Methods

Primary Care Service Areas: A New Tool for the Evaluation of Primary Care Services

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Objective. To develop and characterize utilization-based service areas for the United States which reflect the travel of Medicare beneficiaries to primary care clinicians.

Data Source/Study Setting. The 1996–1997 Part B and 1996 Outpatient File primary care claims for fee-for-service Medicare beneficiaries aged 65 and older. The 1995 Medicaid claims from six states (1995) and commercial claims from Blue Cross Blue Shield of Michigan (1996).

Study Design. A patient origin study was conducted to assign 1999 U.S. zip codes to Primary Care Service Areas on the basis of the plurality of beneficiaries' preference for primary care clinicians. Adjustments were made to establish geographic contiguity and minimum population and service localization. Generality of areas to younger populations was tested with Medicaid and commercial claims.

Data Collection/Extraction Methods. Part B primary care claims were selected on the basis of provider specialty, place of service, and CPT code. Selection of Outpatient File claims used provider number, type of facility/service, and revenue center codes.

Principal Findings. The study delineated 6,102 Primary Care Service Areas with a median population of 17,276 (range 1,005–1,253,240). Overall, 63 percent of the Medicare beneficiaries sought the plurality of their primary care from within area clinicians. Service localization compared to Medicaid (six states) and commercial primary care utilization (Michigan) was comparable but not identical.

Conclusions. Primary Care Service Areas are a new tool for the measurement of primary care resources, utilization, and associated outcomes. Policymakers at all jurisdictional levels as well as researchers will have a standardized system of geographical units through which to assess access to, supply, use, organization, and financing of primary care services.

Key Words. Primary health care, small-area analysis, health services accessibility, Medicare, Medicaid

The need to improve the availability and effectiveness of primary care services in the United States was recognized as long ago as 1932 in the *Final Report of*

the Committee on the Costs of Medical Care (1932), and remains a perennial concern of health care planners (Horton 1928; Grumbach, Vranizan, and Bindman 1997; Rabinowitz et al. 2001; Mullan 1997; Davis 1991; Forrest and Whelan 2000). The persistence to this day of local disparities in the availability of primary care, even as the overall numbers of generalist physicians continues to grow, has not been for lack of effort (Politzer et al. 1991; Pathman 2000; Siegel 2000; U.S. General Accounting Office 2000a). Public policy directed toward improving the availability of primary care clinicians includes an extensive set of federal and state programs. Some of these seek to increase the aggregate number of generalist clinicians through influencing the specialty choice of medical students or supporting primary care residency training programs (Ricketts 1994). The goal of other programs is to improve the availability of primary care services to either local areas or specific populations by directly subsidizing primary care delivery (Ricketts and Cromartie 1992). Notable federal examples include funding for community health centers (U.S. General Accounting Office 2000b), for health professions training programs via Title VII of the Public Health Service Act (Politzer et al. 1999), and the National Health Service Corps (Cullen et al. 1997).

These ongoing efforts to increase the availability of primary care often take place without an adequate data infrastructure that reveals the local differences in primary care capacity and the populations that use these resources (U.S. General Accounting Office 1995). This is an old problem, with one of the first national schemes of service areas for primary care having appeared a half-century ago (Dickinson 1949), and with only limited progress having been made since then. Over time, investigators have used three general methods for defining geographical health care markets (Baker 2001; Kleinman and Makuc 1983): use of (1) geographical or geopolitical

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boundaries, for example, counties, (2) a fixed area, for example, a circumferential travel time boundary, within which providers and patients are located, (3) and “variable market approach,” based on the location of health consumers. Market or service area definitions that focus on primary care include clusters of zip codes of both inpatient and outpatient patients in Iowa (Briggs et al. 1995), and county-based approaches including travel time (Makuc, Kleinman, and Pierre 1985; Makuc et al. 1991). In the Makuc, Kleinman, and Pierre study (1985), a system of ambulatory care service areas based on travel distance (Health Care Commuting Areas) yielded relatively small geographical areas with minimal travel to outside areas. Still, the building blocks of this approach were counties, which were and are arbitrary political jurisdictions, likely too large to be a meaningful proxy for the boundaries of where primary care is delivered (Goody 1993; Zwanziger, Mukamel, and Indridason 2002). As a result, local conditions of very low and very high resources and utilization can be obscured within an overall county rate. In addition, the physician-to-population ratios are biased, to an extent rarely known, by patients seeking services in adjacent counties (Borders et al. 2000; Hong and Kindig 1992).

One method for area definition currently in use defines rational service areas (RSAs) for Health Profession Shortage or Medically Underserved Areas applications. Federal rules (42 CFR ch.1, part 5.2) are intentionally flexible to accommodate local circumstances, but this lack of standardization complicates an unbiased comparison of primary care capacity and utilization from one RSA to the next (U.S. General Accounting Office 1995). The RSAs are also normative rather than descriptive by constraining the area to reasonable travel limits. Furthermore, few states have yet undertaken the definition of RSAs that encompass their entire population.

We propose a new geographical approach to delineate service areas where the plurality of primary care is delivered, a method we call Primary Care Service Areas (PCSAs). The purpose of this article is to describe the PCSAs, to detail the methods used in their development, and to present an assessment of their validity. We finish with a discussion of the next steps in their implementation and dissemination as well as of some remaining methodological challenges. Primary Care Service Areas are defined through utilization data and represent geographic approximations of markets for primary care services. When linked to resource, population, risk factor, and utilization data, their uses are myriad. The information could simplify the identification of locales where ambulatory care utilization is notably low or high and could be correlated with differences in need as expressed by age,

social status, or risk factors. The data would also allow studies that examine the marginal health benefits of differing resource levels. As reflections of primary care market areas, PCSAs would promote a new generation of analyses of the interplay between market forces and the financing and delivery of primary care services. Finally, the data would assist in evaluating the effectiveness of public and private initiatives that seek to improve primary care availability.

METHODS

Overview

We employed standard methods of small area analysis to delineate PCSAs (Wennberg and Gittelsohn 1973). First, a patient origin matrix was computed that tabulated Medicare ambulatory care visits from zip code of beneficiary residence (population zip code) to zip code of generalist provider (provider zip code). Next, to define crude PCSAs, population zip codes were assigned to the provider zip code where the plurality of beneficiaries received care, and these assignments were adjusted to create contiguous zip code groups. The comparison of utilization patterns using pediatric primary claims from Medicaid files in six states and commercial claims in Michigan evaluated the generality of the PCSAs to younger populations. Finally, we characterized the areas in terms of their geography, population, and the degree to which primary care utilization occurred within PCSA boundaries, a phenomenon we call "localization."

Medicare Claims Data

The principal Medicare data sources for primary care utilization were the 1996 and 1997 Part B 5 percent Physician Provider File and a supplemental file of 3 million additional beneficiaries sampled from low-population zip codes (Table 1). This latter file included utilization from all beneficiaries within zip codes having fewer than 140 beneficiaries, the minimum number required for reasonably certain zip code assignment. (Power calculations are available from the authors.) In zip codes with more than 140 beneficiaries, the sampling fraction was adjusted downward to always obtain 140 beneficiaries until the 5 percent file, by itself, sampled 140 or more persons within zip codes. Thus, the 5 percent file was the sole source of Part B data when there were at least 2,800 beneficiaries residing in the zip code. The total number of beneficiaries included in the sample was 2,596,005. Claims were weighted to reflect the

Table 1: Data Sources for Primary Care Service Area Analyses

<i>Data Set Name</i>	<i>Data Date</i>	<i>Data Source</i>	<i>Notes</i>
Medicare physician supplier Part B 5%	1996 & 97	HCFA	Physician/supplier utilization data, 5% sample of beneficiaries.
Medicare physician supplier Part B “finder file”	1996	HCFA	3 million beneficiary oversample of low population zip codes.
Medicare Outpatient File 20%	1996	HCFA	Medicare outpatient utilization, 20% sample; rural health and community health center utilization.
Denominator File	1996 & 97	HCFA	Medicare beneficiary demographic and enrollment data
Medicaid Standard Medicaid Research Files (SMRF)	1995	HCFA	Pediatric utilization data
South Carolina Medicaid File	1995	SC Office of Medicaid	Pediatric utilization data
Michigan Blue Cross Blue Shield claims	1996	BCBS of Michigan	Commercial insurance utilization for those age < 18 and 18–64 years.
Demographic data	1999	Claritas, Inc.	Demographic characteristics of PCSAs
Zip code geographic boundary files	1999	Geographic Data Technologies, Inc.	Zip code standard for PCSA delineation

aggregate (5 percent plus additional sampled beneficiaries) beneficiary sample of each zip code.

Visits at Federally Qualified Health Centers and Rural Health Clinics came from a 1996 20 percent Outpatient File (Welch 1998) and were weighted accordingly during analyses; 232,400 beneficiaries (unweighted) had claims in the Outpatient File in addition to any Part B utilization.

Zip Code File

We used a 1999 area zip code file (Geographic Data Technologies, Inc., Lebanon, NH) as the geographic building blocks of PCSAs (number of zip

codes = 30,107). All claims, population, and provider data were mapped to these zip codes for data summaries and analysis.

Patient Origin Study

The following criteria constituted the operational definition of primary care services in the Part B Medicare claims (Table 2): ambulatory visits at offices, clinics, and hospital outpatient departments to generalist physicians (family and general practitioners, general internists, and general pediatricians),

Table 2: Criteria for Identifying and Selecting Medicare Primary Care Claims

Part B Files (Selected Claims = 16,852,855)

<i>Criteria Category</i>	<i>Selected Types (HCFA codes)</i>
Provider Specialty	General Practice (1) Family Practice (8) Internal Medicine (11) Pediatrician (37) Nurse Practitioner (50) Physician Assistant (97) Clinic (70)
Place of Service	Office (11) Outpatient Hospital (22) Rural Health Clinic (72) Federally Qualified Health Center (50)
Procedures	Office Visits (nonconsult) (CPT 99201–99205; 99211–99215) Preventive Medicine Services (CPT 99381– 99387; 99391–99397)

Outpatient File (Selected Claims = 1,052,903)

<i>Criteria Category</i>	<i>Selected Types (HCFA codes)</i>
Provider Number	FQHC (1800–1989) RHC (3400–3499, 3800–3999, 8500–8899, 8900–8999)
Type of Facility/Service	Clinic-Rural Health (71) Clinic-FQHC (73)
Revenue Center	Clinics (051 or 052)

midlevel providers, and “clinic,” a residual category that constituted primary care as evidenced by diagnostic codes. Emergency room and consultative visits were excluded. Claims within the Outpatient File were restricted to those with provider number and facility type of Rural Health Clinics and Federally Qualified Health Centers that also had a revenue center of “clinic.” These claims constitute primary care patient encounters. The Medicare beneficiary population included those U.S. residents aged 65 and older and who also had “aged” eligibility. The utilization of beneficiaries enrolled in risk-contract HMOs (health maintenance organizations) is not reliably reported, and these patients were excluded (15 percent). Altogether, these criteria resulted in 17,905,758 claims that represented, after sample weighting, 197,797,757 visits.

We used the provider zip code from the claim to ascertain provider location. We identified provider zip codes as those with at least 50 weighted primary care claims. This threshold of claims was intended to reduce the number of zip codes whose apparent primary care activity was from zip code misspecification in the claim form or from extremely part-time provision of care. Population zip codes were those with at least one resident beneficiary.

Each beneficiary’s utilization was analyzed to identify the number of claims for each unique provider zip code in which services for that beneficiary were received. Past methods for defining health service areas have often used counts of utilization events (i.e., hospital discharges) (Baker 2001), and may, therefore, have been disproportionately influenced by ill patients with high utilization rates. Because historically a relatively small percent of the population uses a high percent of services (e.g., surveys in 1987 and 1996 reveal that the top 1 percent of the population accounted for 27 percent of aggregate expenditures; the top 5 percent of spenders used one-half of all health spending in the same years [Berk and Monheit 2001]), PCSA definitions could be biased toward the most ill beneficiaries even though primary care serves those who are healthy as well as those with illnesses of diverse resource requirements. Thus, to balance the use rates of the low versus high users, we devised a system of “preference” weighting. Each beneficiary’s total use was therefore set at total “vote” of one. The proportion of the beneficiary’s total weighted claims located within a particular provider zip code was termed a preference fraction. For example, a beneficiary receiving three services in one provider zip code and two services in another provider zip code would have a preference fraction of 0.6 for the first provider zip code and a preference fraction of 0.4 for the second provider zip code. The sum of that beneficiary’s preference fractions, as defined, must equal 1.0. For beneficiaries residing in more than one zip code, their preference vote was

apportioned to population zip codes in accordance with the frequency of residence zip codes in their claims.

The patient origin matrix can be viewed as an $R \times C$ table with R equal to the number of resident zip codes represented in rows and C equaling the number of provider zip codes represented in columns. The value in each cell of the matrix is a sum of the preference fractions at the intersection of a particular resident zip code and a particular provider zip code. Crude PCSAs were formed by assigning population zip codes to the provider zip codes with the most preference fractions, which indicated the provider zip that received the highest number of vote fractions. The preference of beneficiaries without primary care utilization (35 percent for 1996) was, of course, indeterminate. In some provider zip codes, the beneficiaries received the plurality of their primary care services from a different provider zip code and both provider zip codes were included in the PCSA. This often occurred when a sole provider was adjacent to a zip code with a large medical group.

Population zip codes were reassigned from their primary provider zip code to a provider zip code with a lower total of preference fractions for four reasons. First, in keeping with nearly all previous methods of health service area definition, final PCSAs always constituted contiguous zip codes. To achieve this, 6.4 percent were reassigned. Second, in some instances the beneficiaries residing in the crude PCSA failed to seek the plurality of their primary care (based upon preference fractions) from providers within the same PCSA. This signifies that the method failed to assign the population to the providers they most commonly used. In this instance, 4.4 percent of the zip codes were reassigned. Third, a number of crude PCSAs were identified as having beneficiaries with excessive border crossing, defined as more than 70 percent seeking the plurality of their primary care from outside the PCSA, and their component zip codes were assigned to an alternate PCSA (3.8 percent). Finally, PCSAs with populations of less than one thousand were judged not to have sufficient populations reasonably to support a primary care clinician, necessitating a reassignment of 0.2 percent of the zip codes. Despite these reassignment procedures, 85 percent of population zip codes remained assigned to the provider zip code with the highest preference of the Medicare patients.

Preference Indices

In a PCSA ideally defined for measuring primary care resources and utilization rates, the population inside a PCSA obtains all of its primary care

from clinicians within the area. Recognizing that there will always be some patients who seek care in other areas, the localization of utilization is a key performance indicator of PCSA definitions and is measured through the preference index. This is the proportion of summed preference fractions for the population residing in a PCSA that occurs in provider zip codes within the same PCSA. Preference indices were calculated from the patient origin matrix after the previously described zip code reassignments. In addition, we calculated mean adjusted preference indices for the PCSAs of each state that were weighted for varying PCSA population size; this is equivalent to the proportion of an entire state's population preferences to a provider within their home PCSA.

Because primary care is thought of as a local medical service, the size of a PCSA is another important characteristic, and one that is positively correlated with the degree of utilization localization. The larger the area, the more localized the primary care activity. Given, however, the local nature of primary care services, smaller areas are more revealing of resources and care patterns. At a certain size, the greater accuracy in the per capita measure of physician supply may obscure heterogeneous primary care availability as areas of locally high and low supply are hidden in the overall rate.

Evaluation with Non-Medicare Utilization

Although it is desirable to define PCSAs using all payer claims data, no such national dataset exists for any purpose. Instead, the project evaluated the generality of the Medicare-defined PCSAs by calculating preference indices with Medicaid and Blue Cross Blue Shield claims in several states. A PCSA with similar Medicare and non-Medicare preference indices is evidence that a non-Medicare population localizes its use in the same service area, an important validation of the PCSA boundaries.

In order to make these comparisons, we used 1995 Standard Medicaid Research Files from HCFA for eight states. The states (Florida, Kansas, Maine, Michigan, Missouri, New Hampshire, Utah, Vermont) were part of the research project's core of so-called pilot states, selected on the basis of interstate geographic differences, of familiarity with the state's health care system, and of state and private agencies willing to work with the project staff. The necessary provider characteristics for claims linkage were, however, available for only five states (Maine, Missouri, New Hampshire, Utah, Vermont). Accurate provider data were not available for Kansas, and the Michigan Medicaid file included widespread errors in the zip codes of enrollee

addresses. The Florida ICD-9 diagnosis code data were incomplete. South Carolina was the ninth pilot state and provided Medicaid claims directly from the South Carolina Office of Medicaid, leaving six files for analysis.

Analyses focused on enrollees under age 18 years in order to study a population less selected by health status than others eligible for coverage on the basis of disability. Compared to the Medicare files, the place-of-service and provider specialty fields were relatively incomplete; these fields were used only to exclude claims that were obviously nonprimary care (e.g., pharmacy, specialists). We selected primary care claims by first using the 1995 National Ambulatory Medical Care Survey (National Center for Health Statistics, Hyattsville, MD) to identify the fifty most common primary diagnoses of office-based general pediatricians and family practitioners caring for patients less than 18 years of age. We then used these diagnoses as the Medicaid claims selection criteria for primary care. This definition of primary care utilization was moderately accurate. The diagnoses represented 78.6 percent of the visits nationally provided by these primary care clinicians and, in turn, 61.3 percent of visits with these diagnoses were provided by general pediatricians and family practitioners.

Finally, we evaluated PCSA definitions using a 1996 Michigan Blue Cross Blue Shield (BCBS) file. Michigan BCBS has one of the highest market shares of a commercial carrier in any state (Blue Cross Blue Shield of Michigan 2001). Claims were selected using the same criteria as Medicare Part B.

PCSA Characteristics

In addition to the preference and localization indices, demographic and geographic characteristics were determined using 1999 population data from Claritas, Inc. (San Diego, California). The PCSA geographic size was measured using ArcView 3.2 (ESRI, Inc., Redlands, Washington).

RESULTS

General Characteristics

The final number of PCSAs defined was 6,102 after adjustment for contiguity, plurality, localization measures, and minimum population. Twenty-three percent of PCSAs consisted of one zip code, 17 percent had two, 13 percent had three, and 47 percent had four or more. The Anchorage, Alaska, PCSA had 75 zip codes, the maximum number. Fifty percent of PCSAs had one provider zip code while the highest number was Houston, Texas, with 43.

The total population of PCSAs varied widely (Table 3). As described in the methods section, PCSAs were defined with a minimum population of one thousand. The median population size for all PCSAs was 17,276 and varied from a median of 3,146 within South Dakota to 55,780 within California. The median population in the three PCSAs in the District of Columbia was 375,136. The maximum population in a PCSA was 1,253,240 in San Jose, California.

A land area of 1,256 square miles or a radius of 20 miles (assuming a circular shape) was used as a crude indicator of geographically large PCSAs. Fifteen states did not have PCSAs exceeding this land area. The states with the highest proportion of their populations residing in large PCSAs were Alaska (96 percent), Wyoming (92 percent), Montana (84 percent), Idaho (81 percent), and New Mexico (81 percent).

Localization of Primary Care Utilization

The extent that beneficiaries used primary care providers within their own PCSA was generally high, but varied as widely as the population size (Table 3). For the United States as a whole, the median Preference Index (PI) was 0.55 with a mean adjusted PI of 0.63. This latter measure is equivalent to the proportion of beneficiaries in the United States with the plurality of their utilization occurring within the PCSA or the inverse of the proportion that generally seek care outside of their PCSA. The median PI was negatively related to the extent of urbanization and varied from 0.43 in New Jersey where 58 percent of the population resided in PCSAs with a PI of less than 50 percent to 0.77 in Alaska where virtually no one lived in PCSAs with a PI of less than 50 percent. Wyoming had the highest median PI (0.76) of the contiguous states; only 2.7 percent of the residents lived in PCSAs with a PI of less than 50 percent.

Those PCSAs with low PI tended to have smaller populations irrespective of urban or rural status. After adjusting for population size, the mean PI varied from 0.50 in New Jersey to 0.82 in Alaska and compared to 0.63 for the United States as a whole (Table 3).

Medicaid Analyses

Measuring utilization patterns in Medicaid and commercial insurance claims tested the generality of PCSAs for non-Medicare patients (Table 4). Preference indices measure the extent to which utilization similarly occurred to providers within a given PCSA, an indication of the localization of the market for

Table 3: Primary Care Service Area ($N = 6,102$) Characteristics by State

Area (Number)	Preference Index*		Adj. Preference Index [†]	Population [‡]		% Population		
	10th%	Median		90th%	Median	Maximum	PI < 0.5*	> 20 mi radius*
United States								
Northeast (1,209)								
CT (87)	0.36	0.55	0.77	0.63	17,260	1,253,240	29.4	8.5
DC (3)	0.33	0.48	0.72	0.57	28,034	194,545	28.4	0.0
DE (11)	0.41	0.52	0.57	0.52	375,136	410,386	5.4	0.0
MA (122)	0.34	0.64	0.73	0.66	39,788	279,035	12.8	0.0
MD (66)	0.33	0.46	0.66	0.56	31,789	322,138	47.5	0.0
ME (67)	0.36	0.48	0.69	0.58	37,896	356,752	41.8	0.0
NH (35)	0.39	0.58	0.79	0.65	11,308	105,293	18.0	1.5
NJ (148)	0.35	0.52	0.70	0.63	16,992	193,879	19.5	0.0
NY (295)	0.33	0.43	0.60	0.50	34,237	228,819	57.8	0.0
PA (321)	0.33	0.45	0.66	0.55	31,210	522,907	54.7	1.9
RI (16)	0.33	0.47	0.67	0.56	20,569	530,888	36.3	0.0
VT (38)	0.37	0.51	0.73	0.58	54,198	164,780	30.2	0.0
	0.38	0.55	0.72	0.62	9,106	89,722	19.5	0.0
Southeast (1,321)								
AL (130)	0.36	0.56	0.77	0.64	17,956	300,135	23.1	1.3
FL (160)	0.34	0.54	0.76	0.63	54,450	738,687	25.3	6.0
GA (146)	0.37	0.57	0.77	0.65	17,540	826,007	23.3	5.2
KY (143)	0.38	0.59	0.79	0.67	14,881	551,906	15.1	2.5
MS (109)	0.40	0.59	0.77	0.66	15,781	221,997	14.6	3.8
NC (168)	0.38	0.58	0.81	0.70	21,809	605,712	13.2	0.0
SC (101)	0.36	0.56	0.78	0.65	21,956	331,891	22.0	0.0
TN (118)	0.36	0.58	0.74	0.64	18,862	643,797	16.0	10.0
VA (169)	0.37	0.53	0.77	0.62	17,871	473,797	23.9	0.0
WV (77)	0.40	0.54	0.79	0.66	12,959	149,520	18.4	0.0

Midwest (1,939)	OH (260)	0.34	0.49	0.70	0.59	24,681	340,462	36.0	0.0
	MI (197)	0.34	0.47	0.71	0.57	17,391	638,384	45.5	3.6
	IN (172)	0.36	0.52	0.73	0.62	20,476	316,131	22.6	4.1
	WI (163)	0.39	0.57	0.77	0.64	15,199	274,976	24.5	4.9
	IL (252)	0.36	0.48	0.68	0.58	16,508	646,628	47.7	3.4
	MN (162)	0.40	0.60	0.73	0.64	8,969	530,812	23.4	7.6
	IA (198)	0.37	0.58	0.75	0.63	6,705	273,644	16.4	3.7
	MO (172)	0.38	0.53	0.69	0.61	11,919	496,022	25.8	12.5
	ND (54)	0.42	0.64	0.76	0.66	4,128	90,468	30.1	67.8
	SD (63)	0.41	0.66	0.79	0.71	3,146	155,768	4.4	73.9
	NE (101)	0.49	0.65	0.78	0.69	5,367	361,433	5.6	16.0
	KS (145)	0.44	0.64	0.78	0.66	5,471	210,141	20.4	15.1
South-central (703)	AR (106)	0.45	0.63	0.81	0.71	13,047	270,431	8.3	20.8
	LA (111)	0.38	0.58	0.76	0.64	17,183	466,782	13.7	5.8
	OK (126)	0.40	0.58	0.73	0.62	10,668	358,800	21.5	14.4
	TX (360)	0.37	0.58	0.78	0.66	15,554	1,166,747	19.0	17.2
West (584)	AZ (62)	0.36	0.56	0.81	0.61	26,403	371,592	35.9	21.9
	CA (304)	0.35	0.56	0.78	0.62	55,780	1,253,240	30.2	5.6
	CO (85)	0.37	0.67	0.87	0.72	11,343	799,968	22.0	55.5
	HI (22)	0.42	0.59	0.90	0.76	17,343	444,559	25.3	6.1
	NM (39)	0.38	0.67	0.89	0.73	21,656	579,971	21.0	80.8
	NV (23)	0.48	0.61	0.82	0.66	12,143	656,234	5.9	53.0
	UT (49)	0.39	0.63	0.82	0.68	18,402	211,808	28.9	15.4

continued

Table 3: Continued

Area (Number)	Preference Index*		Adj. Preference Index [†]	Population [‡]		% Population			
	10th%	Median		90th%	Median	Maximum	PI < 0.5 [§]	> 20 mi radius [¶]	
Northwest (346)									
AK (25)	0.53	0.77		0.91	0.82	5,173	289,794	0.5	96.3
ID (39)	0.50	0.74		0.84	0.75	11,956	274,634	2.9	81.0
MT (61)	0.49	0.66		0.85	0.76	4,656	124,134	3.6	84.0
OR (72)	0.42	0.59		0.83	0.68	20,790	460,731	16.9	21.0
WA (115)	0.40	0.57		0.82	0.66	23,744	488,482	19.3	8.6
WY (34)	0.40	0.76		0.87	0.75	8,627	76,741	2.7	92.3

Notes: *Preference index is a measure of Medicare beneficiaries' utilization of primary care services within the area; 1 indicates all and 0 indicates none of the beneficiaries prefer to use local providers.

[†]Mean preference index adjusted for varying populations of Primary Care Service Areas.

[‡]Minimum population is 1,000.

[§]"PI" indicates Preference Index.

[§]Assumes idealized circle shaped Primary Care Service Area.

Table 4: Comparison of Medicare, Medicaid, and Blue Cross Blue Shield Derived Localization of Primary Care Utilization within Primary Care Service Areas ($N=6,102$)

	Preference Indices*														
	Northern NE			Missouri			Utah			S. Carolina			Michigan†		
	Mcare	Mcaid		Mcare	Mcaid		Mcare	Mcaid		Mcare	Mcaid		Mcare	BC age < 18	BC age 18-64
Median	0.56	0.51		0.53	0.56		0.63	0.50		0.56	0.42		0.47	0.40	0.45
Adjusted‡	0.64	0.65		0.61	0.68		0.68	0.56		0.65	0.58		0.57	0.54	0.52
Preference Indices	Number of PCSAs by Category of Preference Index														
0.8	7	27		7	20		9	6		7	11		4	20	14
0.6 to <0.8	49	34		41	52		17	11		36	21		38	30	30
0.4 to <0.6	66	24		97	48		18	13		41	20		100	48	65
0.2 to <0.4	18	26		27	41		5	6		17	22		55	60	64
< 0.2	0	29		0	11		0	13		0	27		0	33	17
Spearman correlation*		0.68			0.53			0.70		0.65			0.66		0.71

Notes: *Preference index is a measure of Medicare beneficiaries' utilization of primary care services within the area and varies from 0 to 1; 1 indicates all and 0 indicates none of the beneficiaries prefer to use local providers.

†BC indicates Blue Cross Blue Shield claims.

‡Mean preference index adjusted for Primary Care Service Area population.

¶Spearman correlation compares Medicare to Medicaid or Blue Cross Blue Shield preference indices.

primary care services. In most of the pilot states, median and adjusted mean preferences indices were moderately lower for pediatric Medicaid patients. The largest difference was found in South Carolina where the median PI was 0.56 for Medicare and 0.42 for Medicaid and the adjusted mean PIs, 0.65 and 0.58. The PI, in contrast, for children in Missouri with Medicaid (median 0.56; adjusted mean 0.68) was higher than for Medicare (median 0.53; adjusted mean 0.61).

Examination of the distribution of PIs across PCSAs revealed a flattened distribution curve of Medicaid PI, with many more PCSAs having very high and very low PIs compared to Medicare (Table 4). The correlation of PIs across PCSAs was moderately high, ranging from Spearman correlations of 0.53 for Missouri to 0.70 for Utah.

Examination of primary care localization in Michigan BCBS claims showed similar findings to the Medicaid analyses. For both age groups of 0–17 and 18–64 years, the extent of PCSA border crossing was somewhat greater than for Medicare beneficiaries with a flattening of the PI distribution across PCSAs.

DISCUSSION

This article reports on the methods and characteristics of the first contemporary national service area definitional system for primary care services. The Primary Care Service Areas (PCSA) that we have developed have moderately high localization of primary care services and are generally small enough to provide locally detailed information about populations, primary care resources, and their use. We also found that younger Medicaid populations sought care within these Medicare defined areas to a similar, although not identical extent, to Medicare beneficiaries within six states. The same was true for a large commercial insurer in Michigan. The PCSAs offer a defined set of areas and populations using a single and documented definitional methodology that promises to be useful for the study of primary care services.

In further work conducted at Dartmouth College and Virginia Commonwealth University, the investigators have characterized the PCSAs and their component zip codes using sociodemographic, provider, and Medicare utilization data. This geographic database has been incorporated into an Internet-based geographic information system that allows both novice and advanced analysts to view PCSAs, associated geographies, and utilization

data (<http://pcsa.hrsa.gov>). Recognizing that primary care sites may change frequently, the first updating of the PCSAs occurred in spring 2002 using 1999 Medicare data. These PCSAs will then be used to redefine current hospital service areas and hospital referral regions for the next edition of the *Dartmouth Atlas of Health Care* (<http://www.dartmouthatlas.org/>). This will lead to a hierarchical system of medical care service area definition—primary care service areas, hospital service areas, and hospital referral regions—with unique potential for measuring health care resources and services in the United States.

The need for PCSAs is evidenced by the almost complete lack of any alternative viable approach that defines markets for office-based services, never mind primary care services. In a comprehensive review of current approaches to the measurement of competition in health care markets, Baker (2001) wrote that “virtually all studies that have examined physician competition have used this [aggregation of AMA data to counties or states] approach” (Baker 2001, p. 241), which, as we have argued above, is an inexact and inappropriate approach for assessing primary care delivery. Baker notes that Medicare Part B data with “unique provider identification numbers (UPINs) could be used to calculate patient flow information, thus leading to ‘variable market area measures’.” This is essentially the PCSA methodology.

Limitations

The methods used to define PCSAs have their own limitations. Most notably, the reliance upon Medicare utilization may limit their applicability for certain policy analyses or within particular locales. Lower preference indices for pediatric Medicaid indicate that overall travel patterns of poor children, for example, are different than for Medicare beneficiaries. The extent of these differences cannot be precisely known given the data quality problems with the Medicaid files. These deficiencies necessitated our use of a diagnosis-based definition of primary care visits that inevitably incorporates some core of common pediatric diagnoses by specialty physicians whose geographic “reach” will be higher than their generalist colleagues. In contrast, the Michigan BCBS claims data included fields similar to Medicare Part B, and we applied identical definitions of primary care visits. Preference indices using claims from this commercial insurer were again lower for both the child and nonelderly adult groups than for Medicare. These differences are smaller than the differences among the Medicare preference indices across the states. Variation in the travel patterns of persons seeking primary care obviously

differs from one locale to another for an abundance of reasons, including payer effects, and the application of any standardized method of service area definition will inevitably lead to areas with differing extents of border crossing. These differences do not diminish the value of PCSAs when a general definition of a primary care service area is required for research and policy analysis, but it needs to be understood by users and compared to available alternatives, such as counties.

Another limitation in the use of Medicare claims is that the utilization of risk-contract HMOs is not reliably captured in the Part B file. In 1996, about 15 percent of beneficiaries were enrolled in this managed care type and their utilization is not represented in the zip code to PCSA assignments. Considerable regional variation in HMO market share exists with a high of 38 percent in California and 35 percent in Arizona to less than 0.5 percent in eleven largely rural states (Iowa, Maine, Mississippi, Montana, North Carolina, North Dakota, South Dakota, Tennessee, Vermont, West Virginia, Wyoming). Within areas with relatively high HMO market share, the distortion of fee-for-service geographic markets will be dependent upon the nature of the provider network. Constraints in consumer choice would appear to be higher for HMOs reliant upon staff or group models (e.g., Kaiser-Permanente in northern California or Group Health Cooperative of Puget Sound in the Seattle area) than those contracting with physician networks or group practices that care for a mix of capitated and fee-for-service Medicare patients. It is the latter model of Medicare managed care that predominates in most areas of the country (Bazos and Fisher 1999). Recent declines in risk-contract enrollment (Zarabozo 2000), irrespective of the public desirability of Medicare capitation, would reduce assignment errors in the future.

The PCSAs are not derived from need-based measures, and some observers may regard this as a limitation. This is not a weakness for two reasons. First, the PCSAs are intentionally not normative or prescriptive; rather, they describe the world of primary care use as it exists. Whether this is a good or bad thing is a judgment to be made by policymakers and researchers. The PCSAs provide a baseline system to assess the correctness or error of primary care use patterns, for example, whether travel distance between potential patient and provider is too great, or whether use levels are well beyond anything clinical norms would suggest. Second, the PCSA database is populated with numerous socioeconomic, demographic, and risk factor variables such that need within each PCSA may be assessed and contrasted with use levels. In this way, policy makers and analysts can determine

for themselves what is or is not a desirable correspondence between need and use.

A final limitation is that PCSAs do not incorporate utilization of the uninsured into area definitions. In many parts of the country, the uninsured do not have a regular doctor upon whom to rely for care (Duchon et al. 2001), potentially leading to longer travel and, consequently, larger service areas. This weakness cannot be addressed without a feasible alternative to claims-based analyses.

Potential Users of the PCSAs

The project has identified three groups of potential users for PCSA-related data. The first of these is the federal government. The Health Resources and Services Administration (HRSA) contracted for the development of PCSAs because of current limitations in previously defined service areas when used for programmatic planning and evaluation purposes. Federal programs aimed at improving primary care may miss important underserved populations when the measurement of primary care employs area or population definitions that vary from one locale to another. If every jurisdiction has unfettered latitude in defining a population for measurement of the adequacy of primary care resources, good intentions can lead to an area definition that leans toward demonstrating need. Local information and opinions are, of course, valuable when they add new information that is not easily captured by national datasets. The PCSAs can augment these efforts and assist in establishing public accountability by providing standardized comparative national analyses. In a similar fashion, the evaluation of the many federally funded primary care programs (Health Resources and Services Administration 2001) also requires a standardized method of measuring underservice.

The second potential user group is state primary care offices and associations that need to identify specific areas and populations of underservice. States vary widely in their health care data infrastructures with some, like North Carolina or Washington (Smith et al. 2000), already having established databases that go beyond the data currently available for PCSAs. Many other states lack data or clear boundaries for areas and subsequent data tabulation, and no state agency is currently able to view its own measures in comparison to small service areas outside its state boundaries. The PCSA project has presented the methods and possible uses to national meetings of state primary care offices and associations on three occasions and visited nine states to elicit detailed comments. Generally there was enthusiasm for

utilization-based areas and for the attributes developed and several states have begun to use PCSA data in their planning efforts. Concerns about the project were focused, as might be expected, upon its reliance on Medicare data, the timeliness of the areas, and the concern that PCSAs might be mandated as rational service areas for Health Profession Shortage Area (HPSA) designations. This last issue was addressed by pointing out that PCSAs have no inherent normative value with respect to primary care service provision and that their intended use is for diagnostic and not prescriptive purposes.

The final user group will be health services researchers with an interest in national or regional studies of the availability and use of primary care services. The PCSAs measure resources across the entire range of supply. Studies of overservice as well as underservice are feasible. The methodology of defining PCSAs produces a representation of health care markets within which investigators may study the effects of primary care availability on utilization and patient outcomes (Susser 1994). The PCSA-derived measures may also be useful for investigating medical care effectiveness and efficiency when the supply of primary care resources is an important, but not a primary, consideration. Other potential users should also be mentioned: health care systems planning their primary care delivery, municipalities and public agencies that operate primary care clinics, medical schools and graduate medical education programs that are interested in the workforce availability and requirements of their regional population, and instructors teaching health care delivery to future health care professionals, researchers, and planners.

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