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Primary Care Service Area Version 3.1 Methods

Overview

Primary Care Service Areas (PCSAs) are geographic areas of relatively self-contained markets for ambulatory primary care services that can be used to measure primary care for planning and evaluation. PCSAs were first defined with Medicare primary care claims from 1996-97, [1] and were redefined using data from 1999. This document reports on the methods for PCSA Version 3.1, which further updated the areas using 2009 claims.

Primary care is the most localized medical service. PCSAs methods were designed to identify small areas that are relatively self contained markets for primary care in which the residents are likely to seek care from within PCSA primary care providers.

Each version of PCSAs uses definition methods that relies on a set of small geographic areas linked to the residence location of Medicare beneficiaries. These geographic areas are assigned to primary care location based on patient travel for ambulatory non-consultative primary care services. The initial assignments are adjusted for contiguity, and then additional criteria are applied, depending on the PCSA version.

Methods used in all PCSA versions

Similar utilization data was used for all versions of PCSAs. Medicare beneficiary eligibility was determined from the Denominator File. The Carrier and Outpatient Files contained primary care claims with information about the number of services and type of provider. Providers included either clinicians (e.g. physicians or nurse practitioners) or facilities (Rural Health Clinic or Federally Qualified Health Center).

The claims definition of primary care services is found in Table 1.

[1] Goodman, DC, et al. Primary Care Service Areas: A New Tool for the Evaluation of Primary Care Services. *Health Services Research* 2003:38:287-309.

Table 1. Medicare claims criteria for selection of primary care visits.

Criteria Category	Selected Types	CMS Codes
Carrier File		
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 (non-consult)	CPT 99201-99205; 99211-99215
	Preventive medicine services	CPT 99381-99387; 99391-99397
Outpatient Files		
Provider Number	Federally Qualified Health Center Rural Health Center	1800-1989 3400-3499, 3800-3999, 8500-8899, 8900-8999
Type of Facility/ Service	Clinic – Rural Health Clinic – FQHC	71 73
Revenue Center	Clinics	051X, 052X

The primary care utilization data identified geographic units that provided primary care. Areas with less than 50 claims were excluded because they were likely to indicate part-time practice or data errors. Population areas included were those with at least one person counted by the Census.

Each beneficiary's utilization was analyzed to identify the number of claims (each claim represents one service event, such as a primary care visit) for each unique provider area in which services for that beneficiary were provided. Past methods for defining health service areas have often used counts of utilization events (i.e., hospital discharges)[2], and may,

[2] Baker, LC. Measuring competition in health care markets. *Health Services Research* 2001; 36:223-251.

therefore, have been disproportionately influenced by ill patients with high utilization rates. Because a relatively small percent of the population receives a high proportion of health services, using primary care visits for PCSA definitions would bias the areas toward the most ill beneficiaries. Thus, to balance the use rates of those who are healthy with those who are ill, we devised a system of "preference" weighting, with each beneficiary's total primary care service use standardized. The proportion of each beneficiary's total weighted claims located within a particular provider area was termed a preference fraction. For example, a beneficiary receiving 3 services in one provider area and 2 services in another provider area would have a preference fraction of 0.6 for the first provider area and a preference fraction of 0.4 for the second provider area. The sum of each beneficiary's preference fractions, as defined, always equals 1.0. For beneficiaries residing in more than one area, their preference fraction was apportioned to population area in accordance with the frequency in which each population area was represented in their claims.

Crude PCSAs were formed by assigning each population area to the provider area with the highest preference fraction. When the PCSAs so defined included areas that were not adjacent, population areas were reassigned to the provider area with the next highest preference fraction that achieved contiguity. PCSAs with populations of less than 1,000 were judged not to have sufficient populations reasonably to support a primary care clinician and were combined to create PCSAs that exceed a population of 1,000.

Methods that changed from PCSA Version 2.1 to Version 3.1 definitions

Many changes occurred in the ten-year period between the definition of Version 2.1 and 3.1, including the availability of data, computational capacity, and travel patterns of beneficiaries. In response to these differences, new methods were developed. In addition, Version 3.1 methods address concerns that Version 2.1 did not constrain PCSAs to reasonable travel limits for primary care services, thus limiting their usefulness as Rational Service Areas. A summary of the differences in the methods for Version 2.1 and 3.1 is in Table 2.

First, Census tracts (CTs) were used instead of ZIP Code Tabulation Areas (ZCTA). Although the much greater number of CTs (73,057) increased the time and cost of the definition process, CTs are small stable Census defined areas that are familiar to state and municipalities. In addition, when reassignments were necessary, in Version 3.1, CTs were reassigned, while in Version 2.1 the entire PCSA was reassigned.

Second, the currently available Medicare files have utilization for 100% of fee-for-service beneficiaries. In Version 2.1, most of the utilization was from a 20% beneficiary sample.

Third, in Version 3.1 provider and beneficiary locations were ascertained from 9 digit ZIP Code information from Medicare files, giving the analyses a higher degree of geographic specificity than the 5 digit ZIP Code previously used.

Fourth, the data file source of provider location changed. Version 2.1 definitions relied on the provider ZIP Code listed in the line item Medicare claim. For Version 3.1 PCSAs, preliminary testing in New England found that this field sometimes reflected billing addresses instead of provider location. To address this error, claims were linked to National Provider Identifier (NPI) records, and the service location of the NPI file was used.

Fifth, in Version 2.1 we identified PCSAs where more than 70% of the beneficiaries travelled to other PCSAs to receive most of their care (i.e. of the preference fractions). These PCSAs were combined with an adjacent PCSA to define service areas with high localization of primary care. At times this led to PCSAs that were larger than considered reasonable for use as a rational service area.

In addition, in the 10 years since the development of Version 2.1 PCSAs, the travel patterns of Medicare patients seeking primary care changed significantly. We used 2000 ZCTAs as the units to compare differences in travel patterns of beneficiaries seeking care from ZCTA of residence to ZCTA of primary care service between 1999 and 2009 Medicare claims. We found that patients are now more likely to seek care from a greater number of ZCTA locations (i.e. patients travel a longer distance and also to a greater number of provider

locations). The median number of ZCTAs providing primary care for each population ZCTA increased from 13 to 35, although the total number of places providing primary care did not change much (total number of PCP provider ZCTAs 15,612 vs. 15,508). Patients were also less likely to have a 'consensus' primary care provider ZCTA to which a majority of local patients travel. For example, the 90th percentile of the ratio of the highest provider ZCTA preference to the total preference per each population ZCTA decreased from 82% to 72% reflecting more dispersed care patterns. These changes in travel mean that far fewer PCSAs meet the minimum 30% local preference criteria (i.e.< 70% travel outside the PCSA). Maintaining Version 2.1 criteria would have led to fewer and larger PCSAs and more likely to exceed the geographic limits that many consider reasonable for primary care. Therefore, we modified methods to better reflect the new care seeking patterns while constraining PCSA size closer to the dimensions expected for rational service areas.

In Version 3.1, at least 30% local patients' preferences must travel to local providers, or at least 10% local patients' preference must travel to local providers AND the ratio of preferences between the next highest provider PCSA and the putative PCSA must be less than 1.5. This means that if less than 10% of patients received the majority of their care from local providers, the PCSAs were identified and CTs were reassigned. Or, the CTs were reassigned if the percent of patients received the majority if their care from local providers was between 10 and 30%, and there was a different PCSA with a 50% greater preference of beneficiaries.

Sixth, given the higher mobility of Medicare beneficiaries when seeking care, PCSAs were screened for CTs with longer than 10 miles straight line distance to the nearest within primary care provider. For the CTs failing this screen, if the *road based travel time* was longer than 30 minutes to the nearest within PCSA primary care provider, then the CT was reassigned to another PCSA if there was a closer provider.

Seventh, in Version 2.1, we did not limit the land area size of a PCSA or if a PCSA was surrounding by another PCSA. This meant that many PCSAs could not be used as a rational

service area. Efforts were made to identify those PCSAs and, if possible, dissolved or spilt those PCSAs.

After Version 3.0 PCSAs were defined, we held webinars with representatives from each state's PCO/PCA offices. Based on the feedback, several issues of Version 3.0 PCSAs were identified:

- PCSAs nested in other PCSAs ("donut" PCSAs)
- PCSAs with a connecting corner census tract (CT)
- PCSAs with large land areas

To address these issues, the following steps were used to 1) identify those areas systemically; 2) determine possible solutions nationwide; 3) implement working solution(s) and evaluate the results. Decisions were made during our weekly project meeting after reviewing the PCSAs in question on GIS maps. We have determined the following PCSAs in question could be dissolved or split.

1. When a PCSA is entirely nested in another PCSA, then the PCSA was dissolved.
2. When a PCSA is largely surrounded by another PCSA – PCSA was dissolved only if the PCSA in question had a low preference index (< 0.4). Otherwise, that PCSA remained.
3. We used a 1-kilometer wide corridor as a minimum connecting area between two CTs. A PCSA was split if a component CT had a < 1-kilometer wide connecting area with another CT within the PCSA, and the CT could be reassigned to an adjacent PCSA when the adjacent PCSA contained the provider CT with the next highest preference fraction.
4. When a PCSA with > 10 mile straight-line-distance between two provider CTs and each provider CT had at least 30% of local preference, then that PCSA was split accordingly.
5. When a PCSA overlapped at least 5 Version 2.1 PCSAs, had at least 40% preference index, and had more than 2 provider CTs, that PCSA was split based on Version 2.1 boundaries and preference factions from the Version 3.0 patient original matrix.

6. Lastly, we identified the three largest (in land area) PCSAs for each state (except Alaska). We used several criteria to determine if these relatively large PCSAs could be split: i) the size of CTs within the PCSA (smaller than the U.S. average), ii) the extent of overlap with federal land (less than 25%), iii) any provider CTs geographically clustered, iv) relatively large in size comparing to surrounding PCSAs, and v) size of land area increased > 25% from step1 (patient origin matrix) to the final step of Version 3.0. We spilt those PCSAs with similar approaches to those described above.

After dissolving and splitting Version 3.0 PCSAs, the revised PCSAs were checked against the criteria of preference index (at least 0.3 or between 0.1-0.3 AND the ratio of preferences between the next highest provider PCSA and the putative PCSA must be less than 1.5), population size (at least 1000 population), reasonableness travel time within the PCSA (less than 30 minutes travel time between a population CT and a provider CT). If a PCSA failed, the PCSA was entirely reassigned to an adjacent PCSA with the highest preference faction, and still held the criteria for dissolving/splitting listed above. This resulted in 7,44 Version 3.1 PCSAs (7,624 for Version 3.0).

Table 2. Differences between Version 2.1 and Version 3.1 methods.

	Version 2.1	**Version 3.1**
Primary care utilization data	1999	2009
Fundamental geographic units and reassignment	2000 ZIP Code Tabulation Areas (N=33,048) Reassignment - PCSA	2010 Census Tracts (N=73,057) Reassignment – Census tract
Population sample	Fee-for-service Medicare beneficiaries: 20% beneficiary sample for clinician claims, 100% sample for Federally Qualified Health Center and Rural Health Center claims	Fee-for-service Medicare beneficiaries: 100% beneficiary sample for clinician and Federally Qualified Health Center and Rural Health Center claims.
Beneficiary and provider location	5 digit ZIP Code	9 digit ZIP Code
Provider location source	Part B and Outpatient File claims	National Provider Identifier records
Minimal localization of care (The proportion of PCSA beneficiaries who received the majority of primary care from within PCSA provider)	0.30	0.30 or at least 0.10 AND the ratio of preferences between the next most preferred PCSA was less than 1.5.
Travel limitations	None	Straight-line distance between population CT and nearest

		provider CT must be < 10 miles unless there is no reasonably close alternative primary care provider
A PCSA nested entirely in another PCSA	No limit	Reassigned the PCSA to its surrounding PCSA
A PCSA surrounded mostly by another PCSA	No limit	Reassigned the PCSA to the surrounding PCSA only if its PF< 0.4
A PCSA with component CTs connected only by a corner (a point or < 1 km wide)	No limit	Reassigned the CT to the adjacent PCSA where the CT had the highest preference
A PCSA with at least two provider CTs separated by at least 10 miles straight line distance	No limit	Spilt the PCSA if both provider CTs had > 30% preference from its population
A PCSA land areas overlapped with 5 or more v2.1 PCSAs	No limit	Use v2.1 as a template for reassigning CTs based on each CT preference fraction.
PCSAs with large land area	No limit	Identify the largest 3 of each state. Spilt a PCSA if 1) size of CTs was smaller than that of the US average, 2) < 25% land was federal land, 3) provider CTs geographically clustered, 4) significantly larger than surrounding PCSAs, 5) land size increased more than 25% from assignment based on patient origin matrix

The results of these assignments are presented in Table 3.

Table 3 PCSA version 3.1, assignment results.

	Assignment step	**No. PCSAs**	**Median preference index**
1	To provider CT with highest preference fraction	11,732	0.27
2	Contiguity	9,261	0.35
3	> 30% preference index OR >10% PI AND ratio with next higher PCSA > 1.5	7,633	0.41
4	Population >1,000	7,633	0.41
5	Travel limitation to provider	7,624	0.41
6	Reasonable PCSA shape and size	7,144	0.43

In general, PCSA size has decreased since Version 2.1 (Table 4). This does not mean, however, that PCSAs are always suitable as rational service areas.

A comparison of Version 2.1 and 3.1 PCSAs is presented in Table 4.

Table 4. Primary Care Service Areas, Version 2.1 vs. Version 3.1.

Measures	Version 2.1	Version3.1
Medicare data		
Date	1999	2009
Number of fee-for-service Medicare beneficiaries >=65 yr	26,927,925	27,721,734
Percent of total Medicare beneficiaries enrolled in Medicare Advantage	18%	28%
Number of primary care claims	85,021,518	98,471,197
Number of PCSAs	6,542	7,144
Mean total population per PCSA (2000/2010 U.S. Census)	43,012	43,217
Median total population per PCSA	14,922	20,344
Minimum total population per PCSA	1,005	1006
Maximum total population per PCSA	1,329,444	1,010,003
Mean beneficiary population per PCSA	4,116	3880
Median beneficiary population per PCSA	1,854	2073
Median land area	222	158
Number of PCSAs with land area <= 314 sq mi (10 mi radius)	4,069	4,723
Number of PCSAs with land area > 314 sq mi (10 mi radius)	2,473	2,421
Number of PCSAs with land area > 707 sq mi (15 mi radius)	916	1,057
Number of PCSAs with land area > 1256 sq mi (20 mi radius)	385	493
Number of PCSAs with land area > 1963 sq mi (25 mi radius)	207	292
Component ZCTAs (v 2.1) or census tracts (v 3.1)		
ZCTAs/CTs	32,011	72,740
Mean # ZCTAs/CTs per PCSA	5	10
Median # ZCTAs/CTs per PCSA	3	5
Minimum number of ZCTAs/CTs per PCSA	1	1
Maximum number of ZCTAs/CTs per PCSA	81	247
Five highest number of ZCTAs/CTs per PCSA	81	247
	49	177
	42	170
	40	162
	39	160

# single ZCTAs/CTs PCSAs	1,231	1051
Mean number of unique provider ZCTAs/CTs	2	5
Median number of unique provider ZCTAs/CTs	1	3
Maximum number of unique provider ZCTAs/CTs	41	101
Percent of ZCTAs/CTs assigned to primary assignment	83%	77%
Localization Measures		
Overall Preference Index for PCSAs in Region	0.67	0.55
Median Preference Index	0.61	0.43
No of PCSAs with Preference Indices < 0.30	0	1,707
No of PCSAs with Preference Indices 0.30 - 0.50	1,978	2,626
No of PCSAs with Preference Indices 0.50 - 0.75	2,947	2,185
No of PCSAs with Preference Indices > 0.75	1,617	626

Limitations of PCSAs

While the use of PCSAs for the measurement of primary care has the advantages of detailed data about populations in small areas, there are drawbacks to the methods. First, defining PCSAs ideally requires very detailed data about patients travel to primary care providers across the entire U.S. In practice, national data is only available for the elderly with fee-for-service Medicare insurance. The PCSA project has examined the preference indices for alternative populations (e.g. Medicaid, and commercially insured) in a number of states.[3] The patterns of patient travel are similar, but not identical to the elderly. Second, the definition method is analytically complicated and expensive. Primary care physicians are highly mobile leading to frequent gains and losses of providers. Practically, PCSAs can be redefined on a periodic but not annually. In order to measure changes in patient travel, the PCSA project checks the travel pattern of current Medicare beneficiaries every few years to identify the areas that have lost primary care providers, or where localization to within area providers has declined. Finally, the small size of PCSAs places additional challenges on providing demographic and socioeconomic data estimates, particularly during non-Census years. The problem of small area population demographic estimation is shared with other geographic units used in health care planning, such as rational service areas, ZIP areas, census tracts, and towns.

[3] Goodman, DC, et al. Primary Care Service Areas: A New Tool for the Evaluation of Primary Care Services. *Health Services Research* 2003:38:287-309.