suggested workload of 2 patients per hour.

Patient activity with the hygienists, or percentage of patients seen per number scheduled, was 78 per-

cent for the bussed group and 49 percent for the nonbussed or control group (table 2). The percentage of patients who missed their scheduled appointment was 19 percent for the bussed and 51 percent for the nonbussed group ($P < 0.001$). The appointments of a small percentage of patients were canceled by the clinic, and there were no walk-in patients.

Percent utilization of scheduled appointments available with the hygienists was 85 percent for bussed patients and 61 percent for nonbussed patients, based on the number of hours worked

and the suggested workload of 1 patient per hour.

Between the hours of 9:30 a.m. and 12:30 p.m. during the bussing period, school children primarily were seen. The percentage of patients seen per number scheduled was 94 percent for both the dentist and the hygienist (table 3). The percentage of patients who missed their scheduled appointment was 2 percent for the dentists and 3 percent for the hygienists. The percentage of appointments canceled by the clinic was 4 percent for the dentists and 3 percent for the hygienists.

Percent utilization of scheduled appointments available with both dentists and hygienists was 78

Table 2. All patients scheduled and seen by hygienists alone during bussing and nonbussing periods, dental clinic, Martha M. Eliot Family Health Center, Boston, Mass.

Activity	Bussing period		Nonbussing period	
	Number	Percent	Number	Percent
Total patients seen.....	271		103	
Patients scheduled.....	348		211	
Patients scheduled and seen.....	271	78	103	49
Patients missing a scheduled appointment.....	64	19	107	51
Scheduled appointments canceled by clinic.....	11	3	1	0
Walk-in patients.....	0		0	

NOTE: 85 percent of 319 available scheduled appointments were used during bussing period and 61 percent of 169 available during nonbussing period.

Table 3. Patients scheduled and seen by both dentist and hygienist on bussing days only, dental clinic, Martha M. Eliot Family Health Center, Boston, Mass.

Activity	Dentist ¹		Hygienist ¹	
	Number	Percent	Number	Percent
Patients scheduled.....	368		247	
Patients scheduled and seen.....	347	94	232	94
Patients missing a scheduled appointment.....	6	2	8	3
Scheduled appointments canceled by clinic.....	15	4	7	3

¹ Figures do not agree with tables 1 and 2 because data for ½ work hour (9–9:30 a.m.) and for walk-in patients were not included.

NOTE: 78 percent of 444 available scheduled appointments with dentist and 78 percent of 297 available with hygienist were used during bussing period.

Table 4. Dollar value of services performed during bussing and nonbussing periods, dental clinic, Martha M. Eliot Family Health Center, Boston, Mass.

Services performed	Bussing period		Nonbussing period	
	Value	Percent	Value	Percent
Grand total.....	\$10,775	100.0	\$6,647	100.0
Dentist.....	6,597	61.0	5,179	78.0
Examinations and radiographs.....	981	14.9	727	14.0
Amalgam restorations.....	3,712	56.3	2,538	49.0
Anterior restorations.....	352	5.3	384	7.4
Temporary fillings.....	78	1.2	135	2.6
Extractions.....	900	13.6	575	11.1
Endodontic procedures.....	540	8.3	800	15.4
Other.....	34	.5	20	.4
Hygienist.....	3,729	35.0	1,468	22.0
Completed prophylaxis, fluoride treatments.....	2,730	73.2	984	67.0
Gross scaling.....	140	3.8	30	2.0
Radiographs.....	859	23.0	454	30.9
Student hygienist.....	449	4.0	(¹)	
Completed prophylaxis, fluoride treatments.....	324			
Gross scaling.....	40			
Radiographs.....	85			

¹ Dollar value of services performed by student hygienists during a nonbussing period were calculated from data for Sept. 18, 1968–Nov. 22, 1968.

percent. The percentage for the dentists would have been greater if the walk-in patients who were seen between the hours of 9:30 a.m. and 12:30 p.m. had been included. Data also were not included on the number of mothers and children or the number of patients seen before 9:30 a.m. in the control group.

During the bussing program, 10 student hygienists were assigned, in pairs, to spend 2 working days at the dental clinic as a part of their training program. Sixty-eight patients were scheduled for these students; however, 13 or 19 percent missed their scheduled appointment. During the control period, September 18, 1968, to November 22, 1968, 53 patients were scheduled with eight student hygienists, but 18 or 34 percent missed their scheduled appointment.

Comparisons between the two control groups showed no significant differences. We compared the

percentage of patients seen per number scheduled (61 and 64 percent), the percentage of patients who missed their scheduled appointment with the dentist (35 and 34 percent), the percentage of walk-in patients (15 and 20 percent), and the nearly identical average dollar value of dental services performed by the dentist per work hour (\$20.00 and \$20.08).

Results—Cost of Dental Services

The various types of services performed by the dentists and hygienists and the value for each group of services in terms of dollars, using the Massachusetts Medicaid fee schedule (6), are summarized in table 4.

Following are the dollar values of dentists' services performed, calculated for 259 hours worked by dentists during both the bussing period and the nonbussing period.

<i>Dentists' services</i>	<i>Bussing period</i>	<i>Nonbussing period</i>
Total dollar value of dental services performed by dentists during evaluation periods.....	\$6,597.00	\$5,179.00
Average dollar value of dental services performed by dentist per work hour.....	25.47	20.00
Cost of bus operation per work hour.....	.80	0
Average adjusted dollar value of dental services performed by dentist per work hour.....	24.67	20.00

The difference of \$4.67 in the adjusted dollar value represents a 23 percent increase per work hour for the bussed group over the nonbussed group, based upon the computed dollar value for the dentist less cost of the bus operation.

Following are the dollar values of hygienists' services performed, calculated for 319 hours during the bussing period and 169 hours during the nonbussing period:

<i>Hygienists' services</i>	<i>Bussing period</i>	<i>Nonbussing period</i>
Total dollar value of dental services performed by hygienist during evaluation periods.....	\$3,729.00	\$1,468.00
Average dollar value of dental services performed by hygienist per work hour.....	11.69	8.69
Cost of bus operation per work hour.....	.80	0
Average adjusted dollar value of dental services performed by hygienist per work hour.....	10.89	8.69

The difference of \$2.20 in the adjusted dollar value represents a 25 percent increase per work

hour for the bussed group over the nonbussed group, based upon the computed dollar value for the hygienist less cost of the bus operation.

Following are the dollar values of student hygienists' services performed, calculated for 66 hours during the bussing period and 52 hours during the nonbussing period:

<i>Student hygienists' services</i>	<i>Bussing period</i>	<i>Nonbussing period</i>
Total dollar value of dental services performed by student hygienists during evaluation periods.....	\$449.00	\$336.00
Average dollar value of dental services performed by student hygienists per work hour.....	6.80	6.46
Cost of bus operation per work hour.....	.80	0
Average adjusted dollar value of dental services performed by student hygienists per work hour..	6.00	6.46

The difference of 46 cents in the adjusted dollar value represents a 7 percent decrease per work hour for the bussed group over the nonbussed group, based upon the computed dollar value for the student hygienists less cost of the bus operation. Only two patients were scheduled with a student hygienist for a morning. Each student hygienist was allowed 1½ hours for each patient to complete a prophyl fluoride treatment and the necessary radiographs. The students were naturally slower and were given less to do per hour. In a training situation it was difficult to evaluate these students with the same criteria used for the dentists or hygienist unless their contribution of services to the clinic operation and to the surrounding community was considered to be significant.

Results—Other Costs

Cost of bus operation. The cost of operating the health center's minibus was based on the driver's wage per hour (\$2.75) and the cost of the mechanical operation and depreciation of the bus per mile driven (15 cents). The mechanical cost of operating the minibus per morning was 90 cents. The cost of bussing school children to the clinic and back to school during a 4-hour bussing morning was \$11.90 or \$2.98 per hour. The total cost of the bus operation was calculated to be \$511.70 for the 43 mornings of the bussing program. The cost of operating the bus per dentist or hygienist work hour was 80 cents, using as the denominator the total number of hours worked (644) by dentists (259), hygienists (319), and student hygienists (66) during the bussing program.

Cost of clinic operation. The estimated cost of operating the Martha M. Eliot dental clinic was

\$48.01 per hour during 1968, based on the calculated operating costs (7) of the clinic (\$83,015), the estimated rental of the building (\$4,000), the number of days the clinic was open (250 workdays), and the number of hours worked each day (7¼ hours). The cost of operating the minibus was \$2.98 per hour. The hourly operating costs of the dental clinic increased 6 percent while using the bus.

Dollar value of clinic services. The calculated average dollar value of all dental services at the clinic during 1968 was \$37.96 per hour, based on the total dollar value (7) of all dental services (\$68,800) and the number of days and hours worked. During the bussing program the average hourly value of all services performed by the dentists and the hygienists was \$68.61, based on the total dollar value of all services performed by the dentists and hygienists (\$10,326) and the number of clinic hours worked (150.5). There was a difference of 81 percent between the average hourly dollar value of all dental services performed during the bussing program (\$68.61) and the average hourly dollar value of services for 1968 (\$37.96).

Conclusion

The efficient use of a low-cost transportation system to bring school children to a health center can increase the quantity of services provided, as realized by the increase in dollar value per staff work hour over the nonbussed period. The clinic was able

to manage the flow of patients and the staffing problems more effectively, as demonstrated by the decreased number of missed appointments and the greater use of appointment time. The bussing program minimized the period of time the student was away from the classroom when receiving dental care.

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FIELD, HOWARD M. (Harvard School of Dental Medicine), and **JONG, ANTHONY:** *Cost-effectiveness of bussing pupils to a dental clinic. HSMHA Health Reports, Vol. 86, March 1971, pp. 222-228.*

The dental clinic of the Martha M. Eliot Family Health Center, Boston, Mass., implemented a school bussing program designed to reduce the number of missed appointments and to minimize the period of time the student was away from the classroom.

There was a significant decrease in the number of patients who missed their scheduled appointments during the program: from 35 to 9 percent for the dentist and from 51 to 19 percent for the hygienist. The percentage of avail-

able appointments used at the clinic increased from 67 to 98 percent for the dentist and from 61 to 85 percent for the hygienist.

The calculated cost of using the minibus per hour worked by each staff member was 80 cents, whereas the net value of the dental services provided for each patient during the bussing program was increased 23 percent or \$4.67 per dentist work hour and 25 percent or \$2.20 per hygienist work hour.

The bussing program increased

the average hourly cost of operating the dental clinic by 6 percent; however, the difference between the average hourly dollar value of all dental services performed during the bussing program was 81 percent greater than the hourly dollar value of all dental services performed at the clinic during 1968.

Under the bussing program the children were away from school for only 1½ hours per dental appointment, rather than the entire day they often missed.