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Health Care Markets, the Safety Net, and Utilization of Care among the Uninsured

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Objective. To quantify the relationship between utilization of care among the uninsured and the structure of the local health care market and safety net.

Data Sources/Study Setting. Nationally representative data from the 1996 to 2000 waves of the Medical Expenditure Panel Survey (MEPS) linked to data from multiple secondary sources.

Study Design. We separately analyze outpatient care utilization and whether an individual incurred any medical expenditure among uninsured adults living in urban and rural areas. Safety net measures include distances between each individual and the nearest safety net providers as well as a measure of capacity based on local government and hospital health expenditures. Other covariates include the managed care presence in the local health care market, the percentage of individuals who are uninsured in the area, and local primary care physician supply. We simulate utilization using standardized predictions.

Principal Findings. Distances between the rural uninsured and safety net providers are significantly associated with utilization. In urban areas, we find that the percentage of individuals in the area who are uninsured, the pervasiveness and competitiveness of managed care, the primary care physician supply, and safety net capacity have a significant relationship with health care utilization.

Conclusions. Facilitating transport to safety net providers and increasing the number of such providers are likely to increase utilization of care among the rural uninsured. Our findings for urban areas suggest that the uninsured living in areas where managed care presence is substantial, and especially where managed care competition is limited, could be a target for policies to improve the ability of the uninsured to obtain care. Policies oriented toward enhancing funding for the safety net and increasing the capacity of safety net providers are likely to be important to ensuring the urban uninsured are able to obtain health care.

Key Words. Uninsured, safety net, market, utilization

Over the past 15 years, roughly one in seven individuals in the U.S. (between 13.6 and 16.3 percent of the population) have been uninsured (U.S. Census

Bureau 2004). For many of the uninsured, access to health care is heavily dependent on a "safety net" of providers (Hadley and Holahan 2003; Lewin and Altman 2000). Such providers include traditional safety net providers—those who are legally obligated to provide care to persons who cannot afford it, such as public hospitals, federally funded community health centers, and local health departments—and mainstream providers—those who provide uncompensated care voluntarily or as part of their community-service obligation.

Previous research has documented wide variation in access to medical care among uninsured individuals living in different communities (Cunningham and Kemper 1998) and various studies have linked these access differences to variation across areas in managed care penetration, the percent of the local population that is uninsured, safety net capacity, and the location of safety net providers (Cunningham 1999; Long and Marquis 1999; Hadley and Cunningham 2004a, b; Cunningham and Hadley 2004).

This research further explores the relationships between local health care market and safety net characteristics and utilization of care among the uninsured. It extends previous research in several important ways. First, with nationally representative data including a large sample of more than 8,000 uninsured individuals, created by pooling multiple panels of respondents from a longitudinal survey, we are able to separately analyze uninsured individuals living in rural (nonmetropolitan) and urban (metropolitan) areas. Second, our data allow us to include a comprehensive set of individual-level health status measures which alleviate the potential impact of endogeneity related to health status that may otherwise bias results. Third, we analyze both safety net and health care market characteristics, providing the most comprehensive look at the relationship between these factors and use of care among the uninsured to date.

Conceptual Framework and Hypotheses

Economic models of the demand for medical care suggest that utilization of health services depends on how much an individual values health care and the

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price of health care relative to other goods. Individuals' valuation of (or "taste" for) health care is unobservable, but we proxy for taste with individual characteristics such health status, income, age, race, and gender. Components of the price of health care include the out-of-pocket costs associated with receiving care, search costs associated with finding a provider, time and transportation costs of getting to the care provider, and the cost of time to actually receive care (e.g., waiting time, visit time). For low-income individuals, these costs—especially time costs—may strongly influence the utilization of medical care (Acton 1976).

Characteristics of the local safety net and health care market are likely to be important determinants of the costs of obtaining care for the uninsured. An uninsured individual's location relative to safety net providers affects the time and transportation costs associated with obtaining care. Our expectation is that that travel costs increase with distance, and that the farther individuals live from safety net providers, the lower will be utilization. Further, the costs of care for the uninsured are likely to be lower the greater are the resources, and in turn the capacity, of safety net providers. More resource-rich providers are likely to be able to offer more convenient hours and more immediate care, reducing, for example, waiting times at the place of care and the costs of time off from work an uninsured individual might have to incur to obtain care.

Other dimensions of the health care market are also likely to influence the price of care for the uninsured, and in particular, the out-of-pocket costs that uninsured individuals must pay for care. A greater presence of managed care may result in lower prices paid to mainstream providers for the services they provide to insured patients and limit their ability to cross-subsidize free or discounted care for the uninsured. On the other hand, competition among managed care plans may erode plans' bargaining power, blunting their influence over prices. Thus, in competitive managed care markets, providers may be able to negotiate higher prices that enable them to subsidize discounted care for the uninsured, other things equal. Furthermore, uninsured individuals living in areas where a relatively large fraction of the population is uninsured may have to compete for limited health care resources, which may drive the out-of-pocket price of care up or be associated with longer waiting times for care. Thus, health care utilization may be lower in these areas for any given uninsured individual (IOM 2003).

Finally, we expect that a greater local supply of primary care doctors will reduce search costs associated with finding a provider, and in particular one who provides free or discounted care.

DATA AND METHODS

Data

We use data from the MEPS household component (HC) survey linked to data from numerous sources describing the safety net and health care market structure. The MEPS HC is a nationally representative survey with detailed information on health status and health services utilization. MEPS uses an overlapping panel design in which respondents are interviewed multiple times over a 30-month period to collect data spanning a 2-year period (Cohen et al. 1996/97).

To describe the health care safety net and market structure in each individual's location, we derived variables from numerous sources including the American Hospital Association (AHA) Annual Survey of Hospitals, Area Resource File (ARF), the InterStudy Regional Market Analysis database, the Bureau of Primary Healthcare (BPHC) Uniform Data System, the Current Population Survey (CPS), the Census of Governments, and the Census Bureau's Annual Survey of State and Local Government Finances. Because the public use MEPS data do not contain geographic identifiers, variables describing the health care market and safety net were linked to MEPS respondents by Social and Scientific Systems (SSS), operating through a contract with the Agency for Healthcare Research and Quality (AHRQ). The resulting data file, stripped of geographic identifiers, was available for our use on-site at the AHRQ Data Center.

Study Sample

Our analysis pools MEPS respondents who were uninsured for at least one full calendar year during the period from 1996 to 2000. Each observation represents a 1-year period of an individual being uninsured; thus, there are two observations for each respondent who was uninsured during both calendar years in which he/she was surveyed. We focus on the adult uninsured population (patterns of health services utilization, types of chronic health conditions, and health insurance availability all differ markedly for children compared with adults) and exclude from analysis respondents under the age of 18 or aged 65 or older, as well as individuals who were ineligible for all or part of the calendar year (such as those who died or were institutionalized during the year). In total, our data include 12,513 observations of full calendar-year episodes of uninsurance from 8,285 respondents. There are roughly 2,000–3,000 observations from each year. All analyses are run separately for

individuals living in metropolitan statistical areas (MSAs) and non-MSAs. We term the former "urban" uninsured and the latter "rural" uninsured.

Dependent Variables

We focus our analysis on outpatient measures of utilization, including number of office-based physician visits, number of office-based nonphysician visits, and number of emergency department (ED) visits. Office-based visits include visits to physicians' private offices, to outpatient clinics associated with hospitals, and to community health centers; they do not include outpatient department hospital services. We also analyze whether the individual has had any medical expenditures or charges (exclusive of dental and vision), which provides an overall measure of individuals' access to the health care system. The variable is positive if an individual has any expenditures for inpatient or outpatient care, pharmaceuticals, durable medical equipment, or other types of care (e.g., home health). In addition, the variable is positive if an individual had no expenditures but had positive charges, which indicates receipt of charity (free) care. Table 1 provides descriptive statistics for the dependent variables.

Independent Variables

As described in the *Conceptual Framework*, individuals' use of medical services is hypothesized to be influenced by their health status, demographic characteristics, and characteristics of the local safety net and health care market which bear on the price of care for the uninsured.

Table 1: Utilization among Full-Year Uninsured Adults by Location

	Rural		*Urban*	
Type of Utilization	*Mean*	*SE*	*Mean*	*SE*
No. of office-based physician visits	1.49	(0.072)	1.44	(0.056)
Proportion with any office-based physician visit	0.42	(0.012)	0.36	(0.006)
No. of office-based physician visits given >0	3.54	(0.149)	3.96	(0.137)
No. of office-based nonphysician visits	0.69	(0.072)	0.76	(0.063)
Proportion with any office-based nonphysician visits	0.18	(0.010)	0.13	(0.005)
No. of office-based nonphysician visits given >0	3.86	(0.349)	5.90	(0.413)
No. of emergency room visits	0.17	(0.012)	0.15	(0.006)
Proportion with any emergency room visit	0.13	(0.008)	0.11	(0.004)
No. of emergency room visits, given >0	1.31	(0.046)	1.37	(0.032)
Proportion with any medical expenditures or charges	0.61	(0.011)	0.52	(0.007)

Our analysis of health care utilization includes demographic controls—education (high school degree, some college, and college degree; less than high school omitted), household structure (marital status and family size), gender, age (18–24, 25–34, 45–64 years; 35–44 years omitted), gender–age interactions, race (non-Hispanic black, Hispanic; other nonwhite; non-Hispanic white omitted), language of interview (English or non-English), country of birth (U.S. or other), employment status, and family income as a percentage of the federal poverty line (FPL) (100–200, 200–400, over 400 percent; < 100 percent omitted).

We measure health status with a comprehensive set of variables spanning four domains: (1) functional, cognitive and social limitations (a single indicator for any such limitation), (2) vision/hearing problems (single indicator for any such problem, including blindness or deafness), (3) self-rated health (dichotomous variables for categories very good, good, fair, or poor; excellent omitted), and (4) chronic conditions. We constructed indicators for the presence or absence of 25 chronic conditions (such as diabetes, obesity, and asthma) and included specific indicator variables for a subset of those conditions as well as a summary indicator for the presence of any of the remaining conditions.[1]

We account for the location of the (1) closest migrant health center, community health center, or public housing primary care program; (2) closest public hospital; and (3) closest hospital with an ED. The first two distances can be thought of as measuring the (own) price of obtaining office-based care (which includes care received in a hospital outpatient clinic), whereas the distance to the nearest ED measures the (own) price of obtaining ED care.[2] Each distance is included in the analysis of each dependent variable to allow for both own- and cross-price effects.

Distances between each individual and the nearest ED and public hospital were calculated using AHA data (from each year, 1996–2000) and represent the distance (great circle)[3] in miles between the population centroid of the zipcode in which the individual resides and the exact hospital location based on street address.[4] These distances were calculated using the longitude and latitude coordinates of each location.

We determined the distances between individuals and the nearest of one of three types of federally funded health providers (migrant health center, community health center, or public housing primary care program) using the longitude and latitude coordinates of both the population centroid of the zipcode in which the provider was located and individuals' zip code. We had data for 1997 and 1999, and imputed distances for other years. For brevity we will refer to these providers as "BPHC providers."

For sensitivity analyses, we created variables indicating the number of EDs, public hospitals, and BPHC providers within a given distance from individuals. For the urban uninsured, these radius-based measures are constructed using a 5-mile radius, and for those living in rural areas, the radius is 10 miles. The two measures, distance to the nearest provider and number of providers within a given radius, capture similar but slightly different aspects of safety net availability. It is difficult to say whether one is superior to the other. We present both to provide a robust look at the relationship between safety net availability and utilization.

We use the level of local government expenditures for health and hospitals based on data from the Census of Governments and the Annual Survey of State and Local Government Finances as a measure of the financial status and general capacity of local safety net providers (Long and Marquis 1999; Marquis, Rogowski, and Escarce 2004). This measure is only available for MSAs and thus was not included in the rural specification. Expenditures were converted to 2000 dollars using the medical component of the consumer price index and scaled to the low-income population (within 200 percent of the poverty line) in the MSA using data from the March CPS. The measure captures expenditures for categorical health programs, maternal and child health care, immunization programs, outpatient health clinics and public hospitals. Two limitations of this variable are first, that it also includes some elements that may not be related to safety net capacity such as money spent to gather vital statistics and conduct health-related inspections; and second, that it is measured at the MSA level, whereas the level of safety net resources available more locally may be an important determinant of care. Despite these limitations and because better measures of safety net capacity are unavailable, we included the variable, but as a test of robustness, we performed sensitivity analyses excluding the public health expenditure variable.[5]

As described in the *Conceptual Framework*, aspects of managed care in the area and the insurance coverage of the local population are also likely to influence the price of care for the uninsured. We describe managed care in the area with an MSA-level health maintenance organization (HMO) penetration rate and MSA-level index of HMO competitiveness derived from InterStudy data, and calculate the percentage of individuals who are uninsured in each MSA using a 3-year moving average derived from CPS data. Data on insurance coverage and HMO penetration rates are not available for non-MSAs. The penetration measure indicates the percentage of the population that is in an HMO and the competition measure is one minus the sum of each HMO's market share squared. The competition measure ranges from 0 to 1

where a value near 1 indicates a very competitive market and a value near 0 indicates little competition.

Finally, we measure the local supply of primary care physicians with several variables. First, we include a county-level measure of the number of primary care doctors (family practitioners, internists, and general care practitioners) per thousand people in the county based on ARF data. To capture within county modulation in physician supply, we include zip code tabulation area (ZCTA)-level variables that measure sociodemographic characteristics that are likely to be correlated with physician location: percent minority, percent educated at a high school level or beyond, and percent of households with income less than the FPL. We expect relatively high concentrations of low-income, less-educated, and minority populations to be associated with a smaller local physician supply.

Measuring variation in physician supply across relatively small areas is important methodologically because of the possible endogeneity of the location of safety net providers. Specifically, government decisions about where to locate safety net providers or target safety net resources in particular areas may be related to the local populations' access to mainstream (i.e., nonsafety net) providers such as private physicians. In general, we expect that the availability of safety net services will be greater in small areas (e.g., neighborhoods) where people have less access to mainstream providers. Analyses that do not account for the location of mainstream providers may understate the impact of safety net providers on use.[6]

Tables 2 and 3 provide descriptive statistics for individual-level and market-level independent variables, respectively.

Estimation

All regressions were weighted and adjusted for the complex design of the MEPS survey (Cohen et al. 1996/1997; Cohen, DiGaetano, and Goksel 1999). The number of office-based physician and nonphysician visits, and ED visits assume small, nonnegative integer values (i.e., 0,1,2,3, . . .), also called "count data." We model these outcomes with a negative binomial regression model, which has been often used for analysis of count data (Hausman, Hall, and Griliches 1984; Cameron and Trivedi 1986; Joyce et al. 2000; Schellhorn et al. 2000; Sharma et al. 2000; Burge, Lawson, and Johnston 2003). The negative binomial is an extension of the poisson model which allows for the "overdispersion" that is frequently observed in count data (i.e., the variance conditional on particular values of the independent variables exceeds the

Table 2: Individual-Level Independent Variables

	Rural		*Urban*	
	Mean	*SE*	*Mean*	*SE*
Less than high school	0.33	(0.014)	0.31	(0.008)
High school graduate or GED	0.44	(0.013)	0.40	(0.007)
Some college	0.17	(0.010)	0.19	(0.006)
College graduate	0.06	(0.006)	0.11	(0.005)
Married	0.47	(0.014)	0.37	(0.008)
Widowed/divorced/separated	0.23	(0.011)	0.20	(0.005)
Family size	3.15	(0.056)	3.22	(0.033)
Aged 18–24	0.18	(0.010)	0.21	(0.005)
Aged 25–34	0.26	(0.011)	0.28	(0.006)
Aged 35–44	0.27	(0.011)	0.25	(0.006)
Aged 45–64	0.30	(0.012)	0.26	(0.006)
Female	0.47	(0.009)	0.43	(0.006)
Black	0.13	(0.013)	0.17	(0.008)
Hispanic	0.11	(0.019)	0.29	(0.011)
White (non-Hispanic)	0.73	(0.020)	0.48	(0.010)
Other race	0.03	(0.005)	0.05	(0.005)
Interview in English	0.94	(0.014)	0.83	(0.008)
U.S. born	0.87	(0.013)	0.66	(0.008)
Employed	0.69	(0.012)	0.69	(0.006)
Income < poverty	0.25	(0.011)	0.21	(0.007)
Income 1–2 × poverty	0.33	(0.012)	0.30	(0.007)
Income 2–4 × poverty	0.29	(0.013)	0.30	(0.008)
Income > 4 × poverty	0.13	(0.010)	0.19	(0.006)
Nonorganic psychoses	0.02	(0.004)	0.02	(0.002)
Arthropathies	0.04	(0.004)	0.03	(0.002)
Asthma	0.03	(0.003)	0.03	(0.002)
Depression	0.06	(0.006)	0.06	(0.003)
Diabetes	0.03	(0.003)	0.03	(0.002)
Disease of lipoid metabolism	0.02	(0.003)	0.02	(0.002)
Hypertension	0.08	(0.007)	0.06	(0.003)
Migraine	0.03	(0.004)	0.02	(0.002)
Thyroid disorder	0.01	(0.003)	0.01	(0.001)
Other chronic condition	0.04	(0.005)	0.03	(0.002)
Functional limitation	0.09	(0.007)	0.06	(0.003)
Social limitation	0.04	(0.004)	0.03	(0.002)
Cognitive limitation	0.03	(0.004)	0.02	(0.002)
Hearing problem	0.05	(0.005)	0.04	(0.003)
Vision problem	0.08	(0.007)	0.05	(0.003)
Excellent self-rated health	0.28	(0.012)	0.28	(0.006)
Very good self-rated health	0.26	(0.010)	0.30	(0.006)
Good self-rated health	0.30	(0.011)	0.29	(0.007)
Fair self-rated health	0.12	(0.008)	0.10	(0.004)
Poor self-rated health	0.04	(0.005)	0.03	(0.002)
Year = 1996	0.21	(0.021)	0.20	(0.011)

continued

Table 2 *Continued*

	Rural		*Urban*	
	Mean	*SE*	*Mean*	*SE*
Year = 1997	0.21	(0.018)	0.20	(0.009)
Year = 1998	0.20	(0.021)	0.20	(0.011)
Year = 1999	0.18	(0.018)	0.20	(0.011)
Year = 2000	0.20	(0.027)	0.21	(0.014)

Table 3: Market-Level Independent Variables

	Rural		*Urban*	
Market-Level Variable	*Mean*	*SE*	*Mean*	*SE*
Miles to nearest ED	8.88	(0.47)	3.68	(0.09)
Miles to nearest public hospital	24.54	(1.24)	17.49	(0.57)
Miles to nearest BPHC provider	30.93	(1.48)	12.61	(0.58)
No. of EDs within 5 miles (urban)/10 miles (rural)	0.71	(0.02)	3.12	(0.08)
No. of public hospitals within 5 miles (urban)/10 miles (rural)	0.29	(0.03)	0.43	(0.02)
No. of BPHC providers within 5 miles (urban)/10 miles (rural)	0.36	(0.05)	3.64	(0.17)
No. of of primary care doctors per 1,000 persons	0.38	(0.01)	0.63	(0.07)
HMO penetration rate	*		0.31	(0.01)
HMO index of competition	*		0.71	(0.01)
Local gov't health and hospital $ per low-income population	*		$744	(22)
Percent uninsured	*		0.20	(0.00)
Percent of households with income <FPL	0.17	(0.00)	0.15	(0.00)
Percent minority	0.16	(0.01)	0.33	(0.01)
Percent with a high school education or more	0.72	(0.01)	0.75	(0.00)

*Not applicable.

ED, emergency department; BPHC, Bureau of Primary Healthcare; HMO, health maintenance organization; FPL, federal poverty line.

conditional mean). We use a probit model for any medical expenditures or charges.

Simulations

We simulated values for the various kinds of utilization using standardized predictions. We performed separate simulations for a range of values of the rural- or urban-specific distribution of each of the variables describing the safety net or health care market structure. Rural and urban simulation values are summarized in Table 4.[7] We first obtained parameter estimates using the

Table 4: Simulation Values for Rural and Urban Uninsured

Simulation Variable	*Value*	*Rural*	*Urban*
Distance to nearest ED	25th percentile	1.31	1.33
	75th percentile	12.98	4.43
Distance to nearest public hospital	25th percentile	6.71	4.71
	75th percentile	34.38	23.12
Distance to nearest BPHC provider	25th percentile	13.35	2.35
	75th percentile	44.68	15.66
No. of EDs within 5 miles (urban)/10 miles (rural)	25th percentile	0	1
	75th percentile	1	4
No. of public hospitals within 5 miles (urban)/10 miles (rural)	25th percentile	0	0
	75th percentile	1	1
No. of BPHC providers within 5 miles (urban)/10 miles (rural)	25th percentile	0	0
	75th percentile	1†	3
Primary care doctors per 1,000	25th percentile	0.26	0.46
	75th percentile	0.49	0.74
HMO penetration rate	25th percentile	*	0.22
	75th percentile	*	0.43
HMO index of competition	25th percentile	*	0.67
	75th percentile	*	0.83
Percent uninsured	25th percentile	*	0.15
	75th percentile	*	0.25
Local health and hospital expenditures (per low-income population)	25th percentile	*	307
	75th percentile		900

*Not applicable.

†80th percentile value; 75th is identical to 25th.

ED, emergency department; BPHC, Bureau of Primary Healthcare; HMO, Health Maintenance Organization.

actual data. We then substituted the simulation value for the actual value of the simulation variable, while retaining the values of all other variables, and predicted utilization with the resulting data. Standard errors for the predictions and the differences in predicted values were calculated using the delta method (Bishop, Feinberg, and Holland 1975).

RESULTS

Descriptive Data

Uninsured individuals living in rural areas were more likely to have some versus none of each type of utilization (Table 1) compared with those in urban areas. However, the intensity of use conditional on any use was consistently lower among the rural uninsured (though the differences in intensity of ED use

conditional on any use are not statistically significant). Uninsured individuals in rural areas differ sociodemographically from those in urban areas. Compared with the urban uninsured, rural uninsured were older (more likely to be aged 45–64 and less likely to be aged 18–24), poorer (more likely to have income less than the poverty line), less well-educated (less likely to be college graduates), more likely to be married, less likely to be a racial minority, more likely to have a health problem or condition (greater proportion with hypertension, migraine, arthropathies, and functional or social limitation), and less likely to report good health (Table 2). As expected, mean distances between the rural uninsured and the nearest safety net providers were larger than those for the urban uninsured (Table 3). Our sensitivity measure of the number of safety net providers within a given radii was also smaller for the rural compared with the urban uninsured, even considering 10-mile radii for those in rural areas and 5-mile radii for those in urban locales.

Multivariate Analyses

Tables 5 and 6 show predicted annual utilization among the rural and urban uninsured, respectively, for simulation values of each of the safety net and health care market variables. (Full regression results are available from the authors upon request.) As an example of how to interpret the values in these tables, the first row of Table 5 indicates that if all uninsured individuals living in rural areas had an ED approximately a mile away (the 25th percentile value of the distribution), the average number of annual physician visits would be 1.82. By comparison, if the rural uninsured all lived significantly farther away from the ED (13 miles, the 75th percentile value), annual physician visits would average 1.62. Tables 7 and 8 report predictions for sensitivity analyses using radius-based measures of the availability of safety net providers.

All of the underlying regressions include socio-demographic and health status/health condition controls. Though our main focus is on the safety net and health care market variables, findings related to the individual-level variables include the following: A higher level of education is associated with more office-based visits, fewer ED visits, and a greater probability of any medical expenditures; being married and being a woman are both associated with more office-based visits and a greater probability of any medical expenditures; being a minority is associated with a lower probability of any medical expenditures; and the presence of chronic health conditions is associated with

Table 5: Predicted Utilization for Simulated Scenarios, Rural Uninsured

		Physician Visits		*Nonphysician Visits*		*ED Visits*		*Any Expenditures*	
Simulation Variable	*Simulation Value*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*
Distance to ED	25th pctile	1.82	(0.11)**	0.69	(0.12)	0.19	(0.02)	0.60	(0.01)
	75th pctile	1.62	(0.09)**	0.70	(0.12)	0.16	(0.01)	0.59	(0.01)
Distance to public hospital	25th pctile	1.67	(0.11)	0.60	(0.10)*	0.18	(0.01)	0.59	(0.01)
	75th pctile	1.69	(0.10)	0.73	(0.12)*	0.16	(0.02)	0.59	(0.01)
Distance to BPHC provider	25th pctile	1.80	(0.11)**	0.78	(0.14)*	0.17	(0.01)	0.60	(0.01)
	75th pctile	1.55	(0.09)**	0.63	(0.11)	0.16	(0.01)	0.58	(0.01)
Primary care physicians per 1,000	25th pctile	1.67	(0.10)	0.68	(0.12)	0.18	(0.01)*	0.60	(0.01)
	75th pctile	1.69	(0.10)	0.70	(0.12)	0.16	(0.01)*	0.58	(0.01)

Notes:

**$p<.01$ for difference between 25th percentile and 75th percentile.

*$p<.05$ for difference between 25th percentile and 75th percentile.

ED, emergency department; BPHC, Bureau of Primary Healthcare; pctile, percentile.

Table 6: Predicted Utilization for Simulated Scenarios, Urban Uninsured

		Physician Visits		*Nonphysician Visits*		*ED Visits*		*Any Expenditures*	
Simulation Variable	*Simulation Value*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*
Distance to ED	25th pctile	1.84	(0.14)	0.84	(0.12)	0.15	(0.01)	0.50	(0.01)
	75th pctile	1.79	(0.13)	0.88	(0.12)	0.14	(0.01)	0.50	(0.01)
Distance to public hospital	25th pctile	1.77	(0.14)	0.91	(0.14)	0.13	(0.01)**	0.50	(0.01)
	75th pctile	1.81	(0.13)	0.86	(0.12)	0.15	(0.01)**	0.51	(0.01)
Distance to BPHC provider	25th pctile	1.83	(0.14)	0.88	(0.12)	0.14	(0.01)	0.50	(0.01)
	75th pctile	1.79	(0.13)	0.87	(0.12)	0.14	(0.01)	0.51	(0.01)
Primary care physicians per 1,000	25th pctile	1.79	(0.14)	0.93	(0.13)*	0.14	(0.01)	0.49	(0.01)**
	75th pctile	1.81	(0.13)	0.82	(0.11)*	0.14	(0.01)	0.51	(0.01)**
HMO penetration rate	25th pctile	1.92	(0.15)**	0.81	(0.12)*	0.14	(0.01)	0.51	(0.01)*
	75th pctile	1.64	(0.13)**	1.01	(0.16)*	0.15	(0.01)	0.49	(0.01)*
HMO index of competition	25th pctile	1.79	(0.13)**	0.88	(0.12)*	0.14	(0.01)	0.51	(0.01)
	75th pctile	1.92	(0.15)**	0.77	(0.11)*	0.14	(0.01)	0.50	(0.01)
Local health and hospital expenditures	25th pctile	1.85	(0.14)	0.76	(0.11)**	0.14	(0.01)	0.50	(0.01)
	75th pctile	1.78	(0.13)	0.91	(0.13)**	0.15	(0.01)	0.51	(0.01)
Percent uninsured	25th pctile	1.77	(0.16)	0.85	(0.13)	0.16	(0.01)	0.50	(0.01)
	75th pctile	1.82	(0.14)	0.90	(0.14)	0.14	(0.01)	0.51	(0.01)

Notes:

**$p < .01$ for difference between 25th percentile and 75th percentile.

*$p < .05$ for difference between 25th percentile and 75th percentile.

ED, emergency department; BPHC, Bureau of Primary Healthcare; HMO, health maintenance organization; pctile, percentile.

more utilization, as is a self-reported health status of poor or fair compared with good to excellent.

Rural Uninsured

The analyses of utilization among the rural uninsured provide support for both own-price and cross-price effects of distances to various safety net providers on utilization. First, we observe an own price effect of distance to the closest migrant health center, community health center, or public housing primary care program (BPHC provider), with a longer distance resulting in fewer office-based physician and nonphysician visits (Table 5). These results are consistent with our hypothesis that a higher time-price of obtaining care from a safety-net provider decreases utilization of health care among the uninsured. In the regressions using radius-based measures (Table 7), a greater number of BPHC providers within a 10-mile radius is associated not only with

Table 7: Predicted Utilization for Simulated Scenarios, Rural Uninsured, Radius-Based Specification

Simulation Variable	Simulation Value	Physician Visits		Nonphysician Visits		ED Visits		Any Expenditures	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
No. of EDs within 10 miles	25th pctile	1.49	(0.12)**	0.79	(0.15)	0.12	(0.01)**	0.59	(0.02)
	75th pctile	1.79	(0.11)**	0.64	(0.10)	0.19	(0.01)**	0.59	(0.01)
No. of public hospitals within 10 miles	25th pctile	1.74	(0.11)	0.73	(0.11)*	0.17	(0.02)	0.60	(0.01)
	75th pctile	1.58	(0.16)	0.54	(0.11)*	0.16	(0.02)	0.57	(0.02)
No. of BPHC providers within 10 miles	25th pctile	1.61	(0.10)*	0.72	(0.11)*	0.17	(0.01)	0.58	(0.01)*
	75th pctile	1.77	(0.12)*	0.58	(0.09)*	0.16	(0.01)	0.61	(0.01)*
No. of primary care physicians per 1,000	25th pctile	1.68	(0.11)	0.68	(0.11)	0.18	(0.01)**	0.60	(0.01)
	75th pctile	1.69	(0.11)	0.69	(0.11)	0.15	(0.01)**	0.58	(0.01)

Notes:

**$p<.01$ for difference between 25th percentile and 75th percentile.

*$p<.05$ for difference between 25th percentile and 75th percentile.

ED, emergency department; BPHC, Bureau of Primary Healthcare; pctile, percentile.

Table 8: Predicted Utilization for Simulated Scenarios, Urban Uninsured, Radius-Based Specification

		Physician Visits		*Nonphysician Visits*		*ED Visits*		*Any Expenditures*	
Simulation Variable	*Simulation Value*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*
No. of EDs w/in 5 miles	25th pctile	1.83	(0.14)	0.90	(0.13)	0.15	(0.01)*	0.51	(0.01)
	75th pctile	1.79	(0.14)	0.86	(0.13)	0.14	(0.01)*	0.50	(0.01)
No. of public hospitals w/in 5 miles	25th pctile	1.81	(0.14)	0.95	(0.14)*	0.14	(0.01)	0.51	(0.01)
	75th pctile	1.80	(0.15)	0.76	(0.11)*	0.14	(0.01)	0.50	(0.01)
No. of BPHC w/in 5 miles	25th pctile	1.80	(0.14)	0.84	(0.12)*	0.14	(0.01)	0.50	(0.01)
	75th pctile	1.80	(0.13)	0.91	(0.13)*	0.14	(0.01)	0.50	(0.01)
No. of primary care doctors per 1,000	25th pctile	1.78	(0.14)	0.94	(0.13)*	0.14	(0.01)	0.49	(0.01)**
	75th pctile	1.82	(0.14)	0.89	(0.12)*	0.14	(0.01)	0.52	(0.01)**
HMO penetration rate	25th pctile	1.91	(0.15)**	0.83	(0.12)*	0.14	(0.01)	0.52	(0.01)**
	75th pctile	1.65	(0.13)**	1.01	(0.15)*	0.14	(0.01)	0.49	(0.01)**
HMO index of competition	25th pctile	1.79	(0.13)**	0.89	(0.12)*	0.14	(0.01)	0.51	(0.01)
	75th pctile	1.94	(0.16)**	0.79	(0.11)*	0.14	(0.01)	0.50	(0.01)
Local health and hospital expenditures	25th pctile	1.86	(0.15)	0.75	(0.11)**	0.14	(0.01)	0.50	(0.01)
	75th pctile	1.78	(0.13)	0.94	(0.13)**	0.15	(0.01)	0.51	(0.01)
Percent uninsured	25th pctile	1.79	(0.16)	0.84	(0.12)	0.16	(0.01)**	0.50	(0.01)
	75th pctile	1.81	(0.14)	0.94	(0.15)	0.13	(0.01)**	0.51	(0.01)

Notes:

**$p < .01$ for difference between 25th percentile and 75th percentile.

*$p < .05$ for difference between 25th percentile and 75th percentile.

ED, emergency department; BPHC, Bureau of Primary Healthcare; HMO, health maintenance organization; pctile, percentile.

the frequency of office-based visits, but also with a higher probability of any medical expenditures or charges. In some cases, the differences in utilization observed are statistically significant but relatively small in magnitude. It is difficult to know whether these relatively small differences are also significant in a clinical sense.

Second, we find a cross-price effect of distance to the nearest ED on physician visits (Table 5). We observe an inverse relationship, with longer distances to the ED associated with fewer physician visits, suggesting that office-based visits are complementary with use of the ED. Individuals may follow-up an ED visit with a physician visit, perhaps because an ED doctor refers a patient to a provider. The own-price association we observe of distance to the nearest ED on ED visits is consistent with our a priori expectation (longer distances associated with fewer ED visits), but surprisingly, the relationship is not statistically significant. However, the regression using the radius-based measures (Table 7) shows the statistically significant finding that a greater number of EDs within 10 miles is associated with more ED visits (as well as a greater number of office-based physician visits).

We also find that primary care physician supply is inversely related to ED visits, with greater availability of physicians associated with fewer ED visits (Table 5). This finding suggests that the timing of ED and physician visits affects their relationship. A physician visit may diminish the probability of a later ED visit (perhaps by preventing a medical condition from spiraling into a health emergency), whereas ED visits may result in a referral to a physician for follow-up care.

Finally, we find a relationship between distance to the nearest public hospital and nonphysician visits. Surprisingly, the results show that a longer distance to the nearest public hospital (or fewer number of public hospitals within a 10-mile radius) is associated with *more* nonphysician visits (Tables 5 and 7). Another unexpected finding in the rural results is that a greater number of BPHC providers within 10 miles is associated with a lower number of nonphysician visits (Table 7); by contrast, a longer distance to the nearest BPHC provider is associated with a fewer nonphysician visits (Table 5). The heterogeneity of nonphysician visits—which include visits to physician assistants and nurse practitioners but also to podiatrists, chiropractors, and psychologists—may underlie the unexpected results. Different types of non-physician providers are typically available in different health care settings that may make the effect of availability on the use of these providers difficult to model. Moreover, while the results are significant at the conventionally used

0.05 level, they do not reach the more exacting 0.01 level attained by most of the other conceptually consistent results.

Urban Uninsured

In contrast to the rural uninsured, we find more limited associations between distances to safety-net providers and health care utilization among the urban uninsured. In the continuous-distance specification (Table 6), we find no association between distance to the closest ED and any type of utilization, and no association between distance to the closest BPHC provider and utilization (although the sensitivity analyses—Table 8—show a greater number of BPHC providers within a 5-mile radius is associated with a greater number of nonphysician visits). We find that a longer distance to the nearest public hospital is associated with more ED visits suggesting substitution of ED-based care for office-based visits received in clinics associated with the public hospital.

A key finding for the urban uninsured is the association between the level and structure of managed care in the local market and utilization among the uninsured (Table 6). The relationship appears across numerous types of utilization, including physician visits (the greater is HMO penetration, the fewer are visits), nonphysician visits (the greater is HMO penetration, the more such visits), and any medical expenditures or charges (greater HMO penetration associated with a lower probability of any expenditures or charges). Our results suggest that greater managed care presence shifts utilization among the uninsured away from office-based physician visits and towards nonphysician providers. One possibility is that the uninsured are less able to find charity or discounted care from physicians in areas where managed care limits their ability to set prices for insured patients. The uninsured in areas with greater HMO presence, facing relatively high prices for physician care, may substitute less expensive care from nonphysicians for physician care.

However, the relationship between HMO penetration and physician and nonphysician office-based visits is attenuated by the competitiveness of the HMO market; specifically, holding HMO penetration constant, more competition is associated with *more* physician visits and *fewer* nonphysician visits (Table 6). In competitive managed care markets, doctors may be able to negotiate higher prices and thus to subsidize discounted care for the uninsured. Facing lower out-of-pocket prices for physician care, the uninsured may not engage in the same level of substitution of nonphysician for physician care.

Other aspects of health care market structure are also related to utilization. First, we find that primary care physician supply is associated with a greater probability of any medical expenditures or charges and fewer nonphysician visits (Table 6). Second, greater safety-net capacity, as measured by local government health and hospital expenditures, is associated with more nonphysician visits (Table 6). This result is consistent with our hypothesis that greater safety net capacity promotes higher levels of health care utilization by the uninsured. Third, the percentage of the population that is uninsured is inversely related to ED visits ($p<.01$ in radius regressions; Table 6). This finding suggests that uninsured individuals living in areas with many uninsured may compete for limited resources; in particular, emergency room crowding may be a severe problem in areas with many uninsured (Grumbach, Keane, and Bindman 1993; Solberg et al. 2003).

The urban radius regressions, like the rural ones, reveal the surprising result that a greater number of public hospitals within a 5-mile radius is associated with fewer nonphysician visits, which again may reflect that nonphysician providers are very heterogeneous (Table 8). Some types of these providers may be prevalent in public hospitals' outpatient clinics, whereas as others such as chiropractors and podiatrists, may not be. Finally, the urban radius-based regressions also show a statistically significant association between number of EDs within 5 miles and ED visits (greater number of EDs associated with fewer ED visits), but the statistical significance does not reach the exacting 0.01 level and the magnitude of the difference in ED visits is of little clinical significance (Table 8).

Additional Sensitivity Analyses

For the urban uninsured, we compared the reported analyses with those omitting the HMO index of competition and to analyses where local government health and hospital expenditures and percent uninsured were omitted separately and together. Our results were robust to these exclusions. In addition, we performed sensitivity analyses with an interaction between income and each of the three distances to safety-net providers. The results were robust with one difference. In the main regression of any expenditures among rural uninsured, the coefficient on distance to the nearest BPHC provider was negative but not significant at the 0.05 level. However, when an interaction term was included, the main effect of this distance was negative and significant at the 0.05 level, indicating that distance mattered for the poorest uninsured. This finding is similar to the radius specification finding that a

greater number of BPHC providers within 10 miles is associated with a higher probability of any medical expenditures.

CONCLUSIONS

We find that among the rural uninsured, the location of safety-net providers is a key factor related to health care use. Our results also suggest an asymmetrical relationship between ED and office-based visits—a physician visit appears to diminish the probability of a later ED visit whereas an ED visit may result in a referral to a physician for follow-up care. For the urban uninsured, we confirm and extend earlier work (Cunningham and Kemper 1998) reporting lower use of care among the urban uninsured living in areas where managed care penetration is high. Specifically, we find that the uninsured have more limited utilization of physician services in areas where HMO penetration is high, but that substitution of (less expensive) nonphysician care for physician care may occur in these areas. We further find that the influence of managed care is diminished, and correspondingly levels of health services use among the uninsured are higher, in more versus less competitive managed care markets. In addition, we find less use of emergency services among the uninsured living in urban areas where a relatively large fraction of the population is also uninsured, corroborating recent IOM work on the effects of uninsurance on communities (IOM 2003). Finally, we find that a greater primary care physician supply and greater safety net capacity is positively related to the ability of the uninsured to obtain care in urban areas.

Several limitations of this research should be noted. First, this study analyzed individuals who were uninsured for a full calendar year. From other research, we know that the population of uninsured individuals is heterogeneous, with some "chronically" uninsured and some individuals who quickly transition between insured and uninsured states (Monheit and Schur 1988; Swartz and McBride 1990). Whether patterns of utilization differ for these different groups of uninsured is an open question, as is whether the relationships between features of the health care market and safety net and utilization vary amongst these groups of uninsured.

Methodologically, the calculation of individual-specific distances to safety-net providers is an important contribution of this research. It represents a step in understanding the link between characteristics of the local community and individual specific outcomes like utilization. But, a limitation is our ability to capture travel time for the urban uninsured. Distance in miles to

providers may be a reasonable proxy for travel time for the rural uninsured, but it may be less so for the urban uninsured, where travel times are likely to depend heavily on traffic patterns and the service areas of mass transit systems. This may underlie the differences observed between safety-net provider availability and utilization across the rural and urban uninsured.

A well-developed literature shows that lack of health insurance has substantial repercussions on both access to health care and health status (IOM 2002). Among the findings are that, compared with the insured, the uninsured are less likely to visit a physician, have a usual source of care, or be admitted to a hospital; are more likely to receive care in hospital outpatient department or emergency room, to have unmet medical needs; and have lower annual medical expenditures and higher mortality (Lurie et al. 1984; Weissman and Epstein 1989; Hadley, Steinberg, and Feder 1991; Young and Cohen 1991; Spillman 1992; Weissman, Gatsonis, and Epstein 1992; Franks, Clancy, Gold 1993; Hafner-Eaton 1993; Marquis and Long 1994/1995; Newachek et al. 1998; Cunningham 1999). Absent the universal provision of health insurance, policy approaches to alleviating the barriers to access facing the uninsured include incremental efforts to increase the affordability and availability of public or private health insurance as well as measures to increase the accessibility of health care for the remaining uninsured.

Our findings shed light on areas of focus for the latter class of measures. Specifically, facilitating transport to safety-net providers and increasing the number of such providers are likely to increase utilization of care among the rural uninsured. Our sensitivity analyses suggest that these policies may matter most for the poorest of the rural uninsured. By contrast, the HMO findings for urban areas suggest that particular attention be paid to the uninsured living in areas where many of those insured are covered by managed care, and especially so where little competition among managed care organizations exists. Ironically, the "backlash" against managed care may result in improved access to care for some uninsured (Robinson 2004), although the salutary effects would be offset to the extent that the backlash also results in increasing health care costs, greater numbers of uninsured, and more competition for health care resources. In addition, policies oriented toward enhancing funding for the safety net and increasing the capacity of safety net providers are likely to be important to ensuring the urban uninsured are able to obtain care. Researchers have reported a relatively stable trend in safety net capacity in the late 1990s to 2001 (Felland et al. 2003), but the absolute level of capacity has been shown to vary widely across communities (Marquis et al. 2004), and some research suggests that those disparities may be widening over time (Hoadley,

Felland, and Staiti 2004). Increasing budgetary pressures at the federal level and in many states are likely to pose an increasing threat to safety-net funding.

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NOTES

1. Compared with other datasets, MEPS contains a rich set of health status descriptors. Adequately controlling for health status is especially important because the location of safety-net providers may be related to the health status of the local population. For instance, the government may place safety-net providers where unmet need is greatest or individuals with health problems may themselves attempt to locate close to a safety-net provider. The detailed controls for health status alleviate the possibility of misattributing the association between health status and the location of safety-net providers to that between location of safety-net providers and utilization.
2. Distances to providers are used to proxy for the time and travel costs associated with obtaining care. However, individuals may vary in their valuation of time. Long distances may not be perceived as costly to those who have a low value of time, but very costly to others whose valuation of time is higher.
3. The great-circle distance is the shortest distance between any two points on the surface of a sphere measured along a path on the surface of the sphere.
4. Geocoding at the census block group level is currently available for MEPS data from 1996, 1997, and 2000. However, these variables were not available at the time our analytic files were created. We contracted with AHRQ to add zip code information to 1996, 1998, and 1999 HC respondents because refined geographic identifiers other than FIPS codes were at the time unavailable. Zip codes were later added to the 2000 data by AHRQ. Although the population centroid of the zip

code introduces measurement error into calculation of the distance between each individual's residence and each safety-net provider, it may also be the case that individuals care about the distance between their place of work and safety-net providers. To the extent that places of work are located near the population centroid of the zip code, our distance measure may better portray relevant distances compared with a measure based only on location of residence.

5. Other researchers have measured safety-net funding with information on grant revenues for federally qualified health centers (FQHCs) or organizations that serve as grantees for FQHCs (Cunningham and Hadley 2004; Hadley and Cunningham 2004a). The measure appears to be more localized (describing grant revenues for grantees within a 5-mile radius of the centroid of each individual's zip code); in fact, however, grant revenues are recorded at the grantee level and grantees often provide care at several sites, some of which may be distant from the grantee. As such, grant revenues must be imputed across zip codes served.
6. An instrumental variable (IV) approach is an alternative way to deal with the possibility that the location and capacity of safety-net providers is related to the location of mainstream providers. In practice, however, finding appropriate and valid instruments is often extremely challenging and we were not able to identify an adequate instrument. Hadley and Cunningham (2004a) use the population density in a county and a county-level physician-to-population ratio to instrument for the capacity of local safety-net providers. But conceptually, these variables may be correlated with access to care other than through their correlation with safety-net capacity. For example, a greater physician-to-population ratio is a measure of nonsafety-net care available to the uninsured, because a greater supply of physicians makes obtaining care more convenient for patients. Additionally, both instruments are measured at the county level, but the endogenous explanatory variable for which these variables are instruments—grant revenues within a 5-mile radius of a zip code's population centroid—is measured at a much smaller geographic level. These instruments can only capture differences in grant revenues across counties.
7. The simulation values for each of the 10-mile radius measures used in the rural regressions (number of EDs, number of public hospitals, and number of BPHC providers within 10 miles) were 0 and 1, indicating that most individuals in rural areas lived either in a place with no or one such provider within 10 miles. Ten percent of the rural uninsured had more than one BPHC provider within 10 miles (79 percent had none and 11 percent had one); 7 percent had more than one ED within 10 miles (36 percent had none and 58 percent had one); and less than 1 percent had more than one public hospital within 10 miles (71 percent had none and 28 percent had one).

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