Episodes of Illness and Access to Care in the Inner City: A Comparison of HMO and non-HMO Populations

by David S. Salkever, Pearl S. German, Sam Shapiro, Ralph Horky, and Elizabeth A. Skinner

Using data from a 1974 household survey, accessibility to ambulatory care is compared for residents of an inner-city area (East Baltimore) whose usual source of care is an HMO (the East Baltimore Medical Plan) and residents of the same area with other usual sources of care. Accessibility is measured by the probability of receiving care for an episode of illness. Results from multivariate linear and probit regressions indicate that children using the HMO are more likely to receive care than are children with other usual care sources, but no significant differences in the probability of receiving care are found among adults. Evidence of a substitution of telephone care for in-person care is also found among persons using the HMO. Data from a 1971 household survey of the same area suggest that selectivity is not an important confounding factor in the analysis.

The inaccessibility of ambulatory care is widely regarded as a major deficiency of our current arrangements for providing health services. Although the problem is a general one, it is thought to be particularly serious for persons in sparsely settled rural areas and for low-income residents of the inner city. A number of governmental programs (e.g., neighborhood health centers, National Health Service Corps) and emerging private initiatives (of the Robert Wood Johnson Foundation in particular) have been directed at improving access for these population groups by increasing and/or reorganizing the supply of ambulatory care services. The need for developing alternative organizational arrangements that facilitate access is especially critical in inner city areas, where sources of ambulatory care are physically present but where there are often substantial barriers to access in the form of time costs, fragmentation and lack of continuity of services, and provider indifference to consumer desires.

Research supported in part by grant no. HS00429 from the National Center for Health Services Research, DHEW.

Address communications and requests for reprints to David S. Salkever, Ph.D., Division of Health Care Organization, School of Hygiene and Public Health, Johns Hopkins University, 615 North Wolfe Street, Baltimore, MD 21205.

In this study, access to ambulatory care was compared under differing organizational arrangements for the residents of East Baltimore, a low-income, predominantly black community in the city of Baltimore. East Baltimore residents obtain much of their ambulatory care from hospital clinics and emergency rooms since the local supply of private primary care physicians is quite limited. The area's largest ambulatory care provider is Johns Hopkins Hospital (JHH). Beginning in 1971, ambulatory care has also been provided by the East Baltimore Medical Plan (EBMP), a health maintenance organization offering a comprehensive range of services to a population of enrollees and nonenrolled registrants drawn largely from the East Baltimore community. (The majority of enrollees are Medicaid recipients covered under an agreement between the EBMP and the Maryland Medicaid program. Registrants are individuals who are registered with the EBMP as eligible to receive services financed in full or in part by federal funds authorized under Section 314(e) of the Public Health Service Act.)

With its emphasis on continuity of provider-patient relationships and the use of health care teams, the coming of the EBMP marked a significant change in the provision of care in the community. The work reported on in this article was one component of a large, multifaceted study of the impact of the EBMP on the health care behavior and experiences of the East Baltimore population. (See refs. 1 and 2 for other findings from the study.)

In this component of the study we compare the probability of obtaining care in response to the occurrence of an illness episode for persons using the EBMP and persons using other sources. If the former are found to have a higher (lower) probability of obtaining care, after controlling for other relevant factors such as the characteristics of the individuals and their illness episodes, we interpret this as evidence that the EBMP provides care that is more (less) accessible than care provided by other sources. Thus our measure of accessibility is based on the impact of the source of care on observed consumer behavior, in particular, obtaining care for illness episodes. This behavioral approach to measuring accessibility, which has been used in several recent studies [3–5], differs from the usual methods of describing accessibility in terms of structural access barriers (financial, temporal, psychological, etc.) or individuals' judgments of overall accessibility. In contrast to the usual methods, our approach avoids the ambiguity of offsetting accessibility differences (which may arise when interprovider comparisons are based on more than one type of access barrier), the use of a scalar accessibility index based on arbitrary weighting schemes to combine measures of different types of access barriers, and the imprecision of individual judgments. (Individual judgments are imprecise in the sense that individuals facing identical access barriers might report different levels of perceived accessibility.) Our approach also has the advantage of relating directly (rather than inferentially) to the question of whether timely care is obtained, which is the central concern that underlies the current interest in accessibility.

Study Plan

Household Survey Data

Data were collected by means of household surveys of three different random samples of households in the 12 census tracts surrounding Johns Hopkins Hospital that constituted the target area for the EBMP. These three samples, each containing approximately 600 households, were defined as follows:

- *EBMP Sample.* Households of enrollees and registrants at EBMP drawn from the plan's membership list.
- *Housing Project Sample.* Households in four public housing projects (where the large majority of EBMP households are) that contained no EBMP enrollees or registrants.
- *Community Sample.* Households that were not located in the four public housing projects and that contained no EBMP enrollees or registrants.

A total of 1,455 interviews were completed during the period from March 1 to June 30, 1974. The completion rate ranged from 88 percent for the community sample to 91 percent for the housing project sample and was 89 percent overall.

In order to use these survey data to make interprovider comparisons of accessibility, we identified the population groups served by the various providers on the basis of individuals' usual sources of care as reported in the household interviews. We used reported usual source, rather than the fact of enrollment or registration, to identify the population served by the EBMP because of the possibility that some enrolled or registered individuals actually obtained their care from other sources. Three usual-source categories were used: EBMP, JHH clinics, and other sources (other clinics, private practitioners, or no single usual source). The data indicate that 88.4 percent of the enrollees who reported episodes of illness (and thus were included in this study) cited the EBMP as their regular source of ambulatory care. The corresponding figure for registrants was 50.6 percent. (Similar results for all enrollees and registrants included in the household survey are cited in Table 1, p. 256.)

Episodes of illness were defined as periods of functional disability (bed days or interruptions of usual activities) of at least two consecutive days claimed by study subjects (or their parents) to be caused by health problems. Analysis was confined to the most recent episode reported by or for an individual during the three months prior to the day of the interview; accordingly, no more than one episode was included for an individual. In order to focus on the process of entering the health care system in response to illness, as opposed to receiving ongoing care for a chronic or continuing problem, we also excluded health problems perceived more than 12 months prior to the interview date.

Data Analysis

Household survey data were used to compare the usual-source groups within each of the sample populations in terms of social, economic, and demo-

graphic characteristics of persons reporting episodes of illness, the characteristics of their reported illness episodes, and the percentages of persons receiving telephone and in-person care. These were then used in comparing accessibility of care for the sample populations. In order to explore the possibility that personal characteristics impinging on individuals' decisions to enroll or register at the EBMP were also related to the likelihood of obtaining care for an illness episode, we then examined evidence from a survey carried out among residents of the four public housing projects prior to the establishment of the EBMP [6]. Multiple regression analysis was used to formally test for differences in accessibility by usual source of care. The dichotomous dependent variable in this analysis indicates whether or not a person received care for his illness; the independent variables of principal interest are dichotomous variables indicating the person's usual source of care.

Descriptive Data Obtained from the Surveys

Tables 1–5 present descriptive data for each of the three samples (EBMP, housing project, and community) and for their component usual-source groupings. Several facts about the composition of these usual-source groups should be noted. First, although some enrollees and registrants did not cite the EBMP as their usual source of care, it is still true that 90.6 percent of those for whom the EBMP was listed as usual source of care were enrollees or registrants. Second, in the other-usual-source groups in the community and housing project samples there were a few persons (3.1 percent and 7.4 percent, respectively) for whom the EBMP was listed as usual source of care. Third, of all persons in the other-usual-source category, 28.1 percent had a private physician as usual source of care and only 7.0 percent had no usual source of care. (These percentages relate to persons for whom episodes of illness were reported rather than to all persons for whom survey data were gathered.)

As Table 1 indicates, the age and sex distributions of children age 17 and under in the three sample populations were quite similar but differences in socioeconomic characteristics were more pronounced. Income per capita for the household and, to a lesser degree, level of education of the household head were higher for children in the community sample. Higher income and education levels were also observed for adults in the community sample. This is not surprising, however, since the other two samples consisted mainly of housing project residents who were eligible for public housing by virtue of their low income status. Among adults, the percentage of males and the percentage age 55 and over were also greater in the community sample.

Episodes of illness were reported for 330 children and 347 adults (see Table 2, p. 257); these 647 persons constitute the study population for the present analysis. Although 35 or more persons reported episodes in most of the usual-source groups, two groups of children (other usual source in the community and EBMP samples) and one group of adults (other usual source in the EBMP sample) were considerably smaller and consequently were not included

Table 1. Demographic and Socioeconomic Characteristics of the Sample Populations and Their Usual Sources of Medical Care

Sample and usual source of care	Children (under 18)					Adults (18 and over)				
	N	Age 5 and under (%)	Male (%)	Household per capita income ≥$1000* (%)	Household head education ≥12 yr* (%)	N	Age 65 and over (%)	Male (%)	Household per capita income ≥$1000* (%)	Education ≥12 yr* (%)
Community										
Total	606	24.9	48.3	47.2(464)	28.1(552)	893	31.5	43.3	76.3(619)	27.1(855)
JHH	471	21.7	49.0	42.4(361)	23.6(436)	485	25.4	40.8	69.9(336)	27.0(466)
Other	135	36.3	45.9	64.1(103)	44.8(116)	408	38.9	46.3	83.7(283)	27.2(389)
Housing project										
Total	913	25.6	50.8	19.6(835)	22.9(901)	721	24.7	24.1	53.1(633)	22.4(714)
JHH	551	26.7	49.9	19.9(507)	20.7(545)	364	22.5	23.6	48.5(326)	21.2(363)
Other	362	24.0	52.2	19.2(328)	26.1(356)	357	26.8	24.6	58.0(307)	23.6(351)
EBMP										
Total	938	24.2	50.1	23.9(756)	18.5(893)	840	20.6	31.5	54.1(621)	24.8(825)
EBMP†	400	23.0	48.8	25.4(343)	19.0(378)	349	22.6	28.9	54.4(263)	21.7(346)
JHH§	399	25.1	50.1	26.9(301)	17.6(381)	323	18.0	33.4	55.9(238)	25.6(316)
Other	139	25.2	54.0	11.6(112)	19.4(134)	168	21.4	33.3	50.0(120)	30.1(163)

* Numbers in parentheses are denominators. Persons with missing data are excluded.

† Includes 79 percent of enrollees, 50 percent of registrants, and 9 percent of nonmembers in households of members.

§ Includes 14 percent of enrollees, 37 percent of registrants, and 62 percent of nonmembers in households of members.

Table 2. Numbers and Percentages of Persons for whom Episodes of Illness were Reported, by Sample and Usual Source of Care

Sample and usual source of care	Children (under 18)		Adults (18 and over)	
	Number	Percent*	Number	Percent*
Community				
Total	48	7.9	112	12.5
JHH	39	8.3	56	11.5
Other	9	6.7	56	13.7
Housing project				
Total	121	13.3	112	15.5
JHH	86	15.6	53	14.6
Other	35	9.7	59	16.5
EBMP				
Total	161	17.2	123	14.6
EBMP	79	19.8	59	16.9
JHH	66	16.5	40	12.4
Other	16	11.5	24	14.3

* Denominators are the Ns shown in Table 1.

in Table 2. (Data for these groups are included in the totals in Tables 3–5 but are not shown separately.)

For children the differences in percentages reporting episodes were moderately large, with the lowest percentage reported for the community sample

Table 3. Demographic and Socioeconomic Characteristics of Children for whom Episodes of Illness were Reported, by Sample and Usual Source of Care

Sample and usual source of care	No. of episodes	Age 5 and under (%)	Male (%)	Household head education ≥12 yr* (%)	Medicaid* (%)	Per capita household income ≥$1000* (%)
Community						
Total	48	37.5	47.9	33.3(45)	68.8(48)	52.9(34)
JHH	39	35.9	51.3	35.1(37)	64.1(39)	46.7(30)
Housing project						
Total	121	24.8	47.9	21.2(118)	82.6(121)	23.9(109)
JHH	86	25.6	50.0	20.5(83)	77.9(86)	27.6(76)
Other	35	22.9	42.9	22.9(35)	94.3(35)	15.2(33)
EBMP						
Total	161	24.2	48.4	23.1(147)	74.5(161)	18.4(136)
EBMP	79	22.8	48.1	24.3(74)	72.2(79)	20.6(68)
JHH	66	21.2	45.5	15.8(57)	72.7(66)	18.5(54)

* Numbers in parentheses are denominators. Persons with missing data are excluded.

Table 4. Demographic and Socioeconomic Characteristics of Adults for whom Episodes of Illness were Reported, by Sample and Usual Source of Care

Sample and usual source of care	No. of episodes	Age 55 and over (%)	Male (%)	Education ⩾12 yr*	Medicaid* (%)	Per capita household income ⩾$1000* (%)
Community						
Total	112	25.0	38.4	28.7(108)	41.7(108)	73.8(80)
JHH	56	17.9	33.9	29.6(54)	49.1(55)	59.0(39)
Other	56	32.1	42.9	27.8(54)	34.0(53)	87.8(36)
Housing project						
Total	112	20.5	11.6	24.1(112)	75.9(112)	53.1(98)
JHH	53	20.8	11.3	20.8(53)	77.4(53)	55.3(47)
Other	59	20.3	11.9	27.1(59)	74.6(59)	51.0(51)
EBMP						
Total	123	20.3	22.8	21.9(123)	67.2(122)	48.9(92)
EBMP	59	13.6	16.9	22.0(59)	69.0(58)	38.5(39)
JHH	40	27.5	27.5	17.5(40)	70.0(40)	58.8(34)

* Numbers in parentheses are denominators. Persons with missing data are excluded.

and the highest percentage (17.2 percent) reported for the EBMP sample. For adults the corresponding differences were smaller; a somewhat higher percentage was reported for adults in the housing project sample. Within-sample differences by source of care were small but consistent. In all three samples, episodes of illness were more likely to be reported for children using the JHH clinics than for children in the other-usual-source category, while the reverse was true for adults. For both children and adults, higher percentages of episodes of illness were reported for EBMP users than for those who obtained their medical care from other sources. These differences may reflect a differential incidence of illness, but they may also be due to a lower threshold for recognizing illness among EBMP users (and among children in households of EBMP enrollees or registrants).

The socioeconomic characteristics of persons for whom episodes of illness were reported (Tables 3 and 4) were similar to those of persons in the corresponding sample populations (Table 1), but among adults lower percentages of males reported episodes of illness in all three samples (Table 4), indicating a male-female differential in episode rates. The percentage of children under 5 with episodes of illness (Table 3) was higher in the community sample than in the other two sample populations.

The characteristics of reported episodes of illness are shown in Table 5. These data clearly show that among children most of the reported episodes were caused by common acute illnesses. Only about 8 percent of the episodes reported for children were caused by multiple health problems, only about

Table 5. Selected Characteristics of Episodes, by Sample and Usual Source of Care*

Sample and usual source of care	Cold, flu, or sore throat as first reported problem for the episode (%)	Multiple-problem episodes (%)	Related problems prior to episode (%)	Previous health professional contact for related problems (%)	Perceived severity			
					N	Very serious (%)	Fairly serious (%)	Not serious (%)
CHILDREN (UNDER 18)								
Community								
Total	62.5	8.3	10.4	8.3	48	14.6	35.4	50.0
JHH	69.3	7.7	10.3	7.7	39	10.3	41.0	48.7
Housing project								
Total	81.8	5.0	9.1	6.6	120	9.2	35.0	55.8
JHH	83.7	5.8	5.8	3.5	85	8.2	36.5	55.3
Other	77.2	2.9	17.1	14.3	35	11.4	31.4	57.1
EBMP								
Total	76.4	8.1	11.3†	7.5†	161	13.7	29.2	57.1
EBMP	77.2	10.1	10.3§	9.0§	79	10.1	30.4	59.5
JHH	74.3	6.1	10.6	6.1	66	10.6	25.8	63.6
ADULTS (18 AND OVER)								
Community								
Total	41.1	5.4	28.6	16.1	109	22.9	32.1	45.0
JHH	44.7	7.1	25.0	14.3	55	23.6	32.7	43.6
Other	37.6	3.6	32.1	17.9	54	22.2	31.5	46.3
Housing project								
Total	42.0	12.5	32.1	18.8	111	18.0	42.3	39.7
JHH	37.7	9.4	26.4	17.0	53	15.1	39.6	45.3
Other	45.8	15.3	37.3	20.3	58	20.7	44.8	34.5
EBMP								
Total	52.8	13.8	32.5	17.9	121	13.2	42.1	44.7
EBMP	57.7	13.6	30.5	18.6	57	14.0	45.6	40.4
JHH	47.5	12.5	37.5	17.5	40	12.5	40.0	47.5

* Except as noted, denominators are the numbers of episodes shown in Tables 3 and 4.
† The denominator is 160.
§ The denominator is 78.

Table 6. Telephone and In-person Contacts with Health Professionals in Relation to Reported Episodes of Illness

Sample and usual source of care	N	Telephone contact (%)	Phone advice (%)	Phone advice only; did not see health professional (%)	Saw health professional (%)	Saw health professional or received phone advice (%)
			CHILDREN (UNDER 18)			
Community						
Total	48	2.1	0.0	0.0	64.6	64.6
JHH	39	2.6	0.0	0.0	64.1	64.1
Housing project						
Total	121	9.1	6.6	0.0	47.9	47.9
JHH	86	5.8	3.5	0.0	43.0	43.0
Other	35	17.1	14.3	0.0	60.0	60.0
EBMP						
Total	160	11.3	6.3	3.8	64.4	68.1
EBMP ...	78	19.2	10.3	7.7	65.4	73.1
JHH	66	4.5	3.0	0.0	60.6	60.6
			ADULTS (18 AND OVER)			
Community						
Total	111	5.4	2.7	0.0	54.0	54.0
JHH	56	3.6	3.6	0.0	57.1	57.1
Other	55	7.3	1.8	0.0	50.9	50.9
Housing project						
Total	112	5.4	2.7	0.9	50.9	51.8
JHH	53	3.8	0.0	0.0	47.2*	47.2*
Other	59	6.8	5.1	1.7	54.2	55.9
EBMP						
Total	123	11.4	6.5	4.9	46.3	51.2
EBMP ...	59	15.3	10.2	8.5	47.5	55.9
JHH	40	5.0	2.5	0.0	47.5	47.5

* Includes one person with an appointment for a future visit.

10 percent were associated with prior occurrence of related problems, and about 8 percent were associated with a previous in-person contact with a health professional for related problems. Episodes of illness reported for adults generally showed a slightly higher frequency of multiple problems and of prior related problems, as well as higher levels of perceived severity. Nevertheless, the large majority of adult episodes were caused by problems that were unrelated to previous illness and that were not perceived to be serious, a substantial portion of these being minor acute illnesses.

Table 6 presents information on two aspects of care received in relation to reported episodes of illness: telephone contacts and advice and in-person contacts. As the table shows, there was a striking difference in telephone

use between EBMP users and other usual-source groups. For both children and adults, EBMP users showed the highest percentages with telephone contacts and telephone advice. Furthermore, these groups contained virtually all of the persons who received advice but did not have an in-person contact. This suggests that, unlike other providers in the community, the EBMP uses telephone advice in certain circumstances as a less costly and less time-consuming substitute for in-person visits. The low rate of telephone contacts and advice among persons in the JHH and other-usual-source categories reflects the lack of organizational arrangements in the local ambulatory care clinics to facilitate telephone contacts between patients and health professionals.

In general the percentage of reported episodes of illness resulting in in-person contacts with health professionals did not vary widely by sample or usual source of care. The one exception was the low percentage reported for children in the housing project sample who used JHH clinics. The highest percentage of in-person contacts was reported for children using the EBMP (although the percentage for JHH users in the community sample was almost identical). However, the percentage of in-person contacts for adults using the EBMP was lower than that for three of the other usual-source groups. Similarly, children using the EBMP reported the highest percentage of persons with either telephone advice or in-person contact (last column in Table 6), whereas adults using the EBMP reported a slightly lower percentage than JHH users in the community sample.

Data (not shown here) were also collected on the number of days between onset of illness episode and first telephone or in-person contact with a health professional. In all usual-source groups, every telephone or in-person contact took place within six days of onset. There was a slight tendency among children for delay time to be shorter in the EBMP usual-source group, but this tendency was not observed among adults.

Possible Influence of Selection Factors

Because persons in any usual-source group are self-selected, empirical data (such as those in Table 6) that relate the probability of receiving care for an illness episode to usual source may be interpreted in several ways. The observed relationship may be the result of structural characteristics of the usual sources and their approaches to delivering ambulatory care, selection factors (i.e., the special characteristics of persons that each source attracts as clients), or both. Data from a previous household survey of East Baltimore residents offer some reassurance that selection factors do not strongly influence observed differences in the probability of receiving care between EBMP users and persons using other sources.

The previous survey [6] was carried out in the winter of 1970–71 among residents of the four public housing projects to gather data on their health problems, recent use of services, and attitudes toward medical care. Respondents were asked specifically about their illnesses during the two-week period prior to the interview and about their use of services during this period. As

a follow-up to this study, respondents were identified who subsequently enrolled or registered at the EBMP at any time from its opening in June 1971 until August 1973. Thus, for respondents who reported illnesses involving one or more days of restricted activity in the two weeks prior to the interview, it is possible to compare those who subsequently enrolled or registered with those who did not in terms of the percentages receiving care during those same two weeks.

The data used in this comparison differ from those in Table 6 in several respects. First, the definition of an illness episode is less restrictive and may include some restricted activity due to problems that began long before the survey date. Second, reported care received may not actually have been for treatment of the reported illnesses. And, third, persons are only identified in terms of subsequent enrollee or registrant status rather than usual source of care. Nevertheless, if selectivity is an important confounding factor in the present analysis, it should be possible to observe differences in behavior, prior to the opening of the EBMP, between enrollees and registrants and persons not affiliated with the EBMP.

This comparison reveals that, among children, 33.3 percent (7 of 21) of those who subsequently enrolled or registered received care while 44.4 percent (8 of 18) of those who did not enroll or register obtained care. Among adults, the corresponding percentages were 28.9 percent (11 of 38) for those who subsequently enrolled or registered and 43.6 percent (17 of 39) for those who did not. In both cases the difference in percentages is small and statistically insignificant. If anything, these comparisons suggest that persons who subsequently enrolled or registered were less likely to obtain care. Similar differences were observed when the groups were divided into age classes (under and over 5 for children, under and over 55 for adults). In the present context, the most reasonable conclusion to be drawn from these (admittedly inadequate) data is that selection factors probably had little impact on differences between EBMP users and users of other sources in the probability of obtaining care.

Multiple Regression Analysis

The descriptive data in Tables 3, 4, and 5 reveal variations among usual-source groups in individual and episode characteristics that should be controlled for in testing the hypothesis that persons using the EBMP have greater access to care (as evidenced by a higher probability of receiving care for illness episodes). To accomplish this and thereby obtain a more precise estimate of the relationship between accessibility and source of care, we made use of multiple regression techniques.

Specifically, we estimated separate regression equations for children and for adults in which the dichotomous dependent variable indicated whether or not care was received. The independent variables (also dichotomous) related to demographic and socioeconomic characteristics, perceived severity

Table 7. Independent Variables Used in Regression Analysis

Type and name of variable	Definition
Usual source	
EBMP	= 1 if person's usual source is EBMP
OTHER	= 1 if person's usual source is neither EBMP nor JHH*
Demographic	
AGE6+	= 1 if person ⩾6 (children only)
AGE35+	= 1 if person ⩾35 and <65 (adults only)
AGE65+	= 1 if person ⩾65
MALE	= 1 if person is male
Socioeconomic	
ED12+	= 1 if person has completed 12 or more years of education (adults only)
HED12+	= 1 if household head has completed 12 or more years of education (children only)
PCINCH	= 1 if household per capita income ⩾$1000
PCINCU	= 1 if household per capita income not reported
HSIZE5+	= 1 if there are 5 or more persons in household
Specific access barriers	
VL2+	= 1 if duration of visits to usual source is 2 hr or more
VLU	= 1 if duration of visits to usual source is not reported
TT40+	= 1 if travel time to usual source is 40 min or more
DIFF	= 1 if it is difficult for person to make arrangements at home while he goes to obtain medical care (adults only)
MCAID	= 1 if person is covered by Medicaid
INS	= 1 if person has insurance coverage for outpatient care (including Medicare Part B but excluding Medicaid)
Episode characteristics	
PSER1	= 1 if problem causing episode was perceived as very serious
PSER2	= 1 if problem causing episode was perceived as fairly serious
PREVP	= 1 if person reported related problem prior to the onset of the episode but had not seen a health professional for treatment
PREVC	= 1 if person reported a prior in-person contact with a health professional for treatment of a related problem
Other	
HOUSE	= 1 if person is resident of housing project
CON	= 1 if person has one or more reported chronic conditions
EBN	= 1 if person is in EBMP sample but does not use EBMP as usual source of care

* Persons with no usual source of care are excluded from the regressions.

and other characteristics of the illness episode, several types of access barriers, and usual source of care. These independent variables are defined in Table 7. The unit of observation was the individual; as before, only one episode per person was included in the analysis.

Two different regression procedures were applied. First, following work on dummy-variable multiple regression by Feldstein [7] and Shah and Abbey

[8], we used least-squares regression to estimate the coefficients of a linear additive model. Second, we used the nonlinear probit regression model described in Goldberger [9], in which the probability that the dependent variable (Y) equals 1 for any individual is equal to the value for the cumulative normal (0,1) density function at a point determined by the independent variables (the X_is) and their corresponding coefficients (the b_is). More specifically,

$$\text{Prob}(Y=1) = (2\pi)^{-\frac{1}{2}} \int_{-\infty}^{\Sigma b_i X_i} e^{-u^2/2}\, du$$

and, of course, $\text{Prob}(Y=0) = 1 - \text{Prob}(Y=1)$. The estimates of the coefficients reported here are maximum likelihood estimates; i.e., they are those values for the b_is that maximize the likelihood of observing the sample values for the dependent variable, given the sample values for the independent variables.

Each of these procedures has advantages and disadvantages. The linear additive regression yields results that are more easily interpreted. But this model allows predicted dependent variable values outside the unit (0–1) interval (which cannot be treated as conditional probabilities) and precludes exactly valid significance tests for the coefficient estimates (because error terms cannot be normally distributed and homoscedastic with a dichotomous dependent variable) [9,10]. These statistical problems do not arise in the probit regression model. These procedures are also based on differing assumptions about the functional form of the relationship between dependent and independent variables. Hence the use of both procedures provides at least a limited test of the sensitivity of our findings to the choice of functional form.

The coefficient of an independent variable reflects the difference in the probability of obtaining care between persons in the category defined by that variable and persons in the omitted category. For example, the coefficient of *MALE* in the linear additive model may be interpreted as the difference between males and females (the omitted category) in the probability of obtaining care (controlling for differences in all other independent variables). When several variables are mutually exclusive, the relevant omitted category excludes persons for whom any of these variables equals 1. For example, since *EBMP* and *OTHER* are mutually exclusive usual-source variables, the coefficient of *EBMP* in the linear additive model is the difference between *EBMP* users and *JHH* users (the omitted category) in the probability of obtaining care (controlling for other variables).

In the probit model, the relationship between the coefficient of any independent variable and the difference in the probability of obtaining care is more complex. This difference also depends on the values for the other coefficients and independent variables. For example, if the coefficient of *MALE* is 0.5, the corresponding difference in probabilities is

$$(2\pi)^{-\frac{1}{2}} \int_{\Sigma b_i X_i}^{\Sigma b_i X_i + 0.5} e^{-u^2/2}\, du$$

where the b_is are the coefficients for all other variables (besides *MALE*) and the X_is are the values for these variables for any individual.

Our principal measures of the accessibility-source relationship are the estimated coefficients for the usual-source variables (*EBMP* and *OTHER*). But another component of this relationship is reflected in the coefficient of the visit-length variable (*VL2+*) because of substantial differences among sources of care in the time costs of the services that they provide. The fact that persons using the EBMP faced lower time costs is clearly shown in Table 8.

Table 8. Percentage of Persons Reporting Usual Duration of Visit to Regular Source as 2 Hours or More

Sample and usual source of care	Children		Adults	
	Percent	Number	Percent	Number
Community				
Total	40.0	40	56.6	99
JHH	36.2	36	70.4	54
Other	*	*	40.0	45
Housing project				
Total	60.8	115	63.0	108
JHH	67.5	80	76.9	52
Other	45.7	35	48.2	56
EBMP				
Total	34.7	147	45.7	116
EBMP	28.4	74	33.4	57
JHH	38.3	60	67.6	37

* Data not reported because of insufficient group size.

Among both children and adults, the percentage reporting usual visit lengths of two hours or more was about twice as high for persons using the JHH clinics as for EBMP users; the percentages for persons using other sources also exceeded the EBMP figures. (Other "access barrier" variables are not clearly related to source in our data set although they might be in data drawn from other settings. In particular, financial barriers to access will usually differ between HMO and non-HMO populations. That was not the case here because such a large percentage of our study population was covered by Medicaid and other public health programs.)

Also, it is conceivable that the EBMP may affect the health behavior of persons who usually use other sources but have had some limited contact with the plan. This might be true for enrollees or registrants who have only used the EBMP occasionally or for persons in the same household as EBMP users. In order to test this possibility, we included an independent variable (*EBN*) that identified persons who did not use the EBMP as a regular source but who were members of households containing enrollees or registrants.

The regression coefficients for the linear additive and probit models are

Table 9. Regression Results with Dependent Variable = 1 if In-person Treatment was Received

Independent variable	Linear additive model				Probit model			
	Children		Adults		Children		Adults	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
EBMP	0.132	0.077	–0.102	0.077	0.383	0.234	–0.334	0.240
OTHER	0.123	0.080	–0.033	0.063	0.337	0.247	–0.132	0.195
AGE6+	–0.014	0.063			–0.022	0.190		
AGE35+			–0.010	0.061			–0.017	0.189
AGE65+			0.001	0.124			0.059	0.392
MALE	0.058	0.053	0.086	0.068	0.155	0.158	0.252	0.208
ED12+			0.049	0.064			0.148	0.205
HED12+	–0.176§	0.066			–0.493†	0.200		
PCINCH	0.001	0.077	0.028	0.070	–0.077	0.233	0.071	0.216
PCINCU	0.015§	0.092	–0.030	0.074	0.059	0.280	–0.100	0.226
HSIZE5+	–0.167	0.061	–0.022	0.060	–0.516§	0.186	–0.071	0.187
VL2+	–0.016	0.057	–0.084	0.057	–0.060	0.173	–0.275	0.177
VLU	0.019	0.114	0.007	0.168	0.052	0.334	0.017	0.516
TT40+	–0.159	0.185	–0.178	0.122	–0.352	0.526	–0.604	0.406
DIFF			–0.052	0.082			–0.143	0.257
MCAID	0.131*	0.078	0.039	0.062	0.391	0.237	0.097	0.197
INS	0.218†	0.106	–0.002	0.088	0.662†	0.326	0.006	0.267
PSER1	0.378§	0.087	0.420§	0.073	1.311§	0.320	1.257§	0.234
PSER2	0.188§	0.064	0.274§	0.061	0.544§	0.190	0.772§	0.184
PREVP	–0.047	0.191	–0.110	0.087	–0.144	0.297	–0.331	0.267
PREVC	–0.018	0.100	0.316§	0.067	–0.083	0.565	1.038§	0.224
HOUSE	–0.109*	0.063	0.008	0.053	–0.328*	0.186	0.030	0.164
CON	–0.148†	0.065	0.009	0.057	–0.447†	0.197	0.040	0.178
EBN	0.064	0.071	–0.091	0.071	0.186	0.215	–0.282	0.217
Constant	0.512		0.329		0.055		–0.456	
R^2(cols. 1 & 3) or X^2(cols. 5 & 7)	0.21		0.25		71.4		87.9	
N	310		307		310		307	

* Significance level is 90 percent.
† Significance level is 95 percent.
§ Significance level is 99 percent.

shown in Tables 9 and 10. Both procedures yield virtually identical results concerning the signs and significance levels of the coefficients. Table 9 shows the results obtained when the dependent variable takes on a value of 1 only if in-person treatment was received. Telephone advice is equated with no treatment in these regressions. Table 10 shows the results obtained when the dependent variable equals 1 for either telephone advice or in-person treatment. Comparison of these tables reveals that similar findings emerge regardless of which dependent variable is used.

In particular, the coefficient of the EBMP usual-source variable is positive and significant for children but negative and insignificant for adults. (An exception is the probit regression for children in Table 9, in which the two-tailed significance level for the EBMP coefficient is only 89.74 percent rather

Table 10. Regression Results with Dependent Variable = 1 if Either In-person Treatment or Telephone Advice was Received

Independent variable	Linear additive model				Probit model			
	Children		Adults		Children		Adults	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
EBMP	0.191†	0.077	–0.019	0.078	0.600†	0.240	–0.078	0.239
OTHER	0.107	0.079	–0.020	0.064	0.287	0.249	–0.088	0.194
AGE6+	–0.030	0.062			–0.099	0.194		
AGE35+			0.010	0.061			0.038	0.189
AGE65+			0.041	0.125			0.176	0.393
MALE	0.059	0.052	0.077	0.068	0.155	0.161	0.232	0.209
ED12+			0.053	0.064			0.164	0.203
HED12+	–0.096	0.065			–0.264	0.202		
PCINCH	–0.018	0.076	0.038	0.070	–0.169	0.237	0.104	0.215
PCINCU	–0.014	0.091	–0.030	0.074	–0.010	0.282	–0.102	0.225
HSIZE5+	–0.158§	0.059	–0.024	0.061	–0.521§	0.190	–0.077	0.185
VL2+	–0.026	0.056	–0.098*	0.058	–0.067	0.175	–0.320*	0.177
VLU	–0.008	0.112	–0.001	0.168	–0.042	0.332	–0.008	0.506
TT40	–0.146	0.183	–0.192	0.122	–0.297	0.534	–0.652	0.403
DIFF			–0.002	0.083			0.023	0.253
MCAID	0.165†	0.077	0.064	0.063	0.514†	0.241	0.184	0.197
INS	0.214†	0.105	0.013	0.089	0.673†	0.328	0.050	0.266
PSER1	0.369§	0.086	0.399§	0.074	1.466§	0.358	1.194§	0.233
PSER2	0.151†	0.063	0.273§	0.061	0.431†	0.190	0.763§	0.183
PREVP	–0.056	0.189	–0.132	0.087	–0.093	0.563	–0.396	0.266
PREVC	0.019	0.099	0.286§	0.067	0.031	0.315	0.944§	0.223
HOUSE	–0.119*	0.062	0.010	0.054	–0.376†	0.189	0.031	0.164
CON	–0.146†	0.064	0.025	0.058	–0.473†	0.199	0.088	0.178
EBN	0.058	0.070	–0.072	0.072	0.167	0.218	–0.224	0.215
Constant	0.510		0.297		0.076		–0.565	
R^2(cols. 1 & 3) or X^2(cols. 5 & 7)	0.22		0.24		76.6		83.8	
N	310		307		310		307	

* Significance level is 90 percent.
† Significance level is 95 percent.
§ Significance level is 99 percent.

than 90 percent.) Coefficients for the other usual-source variable, *OTHER*, are also positive for children and negative for adults but are not significant. Thus the hypothesis of greater accessibility, relative to persons using the JHH clinics, is generally confirmed for children using the EBMP but not for adult EBMP users or for persons using other sources of care.

The influence of usual source on time costs does not appear to have a strong effect on the probability of receiving care. Although the coefficients of the visit-length variable (*VL2+*) are negative, as one would expect, they are only significant in two of the adult regressions, and even in these cases the magnitude of the coefficients is not large.

Among the other independent variables, perceived seriousness of the problem causing the illness episode (*PSER1* and *PSER2*) is clearly the most im-

portant. In fact, with the exception of visit length (*VL2+*) in Table 10, perceived seriousness and previous treatment (*PREVC*) are the only significant variables in the adult regressions. In the regressions for children, the insurance variables are also significant and positive as expected. Another particularly interesting feature of these results is that the coefficients for education (*HED12+*), household size (*HSIZE5+*), and chronic conditions (*CON*) are significantly negative. Since better-educated households, households with more children, and households with children receiving care for chronic conditions (primarily allergies and asthma) are probably more knowledgeable about the treatment of minor acute illnesses, a possible interpretation of these results is that more-knowledgeable parents are less dependent on professional care for treating such illnesses. (However, this interpretation presumes that we were successful in controlling for variations in episode characteristics. An alternative explanation is that more-educated parents, parents with large households, or parents of children with chronic conditions are more likely to report many illnesses as more serious even though they are not more likely to seek care. Similarly, it may be that these parents are more likely to restrict their children's activities or that their children are more susceptible to or exposed to minor infections. Unfortunately, these speculations cannot be adequately tested with our data.)

The significantly negative effect on children of residing in the housing projects (*HOUSE*) may be due to aspects of the lower socioeconomic status of project residents that are not adequately captured by our income and education variables. Also the insignificant coefficients for *EBN* indicate that persons having some limited contact with the EBMP but using other usual sources of care are not more likely to obtain treatment for their illnesses.

Finally, as an extension of the analyses just described, we reestimated our probit regressions employing only data for the 211 adults and 280 children who did not report a prior occurrence of a related health problem. (Of course, since $PREVP = 0$ and $PREVC = 0$ for all such persons, these variables were omitted from the regressions.) Results from these additional regressions indicate the differential impacts of various care sources on the probability that persons with newly occurring problems will enter the health care system for treatment. These results were generally consistent with the findings shown in Tables 9 and 10. In particular, the *EBMP* coefficient was positive and significant (at the 95-percent level) for children with either dependent variable. The coefficient of *OTHER* was also positive for children but was significant (at the 90-percent level) only when the dependent variable equaled zero for all individuals not receiving in-person treatment (as in Table 9). In the additional regressions for adults, both usual-source variables were insignificantly negative.

Results for other variables (besides *EBMP*, *OTHER*, *PREVC*, and *PREVP*) also conformed closely to those reported above. All coefficients that were significant in the probit regressions shown in Tables 9 and 10 remained significant in the corresponding additional regressions except for the coefficients of *HOUSE*

in the regressions for children and the coefficient of *VL2+* in the adult regression in Table 10. (Of course the signs of these significant coefficients were also unchanged.) All insignificant probit coefficients in Tables 9 and 10 remained insignificant in the additional regressions, except that the negative coefficients of *TT40* and the positive coefficients of *MALE* became significant in the additional adult regressions and the negative coefficient for *HED12+* in the regression for children in Table 10 became significant in the corresponding additional regression. (Tables presenting the results of the additional regressions are available from the authors.)

Discussion

Multiple regression analysis of data for children supports the hypothesis that services provided by the EBMP are relatively more accessible than those available through other sources of care in the East Baltimore area. Available data for the period immediately preceding the opening of the EBMP suggest that this finding of greater accessibility cannot be attributed to selection factors; indeed, these factors may have tended to work in the opposite direction. However, the hypothesis is not confirmed for adults.

The complete explanation for these results cannot be discerned from the statistics presented here. Although the time cost of services was lower at the EBMP than at alternative sources of care (Table 8), this factor has but a modest influence on the probability of obtaining care. And the marked difference between the EBMP and other sources in the provision of telephone care provides only a partial explanation of the findings. (Because some persons using the EBMP faced higher financial costs of services at other care sources, it could be argued that the observed EBMP impact on accessibility was due to financial factors. However, when we replicated our analysis for Medicaid recipients alone, similar findings emerged.) Furthermore, the reasons for the inconsistencies between the results for children and for adults have yet to be identified. In short, although the study suggests that the EBMP has been at least partially successful in increasing the accessibility of care, further and more detailed research is required to determine which factors in the organization and process of care at the EBMP are responsible for this success.

Although we can only speculate about the generalizability of the findings, there are reasons for believing that similar reorganizations of ambulatory services in other low-income inner-city areas would show a greater impact on accessibility than reported here. The East Baltimore area is atypical in several important respects. Its population consists primarily of long-time residents rather than recent arrivals from other areas, and its population does not contain large numbers of non-English-speaking persons. Thus the average citizen of East Baltimore, in dealing with the local institutions providing ambulatory care, does not confront the informational or language barriers encountered by disadvantaged groups in other urban centers. Furthermore, the variety of care sources available in East Baltimore probably results in lower time costs

and inconvenience relative to areas that are totally dependent on one or two large institutions for ambulatory services. Since these special features of the East Baltimore area presumably reduce the impact of the EBMP on accessibility of care, it seems reasonable to expect that similar reorganizations of services would yield larger increases in accessibility in localities where these features are not present.

Acknowledgments. Comments by Daniel Walden and by an anonymous referee on an earlier version of this paper are gratefully acknowledged.

References

1. German, P. S., E. A. Skinner, and S. Shapiro. Ambulatory care for chronic conditions in inner-city elderly populations. *Am J Public Health* 66:660 July 1976.
2. German, P. S., E. A. Skinner, S. Shapiro, and D. S. Salkever. Preventive and episodic health care of inner-city children. *J Community Health* (in press).
3. Aday, L. A. and R. Andersen. *Development of Indices of Access to Medical Care.* Ann Arbor, MI: Health Administration Press, 1975.
4. Salkever, D. S. Economic class and differential access to care: Comparisons among health care systems. *Int J Health Serv* 5(3):373 1975.
5. Salkever, D. S. The problem of access to medical care: A consumer demand analysis. *East Econ J* 2(supplement):116 July 1975.
6. Bice, T. W. *Enrollment in a Prepaid Group Practice.* Unpublished paper. Johns Hopkins University, 1973.
7. Feldstein, M. S. A binary variable multiple regression method of analyzing factors affecting perinatal mortality and other outcomes of pregnancy. *J R Stat Soc* Series A, 129:61 1966.
8. Shah, F. K. and H. Abbey. Effects of some factors on neonatal and postneonatal mortality: Analysis by a binary variable multiple regression method. *Milbank Mem Fund Q* 49:33 Jan. 1971.
9. Goldberger, A. *Econometric Theory.* New York: Wiley, 1964.
10. Kmenta, J. *Elements of Econometrics.* New York: Macmillan, 1971.