Study of Selected Outcomes of the Early and Periodic Screening, Diagnosis, and Treatment Program in Michigan

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SYNOPSIS

Michigan's Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program has screened more than 1.1 million Medicaid-eligible children since its inception in 1973. A study of its effects showed screening referral rates, but not medical costs, to be inversely related generally to the number of lifetime screenings received. Referrals from screening declined, on average, 4 to 9 percent as the number of lifetime screenings increased from 1 to 4. Medical costs for EPSDT participants were about 7 percent lower than medical costs for non-EPSDT participants when program costs were considered. Although the author acknowledges that a definitive study of EPSDT program effects has yet to be accomplished, he believes that modest gains are attributable to the program.

THE EARLY AND PERIODIC SCREENING, Diagnosis, and Treatment (EPSDT) program is a large and innovative Great Society program that has been reported on previously in this journal (*1*). The program offers a medical screening as well as needed diagnosis and treatment services to Medicaid-eligible persons under the age of 21 years. Outreach to those eligible to use the program is an important component of EPSDT and is a feature that is atypical for a public welfare program.

Congress's enactment of EPSDT legislation (a 1967 amendment to title XIX of the Social Security Act) marked the first time that the United States had included preventive health services in a large national program (*2*). Currently, some 11 million children and young people are eligible for EPSDT, making it the Federal Government's largest health care program for low-income children. In fact, excluding Medicaid itself, EPSDT serves more Medicaid-eligible children than all other federally supported health care programs combined (*3*). Each State with a Medicaid program is required to offer EPSDT.

In Michigan, the Departments of Social Services and Public Health jointly conduct the EPSDT program through an interagency agreement. Until 1983, local social services offices did most of the outreach, scheduling of screening appointments, and transportation of eligibles. Beginning in 1983, local health departments assumed the outreach and scheduling functions. In all localities, specially trained local health department nurses and technicians do the screening and provide certain followup supportive services, and have done so since the program's inception.

When a medical problem is suspected on the basis of the EPSDT screening, the child is referred for diagnosis and treatment to a physician, a dentist, or another health care provider who will accept Medicaid patients. Michigan's program is an active one; more than 1.1 million screenings had been done as of summer 1982.

Given that the stated purposes of EPSDT are to increase access of the poor to medical services and thereby to improve their health status and reduce the costs of their medical care, I undertook a study of the Michigan program with particular interest in its effects on health status and costs. The study was formulated in the context of other EPSDT research with similar focus.

Related Studies

Two types of outcome have been used to assess the effects of EPSDT: (*a*) use of the medical care system, as measured by cost and utilization rates, and (*b*) the presence of health problems, as measured by referral or health abnormality rates. In such studies, the basic research design has been one either of determining participant changes over time

(a longitudinal study) or of determining differences in participant and nonparticipant outcomes at a point in time (a cross-sectional study). Five studies, using one or both of these methods, have been reported that provide insight into EPSDT's influence on health status.

According to unpublished data of the Portsmouth, Va., Department of Public Health, after 3 years of participation (1970–72) in a federally financed demonstration project, some 2,000 EPSDT participants in Portsmouth had total Medicaid costs that were one-third lower than nonparticipants' costs; spent one-third less time in the hospital; and incurred about half the physician visits incurred by non-EPSDT participants. Only 1 screening per participant was given, but participants did receive case management services, such as health education, transportation, and follow-through in obtaining care.

A 1977 study by Applied Management Sciences (*4*) involved selection of 800 screened and 800 unscreened children from each of two States—one southern and rural; the other northern and urban. Researchers examined the Medicaid claims files for both groups for the year prior to screening (January through December 1974), the screening year itself (March 1975 through February 1976), and the year after screening (March 1976 through February 1977). In both States, they found that the rates of increase for service utilization and costs were more rapid for the screened group. However, absolute levels of utilization and costs remained 6 to 27 percent lower for the screened group, with the exception of the screening year itself, in the southern State. Utilization increased 12 percent for EPSDT participants in the southern State and 8.5 percent for participants in the northern State. The participants' costs increased 23 percent in the southern State and 19 percent in the northern one.

A 1977 study by Community Health Foundation (*5*) compared cost and utilization data incurred during one screening year (July 1975 through June 1976) for 622 EPSDT participants and 1,662 nonparticipants in Minot, N.D. Those screened used 103 percent more physician services, 65 percent more dental services, and 24 percent more outpatient hospital services, but used 21 percent fewer inpatient hospital services. Per capita expenditure for the screened group was 6 percent higher for physician services and 17 percent higher for dental services, but 18 percent lower for pharmaceuticals, 47 percent lower for inpatient hospital services, and 36 percent lower for total expenditures. When Minot EPSDT participants were compared with 1,920 children from Bismarck, N.D., which had no program, the results were similar. Participants used 178 percent more physician services, 79 percent more dental services, and 24 percent more outpatient hospital services, but 39 percent fewer inpatient hospital services. The participants' per capita expenditures were 65 percent higher for physician services, 2 percent lower for dental services, 21 percent lower for pharmaceuticals, 58 percent lower for inpatient hospital services, and 44 percent lower for total expenditures. This study controlled outcomes for sex differences but not for age differences. The small number of children screened very likely precluded the latter.

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Currier (*1*), studying Michigan referral rates, found that, during the first half of 1976, 62 percent of EPSDT participants screened for the first time were referred for followup care, compared with 49 percent of those who were rescreened. A similar study of 1977 Michigan data (*6*) showed these rates to be 62 percent for initially screened participants and 51 percent for those rescreened.

A 1980 study by Philadelphia Health Management Corporation, an EPSDT screening provider in southeastern Pennsylvania, analyzed administratively generated, computerized EPSDT data. This study (*7*) included both a longitudinal comparison of health abnormality rates for a representative sample of 1,831 EPSDT participants and a cross-sectional comparison of abnormality rates for the same participants at rescreening and for 1,183 children receiving only an initial screening. Several control procedures were used in making both comparisons. The researchers found that the rescreened group had an approximately 30 percent lower incidence of problems, whether compared with itself over a 2-year period or compared cross-sectionally with the group receiving initial screening ($P < .05$ for both comparisons).

All these studies share the shortcoming of client self-selection in determining program participants. Thus, differences in outcomes might be attributable to those factors that sort eligibles into participant or nonparticipant categories, rather than to the EPSDT program. (The authors of the Applied Management Sciences and North Dakota studies, in particular, acknowledged this possibility and cautioned that they had not produced conclusive evidence of EPSDT's effects.) This bias is unavoidable, however. Participation in the EPSDT program is a benefit that cannot be denied for purposes of research methodology or for any other reason. The authors of the Philadelphia Health Management Corporation study discussed this problem in some detail. They argued that self-selection of research subjects does not necessarily invalidate findings and specifically does not disqualify their results. However, the presence of such self-selection does reduce the certainty of interpretations of the outcome.

Also, caution is warranted in accepting the reliability of some of the obtained findings. (For example, it is not reasonable to expect that EPSDT can reduce inpatient hospital costs as quickly and substantially as suggested by the North Dakota study.) In general, the problem is usually one of distinguishing effects of the program from findings that are merely associated with program participation. The Philadelphia study acknowledged that attribution of effect to the EPSDT program was not unequivocal.

A third shortcoming of the cost studies discussed here is that the costs of program administration and outreach apparently were not included in any of them.

Given these qualifications, a consistent trend does emerge from the five studies; namely, that EPSDT participants incur lower aggregate medical costs than nonparticipants, and that referrals are reduced with increased exposure to the program. Assuming that these differences are due to EPSDT program participation, and assuming that less use of services and lower costs are considered desirable, these studies are supportive of the program's effectiveness. With the knowledge that conclusive results of program effect were not likely to be achievable, I undertook the following research to replicate and test the major findings of these studies in greater detail.

Research Design and Methodology

Ideally, the EPSDT program's effects, if any, would be measured by a longitudinal study that randomly assigned subjects to control and experimental groups. Such a design was not possible for this study and, as an alternative, a cross-sectional design was used. But the number of lifetime EPSDT screenings that each client had received was used as a measure of program participation for that client and as a proxy for time. Thus, use of this number as an independent variable added a longitudinal quality to the study.

The cross-sectional perspective resulted from testing the relationship between participation in the program and the program's effects at a point in time. Random assignment of subjects to test and control groups was not employed.

To elaborate, clients with rescreenings had tended to participate in the program over time. Generally, the more rescreenings received, the longer the client's time in the program and the more "long term" the program's effects. Therefore, the selected indicators of effects—namely, the most recent referral rates and 1979 medical costs—were obtained after a passage of time in the program. In effect, these variables were proxies for long-term outcomes. This conception was the basis for testing for the presence of two inverse relationships: one between the number of lifetime screenings received and referral rates; the other between the number of screenings received and medical costs. The assumption and hypothesis was that if the program was improving the health status of its participants, then referral rates and medical costs should have declined as program participation (that is, length of time in the program) increased.

Another assumption was that referral rates (total number of referable conditions divided by total number of children screened) reflected health status, at least in a general sense. There is a basis for this assumption. The fact that a major purpose of the program is to identify suspected health problems gives some reason for belief that this may in fact occur. Also, the Michigan Department of Public Health uniformly trains all EPSDT screening nurses and technicians in the specifics of conducting the program, provides these personnel with an instruction manual that includes procedures and criteria for identifying referable conditions, and periodically monitors the performance of the screening teams. These activities help to standardize and improve the quality of the screening process and consequently increase the likelihood that suspected problems are properly identified and that referral determinations are valid and reliable. Nevertheless, I recognize that referral rates are general indicators of health status. Moreover, the results of this study suggest that they

may be distorted, but not invalidated, by extraneous factors. In short, for purposes of this study referral rates were regarded as giving an indication, not an infallible reading, of health status.

Medical costs likewise pose some problems when used as an outcome variable. The interpretation of costs may be ambiguous. For example, high costs may be considered indicative of good access to medical care and therefore likely to be indicative of good health status, or they may be regarded as problematic because they represent an outflow of public funds. In addition, these costs tend to be extremely variable. Regardless of interpretation, it is important to learn whether costs flow in any pattern, or show differences, relative to program participation. Moreover, as noted, there has been an expectation that EPSDT would reduce medical care costs. For these reasons, medical costs were studied in this research.

Since Medicaid costs data were most accessible for the year 1979, subjects who were eligible for EPSDT during all of that year, as a minimum, were chosen for study. A computer search of the Department of Social Services Client Information System determined that 244,551 persons were eligible during that time period. For each one, the Michigan computerized EPSDT Master File of 535,753 screening records was searched and calculations were made for those subjects with screening records to determine the number of lifetime screenings and the average number of referrals at the last (most recent) screening. The referral rates were also computed by age and demographic variables to determine whether the rates were influenced by these factors. Of the 1979 eligible population, 154,186 (63 percent) had been screened.

When the referral rates were analyzed, it was apparent that they had declined over time. This development confounded a determination of whether referrals decrease with increased length of time in the program, since repeat screenings occurred later in the program's history, when referrals were made less frequently. Thus, unless year of screening was controlled, it was not possible to decide whether, or to what extent, any observed decrease in referral rates was due to program participation or to time of screening. Accordingly, referral rate data in table 1 are presented by year of screening in order to control for time. This data display allows direct observation to be used in determining whether referral rates and number of screenings are inversely related.

When these results were reviewed, it was also evident that relatively few clients had received 6 or more screenings and that referral rates from these small groups were highly variable. Thus, referral rate data are presented only for groups of 100 or more subjects, since data did not show wide variation when based upon this number of subjects.

'Nevertheless, a comparison of the mean cost for all the EPSDT participants sampled . . . with that for the nonparticipants . . . showed that participants had lower Medicaid costs and that the difference was statistically significant.'

To assess the relationship between medical care costs and participation in the program, a systematic random sample was taken of 6.67 percent of the 1979 eligible population. Subjects selected numbered 16,303 including 6,073 persons who had not been screened. The unscreened group was included to afford an opportunity to contrast outcomes for EPSDT participants and nonparticipants.

The sample's 1979 title XIX costs (not including the costs of EPSDT screening and outreach) were obtained by computer search in late September 1980 from Michigan's automated Medicaid payments system (Medicaid Management Information System). Medical provider bills must be received by the Medicaid program within 1 year of the date of service to be considered for payment. Determining costs some 9 months after the end of the study period ensured that the great majority of costs would have been reported to the program.

I used the Statistical Package for the Social Sciences to conduct a bivariate regression analysis to determine whether costs and number of screenings were inversely related. Also, because the sample data showed a difference between total mean costs for EPSDT participants and those for nonparticipants, Student's t test was used to determine whether the difference was statistically significant.

Referral Rate Results

Two patterns were present in table 1. When one reviews the column values from top to bottom, it is apparent that referral rates generally declined between 1973 and 1980. The descent is not continuous in each column, yet the general trend is one of

Table 1. Average number of referrals [1] at last screening for 1979 Michigan Medicaid EPSDT eligibles, by year and number of lifetime screenings

Year	Number of lifetime screenings					Grand mean	Unduplicated count of children screened
	1	2	3	4	5		
1973	1.476	...	...	...	...	1.476	2,695
1974	1.350	1.153	...	...	...	1.344	11,049
1975	1.137	1.024	...	...	...	1.120	11,924
1976	.995	.885	.824	...	...	.961	15,598
1977	.994	.904	.890	.787	...	.923	23,958
1978	.933	.869	.859	.800	.923	.895	42,582
1979	.794	.743	.695	.695	.646	.747	43,192
1980	.691	.612	.538	.557	...	.603	2,925
Unduplicated count of children screened	83,587	47,312	18,489	4,018	517	...	153,923

[1] Average number of referrals = total number of referred conditions identified by an EPSDT screening, divided by number of children screened.

NOTE: Referral rates throughout this table relate to groups larger than 100 persons.

Table 2. Percentage change in average number of referrals at last screening for 1979 Michigan EPSDT eligibles, as number of lifetime screenings increase by one, by year of screening

Year	Changes in number of lifetime screenings			
	1 to 2	2 to 3	3 to 4	4 to 5
1974	−15	...	...	...
1975	−10	...	...	...
1976	−11	−7	...	...
1977	−4	−2	−12	...
1978	−7	−1	−7	+15
1979	−6	−6	0	−7
1980	−11	−12	+4	...

NOTE: Referral rates throughout this table relate to groups larger than 100 persons.

decreasing referrals over time. The grand mean change is an unequivocal reduction of 59 percent over the 7-year period (1.476 to .603 ÷ 1.476), or an average annual rate of reduction of 11.7 percent. This outcome was an unexpected finding and is not attributable to length of time in the program, as evidenced by its presence in association with clients receiving their initial screening. The cause for this decline is not known. My speculation is that it reflects an accommodation by clinic staff to a declining availability of referral sources.

A second pattern is also present in table 1. When one reviews the rows from left to right, it is evident that referral rates did decline generally as the number of lifetime screenings increased. Table 2 highlights the direction and extent of this change.

Table 2 shows that in each of the 7 years the average rate of referral was lower for those receiving a second screening than for those receiving an initial screening. The decreases ranged from 4 percent in 1977 to 15 percent in 1974. The average annual decrease for the 7 years was slightly more than 9 percent (−64 percent over 7 years). A consistent reduction in referral rates was also present as lifetime screenings increased from 2 to 3. The average annual decrease was 5.6 percent for the 1976–80 period (−28 percent over 5 years).

When rates for screening 3 and screening 4 were compared, the changes were not consistent in direction, although the average annual decrease from 1977 through 1980 was 3.75 percent. A relatively small number of subjects—174 in 1977 and 262 in 1980—received a fourth screening, and this may have influenced the reliability of the data for those years. However, a large number of subjects (2,508) received their fourth screening in 1979, when no difference existed between the referral rates at screening 3 and screening 4. The trend in differences between screening 3 and screening 4 will perhaps become clear once more subjects have received a fourth screening.

Similarly, more data, obtainable only after more experience with the program is gained, is needed to determine the direction of referral rate change between screening 4 and screening 5. For 1978 and 1979, the results differed: an increase in referrals in 1978, a decrease in 1979. The number of subjects receiving a fifth screening was relatively small in both years: 118 in 1978 and 399 in 1979.

Table 3. Average number of referrals at last screening for 1979 Michigan EPSDT eligibles screened in 1978, by age and number of lifetime screenings

Age	Number of lifetime screenings			
	1	2	3	4
Under 1	...	...	...	...
1	.756	...	...	...
2	.722	.619	...	...
3	.771	.675	...	...
4	.800	.826	.810	...
5	.982	.854	.798	...
6	.991	.820	.822	.805
7	1.029	.915	.864	.858
8	.957	.876	.858	.661
9	.978	.867	.829	.740
10	.973	.878	.884	...
11	.996	.872	.790	...
12	1.020	.872	.824	...
13	1.071	.892	.785	...
14	1.019	.881	.956	...
15	1.098	.896	.930	...
16	1.202	.941	1.007	...
17	1.175	1.013	1.010	...
18	1.347	1.000	...	...
19	1.295	1.128	...	...
20	1.342	1.274	...	...
Grand mean	.933	.869	.858	.771
Percentage change as number of screenings increased by one	...	6.9	1.3	10.1

NOTE: Referral rates throughout this table relate to groups larger than 100 persons.

In summary, the existence of an inverse relationship between referral rates and number of lifetime screenings is clearly shown when one compares screenings 1 and 2 with screenings 2 and 3. The relationship is equivocal when screenings 3 and 4 and screenings 4 and 5 are compared. The cumulative average decrease in referral rates between screening 1 and screening 3 was 14.6 percent. That is, those receiving their third screening had 14.6 percent fewer referrals than those receiving their initial screening. The cumulative average decrease between screenings 1 and 4 was 18.4 percent. These outcomes are consistent with the expectation that participation in the program will improve health status, at least across the first 3 screenings, and possibly across the first 4 screenings. Whether additional screenings will further depress referral rates cannot be determined without more program experience.

In interpreting tables 1 and 2, it is legitimate to ask whether differences in the children's ages, rather than differing exposure to the EPSDT program, might explain the generally declining referral rate for each year of screening. That is, perhaps repeated screenings are a function of age, and age controls referral rates. To explore this possibility, screenings in 1978 were computed by both age and number of lifetime screenings. The results are presented in table 3.

Table 3 shows that the inverse relationship between referral rates and lifetime screenings is generally present when age is held constant. For 13 of the 19 ages represented by data, the inverse relationship holds perfectly. With one of the six abnormal patterns, the deviation from the general pattern is slight (age 6); with another (age 4), the deviation is strong. For four of the six abnormal patterns (ages 10, 14, 15, and 16), the problem occurs between screening 2 and screening 3. The number of children having received 3 lifetime screenings is in all cases in table 3 smaller than the number who received 1 or 2 screenings. The smaller number of subjects with 3 screenings may explain the upward drift of referral rates at this level. As noted previously, the data are not reliable in revealing the inverse pattern when the number of subjects is small. In summary, although the patterns of change are not entirely parallel across all ages in table 3, these data seem to disqualify age sufficiently as an explanation for the decline in referral rates.

Similarly, other data showed that the general inverse relationship between referral rates and lifetime screening was present when sex, race, and geographic location (urban or rural) were used as independent variables. The pattern was also present for the "hard core" population of recipients (a subgroup represented in table 1): those continuously eligible since the program began.

Cost Results

The results of the bivariate regression did not support the hypothesis that medical costs are inversely related to the degree of program participation; that is, costs were not shown to decrease as the number of lifetime screenings increased. The regression's overall F was 3.45, which did not exceed the critical value of 3.84 for the 0.95 level of confidence. The obtained r, the zero-order correlation between medical costs and number of screenings, was therefore not statistically significant. In any event, it was extremely small (-0.0140) although it was in the predicted inverse direction. The raw cost data, by number of screenings, are presented in table 4.

Table 4. Mean medical costs for 1979 Michigan EPSDT eligibles, by number of lifetime screenings

Number of screenings	Number of subjects	Mean cost	Standard deviation
0 screenings (nonparticipants)	6,073	$358.62	1011.35
1 screening	5,581	$319.20	1114.70
2 screenings	3,168	$283.23	761.83
3 screenings	1,200	$343.88	1780.13
4 screenings	248	$367.99	1785.13
5 screenings	27	$317.00	424.24
6 screenings	3	$341.14	273.53
7 screenings	3	$148.66	129.87
1–7 screenings (all participants)	10,230	$312.09	1143.19

As table 4 indicates, costs did decrease as predicted at screenings 0–2, but the downward direction was reversed at screenings 3 and 4. It may be significant that costs were most variable for those with 3 and 4 screenings. Medical costs can vary widely, so that a relatively small number of scores may distort mean values. Since costs at screenings 3 and 4 were based on fewer subjects than costs at screenings 0–2, it is possible that costs based on a larger number of subjects with 3 and 4 screenings might show a different pattern of change. Similarly, the number of subjects with 5, 6, or 7 screenings was too small to allow confidence in the obtained pattern of results.

Nevertheless, a comparison of the mean cost for all the EPSDT participants sampled (screened one or more times) with that for the nonparticipants (no screenings) showed that participants had lower Medicaid costs and that the difference was statistically significant. The participants' mean annual cost was $312.09. This was $46.53 (12.9 percent) less than the nonparticipants' mean cost of $358.62. Student's *t* test showed this mean difference to be statistically significant at the 0.007 level of confidence; thus, the chances are less than 7 per 1,000 that the mean cost difference was obtained by chance. Such a likelihood of sampling "error" is extremely small. The generally accepted threshold levels of statistical significance are 0.05 and 0.01.

The results of Student's *t* test provide reason for a high level of confidence that the lower mean cost for the EPSDT participants is representative of cost differences existing in the entire population of 244,551 youngsters eligible continuously for Medicaid during 1979. Since 154,186 of the 1979 eligibles were EPSDT participants, the total medical cost difference associated with EPSDT participation was $7.174 million ($46.53 × 154,186). Given the general interest in reducing medical costs, if one assumes that this cost difference is attributable to EPSDT participation, this outcome is highly favorable for the program.

Program Costs

In determining cost savings attributable to EPSDT participation (again, assuming a relationship of causality), one must, of course, consider the costs that are necessary to operate the program. A precise determination of these costs was not possible in this study, but a reasonable estimate was made.

During 1979, the year for which medical costs were obtained, the average cost for an EPSDT screening in Michigan was $65.56. This figure included all clinical costs for screening and related referral followup, outreach costs included in contracts with local health departments, and State administrative costs. Multiplying this figure by 43,192, the number of study group members screened in 1979 (table 1), yielded a program expense of $2.83 million.

Additional program costs were incurred in providing services to the group under study but were more difficult to determine. Department of Social Services outreach costs were estimated to involve the equivalent of 75 workers at $15,000 per worker, an expense totaling $1.13 million. Medical transportation costs, by program, also were not reported in program statistics. The Michigan Medicaid transportation budget includes funds for EPSDT transportation and for medically related transportation for participants in other programs. The 1979 expenditure for all medical transportation was $1.11 million, half of which was estimated to be EPSDT related. Another $100,000 to $200,000 of program costs are estimated to have been incurred in supervision of outreach workers not included in contracts with local health departments, and in transportation funded through other departmental sources. The total of these additional costs was $1.79 to $1.89 million; however, since these funds were expended on children representing the entire EPSDT-eligible population, not exclusively on the study group, an adjustment factor of one-third was used to relate these costs more specifically to the population of interest. (The study group population numbered about one-third of the total EPSDT population eligible during all or part of 1979.) Additional costs for outreach, transportation, and supervision for the group under study were thus estimated at approximately $600,000 (1/3 × $1.79 to $1.89 million).

Total program costs for the study group were estimated to be $3.43 million ($2.83 million +

$600,000). Subtracting these program costs from the $7.17 million medical cost difference associated with EPSDT participation leaves a medical cost difference of $3.74 million. Thus, the nearly 13 percent reduction in medical costs associated with EPSDT participation was decreased to approximately 7 percent when program costs were considered ($3.74 million ÷ $7.17 million × 0.129).

Total 1-year State cost savings associated with EPSDT participation would be larger than the determined $3.74 million if one assumed similar cost patterns for those studied and those not studied (that is, those participants not eligible during the entire year 1979). This assumption is suggested, but not addressed or proved, by this study. Also, lifetime savings were not estimated.

Discussion

The presence of an inverse relationship between number of screenings and medical costs would have been a stronger indicator of the program's effect than the obtained difference in EPSDT participant and nonparticipant costs. Given an inverse relationship, positive outcomes would have more clearly paralleled participation in the program. Evidence of the beginning of such a relationship was found, but the pattern was insufficiently established. Thus, long-term effects of the program on medical costs were not suggested by the design employed.

Another area of the study that warrants elaboration concerns the association of both referral rates and medical costs with EPSDT participation. This association implies an assumption of causality that links these outcomes to the program. This is a reasonable assumption, but it is also reasonable to question this linkage; perhaps the EPSDT program is not the causal factor. One approach for addressing this possibility is to posit alternative explanations for the obtained outcomes, evaluate them, and then judge the acceptability of the various explanations. I shall follow this approach, noting again that the usual demographic variables (age, sex, race, geographic location) as well as long-term welfare eligibility have already been discounted as explanations for the referral rate differences; the inverse relationship held with these variables controlled. What plausible alternatives, then, remain for explaining the outcomes? Four possibilities appear credible:

Hidden variables and referral rates. Different groups —different by some variable(s) other than those already discounted—might conceivably be represented by the differing number of lifetime screenings received. Referral rates and costs might then vary because of group affiliation rather than program exposure. Similarly, perhaps the mean medical costs of either the screened or the nonscreened group were influenced in 1979 because a different clientele became eligible at that time and either participated or did not participate as a group.

This argument is not supported upon examination. The argument relative to referral rates would appear to be that an extraneous variable causes some recipients to receive 1 screening, others to receive 2, still others to receive 3 screenings, and so on. This is farfetched. And what would the variable be? A reasonable speculation is that the composition of Michigan's welfare caseload changed in 1979 because of worker layoffs in the automobile and related industries; however, this is not the case. The big increase in welfare caseload came in 1980. Data on assistance payments compiled by the Michigan Department of Social Services show that Michigan's recipient population grew 0 percent in 1978, 3.75 percent in 1979, and 14.8 percent in 1980, and decreased by 4 percent in 1981. Also, it is likely that children of the newly unemployed would have fewer, not more, referrals than children of the established welfare population. However, in no year studied was the referral rate less for the first screening, where new eligibles would be represented, than for repeat screenings.

Anticipated client response and referral rates. Another explanation that would be consistent with the observed decrease in referral rates would involve an identification of referable conditions consistently based, at least partially, upon client response to previous referral determinations. If the screening team, in deciding whether a condition merited referral, was influenced by whether the client had kept previous referral appointments, perhaps for the same condition, the result would be a decrease in referrals at subsequent screenings for those clients who failed to act. For example, a client who failed to keep a referral appointment for a problem suspected at first screening might still have the same problem at rescreening. However, because of the client's previous inaction, the clinic might not again make a referral for this problem. A different clinic might react similarly but might refer the client twice before deciding not to make another referral. In both cases, the result, relative to reported referral rates, would be development of an inverse relationship between number of screenings and magnitude of referral rates.

This explanation would also be consistent with my earlier speculation about why referrals decreased over the years. If referral providers had become less accessible over time, screening teams might hesitate to refer clients unlikely to keep appointments. Such unsuccessful referrals would simply irritate providers and thus further restrict provider availability. This argument does not necessarily impugn the professionalism of the screening teams. Such a course of action could be simply a realistic response, intended to maintain the availability of limited medical resources, and especially to retain those resources for persons most in need.

The decrease in referral rates over time does suggest that EPSDT referrals are influenced by nonmedical factors. There is no direct evidence to suggest, however, that EPSDT referrals are influenced by anticipated client compliance with medical directives. Also, a strong argument against this explanation is that it is internally inconsistent. Why would a recipient who participates in repeated screenings to ascertain health status not go for needed followup care? Why would a reluctance to participate be evident only in one of two settings?

Similarly, if the problem were one of providers' not accepting welfare referrals, presumably the reluctance would extend to all referrals, not to initial or repeat referrals in any pattern. If providers were not accepting new patients, and clinics accordingly reduced referrals, this situation would deflate referral rates at initial screening, an occurrence not consistent with the obtained inverse relationship.

Differential service access and costs. Michigan EPSDT screenings are generally conducted by freestanding public health clinics that refer clients primarily to mainstream primary care providers. Therefore, an argument could be made that the non-EPSDT participants may refuse screenings because they are already receiving medical care. Conversely, others may participate in screening because they lack access to mainstream medicine and perceive that EPSDT will remedy this shortcoming. Accordingly, medical cost differences would result from differential access to care rather than from EPSDT participation. Higher costs might then represent better access, a desirable situation.

This possibility was not disproved by this study, but it is not at all clear what this notion would mean in actual practice. From a recipient's perspective, satisfactory access could as well mean use of a hospital emergency room as service by a family physician. In both situations, recipients would be likely to receive quality health care and to consider their health care needs adequately met. The implications, relative to a comparison with EPSDT program performance, are of course quite different for the two situations.

A test of the access hypothesis relative to physicians could be made by replicating this cost study in a State where EPSDT screenings are given by physicians to children already under care. In such circumstances, screenings would be a routine, mainstream service. If EPSDT participant costs remained lower in this situation, this result would not support the notion that inadequate access to physicians resulted in lower medical costs.

Hidden variables and costs. Since subjects were chosen for the cost study by a systematic random sample, controls for demographic factors were not built into the cost analysis. Thus, it is possible that some demographic variable(s) could explain, or influence, the obtained differences between mean costs for EPSDT participants and those for nonparticipants. This would also mean that EPSDT participation itself would be controlled or influenced by that variable.

Age does not appear to be such a hidden factor. EPSDT participants are younger than EPSDT eligibles; however, it seems more likely that younger children would have higher medical costs than older children, an expectation not consistent with the obtained lower medical costs of participants.

Race may exert strong influence. The obtained mean costs were computed by race. Medical care costs for black EPSDT participants were 20 percent lower than medical care costs for black nonparticipants. The statistical significance of this difference was 0.017. However, while medical costs for white EPSDT participants were 7.9 percent lower than those for white nonparticipants, the statistical significance of this difference was only 0.269. This breakdown shows that the difference between mean medical care costs for all participants and those for all nonparticipants is largely attributable to lower costs for black participants. The reason for this outcome is not evident. However, the standard deviation for white participants was extremely high, suggesting that these scores for whites were affected by extreme differences. Perhaps more or higher hospital bills were incurred by white participants.

Information on costs associated with other demographic factors was not obtained. Overall, alterna-

tive explanations for the obtained results are not persuasive; however, the racial difference in costs merits further investigation.

Conclusions

The purpose of this study was to provide a better answer to the question of whether the EPSDT program in Michigan is improving the health status of its participants, and at what cost. Generally, but not in all instances, the results showed EPSDT participation to be associated with desirable outcomes of health status and costs.

Analysis of referral rates indicated that the program is having beneficial effects. This was evidenced by the general presence of an inverse relationship between referral rates and the number of lifetime screenings received by 153,923 EPSDT participants. Those with more screenings tended to have fewer referrals for suspected problems, and this difference is what the program is intended to accomplish. On average, as the number of screenings increased from 1 to 2, 2 to 3, and 3 to 4, decreases in referrals were 9.14, 5.60, and 3.75 percent. The cumulative decrease in referrals was thus 18.35 percent from first to fourth screening. One may question whether this decrease is large enough to be considered meaningful, but its presence was established for a large population of participants.

An analysis of medical cost data from a sample of 16,303 persons eligible for EPSDT did not show an inverse relationship between cost and screenings. However, when the mean medical costs for nonparticipants and for all EPSDT participants in the sample were compared, the costs for participants were nearly 13 percent lower. This difference was significant at the 0.007 level of confidence, but it did not take program costs into consideration. When program costs were considered and a relationship between EPSDT program participation and medical costs was assumed, the difference favoring EPSDT participants was reduced to about 7 percent.

In summary, this study did find EPSDT participation to be associated with modest decreases in both medical costs and health problems as measured by the incidence of referable conditions. Whether these associations also indicate that a relationship of causality exists between program and outcomes has not been conclusively proved by this study or any of its predecessors. Indeed, a determination of such causality is not likely to be attainable in the foreseeable future. However, I believe that the preponderance of findings in this study and other studies of EPSDT outcomes favors continued support for the program as well as continued effort to replicate findings and explore further the program's effects.

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Ophthalmia Neonatorum Prophylaxis in Vermont

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SYNOPSIS

Vermont birth certificates and hospital medical charts for 1979 were reviewed to determine whether