2. METHODS AND DATA

The trend analysis results presented in this report encompass six distinct areas of research. The general research strategy was to analyze trends in Medicare payments during the 1990s under special payment provisions for rural hospitals, RHCs and FQHCs, and physicians. The methods and data used for these analyses are described in this section. The following specific analyses were performed, the results of which are presented in Sections 3 through 8 of this report:

- Descriptive profiles of the U.S. counties, categorized as urban, rural, or frontier, which generated baseline information on county characteristics for use in the trend analyses (Section 3);
- Trends in supply and Medicare payments for rural hospitals, with a focus on those with designations for Medicare special payments (Section 4);
- Trends in supply and Medicare payments for Rural Health Clinics and Federally Qualified Health Centers (Section 5);
- Trends in Medicare bonus payments made for physician services in HPSAs in non-metropolitan counties (Section 6);
- Trends in AAPCC capitation rates with comparisons for metropolitan and non-metropolitan counties (Section 7); and
- Effects of special payment provisions for rural hospitals on Medicare costs per beneficiary for Part A services (Section 8).

The first methodological step was to define the areas that would serve as the geographic basis for this research. We used counties as the unit of analysis because most data are or can be aggregated at the county level. Further, the Medicare AAPCCs, which are the estimates of Medicare costs per capita that are examined in this study, are calculated at the county level. The other important geographic areas are the designated underserved areas for which two measures have been established: HPSAs and MUAs. These also were recorded at the county level in the data files we used. The next research steps were to perform the four trend analyses and the estimation of the effects of special payment provisions on Medicare per capita costs for rural beneficiaries. Each analysis involved use of measures and methods specific to the respective topic area. Below we describe the data used in the analyses, the analytic methods, and the measures we used to categorize counties based on extent of rurality. Finally, we define the key variables used in the analyses.

MEASURES OF RURALITY

The method we used to define rural locations was based on whether a county is part of an MSA, as defined by the Office of Management and Budget. All counties outside an MSA were considered to be rural for purposes of this analysis. This definition is consistent with the geographic boundaries used in Medicare payment schedules for many provider services. However, county boundaries obscure a wide range of local characteristics because each county contains a mix of urbanized and more truly rural locations. Counties that are not in MSAs have
fewer and smaller urbanized locations than MSA counties do, but they are not uniformly rural in nature. Therefore, we refer to these counties as “non-metropolitan” counties rather than “rural.”

Categories by Urban Influence Codes

We defined categories of rural and urban counties to help characterize the rural or urban nature of each county. Urban and rural categories were established using values of the Urban Influence Codes (UICs) developed by the U.S. Department of Agriculture, which classify counties using values from 1 through 9 (Ghelfi and Parker, 1995). (Refer to Appendix B for additional discussion of coding systems.) Codes 1 and 2 define large and small counties in the MSAs established by the Census Bureau, and codes 3 through 9 define categories of counties outside the MSAs (non-metropolitan counties). The UICs classify non-metropolitan counties on two dimensions: (1) the size of the largest town in the county and (2) adjacency to a metropolitan county. Thus, the UICs do not yield a monotonic scale of rurality, but should be considered as a matrix with each dimension serving as an axis. UICs have not been updated since their publication in 1993. Consequently, the stratification of counties using these codes may not reflect the actual rural designation that would be assigned to a county based on data for later years of the study period. The advantage for the analysis is that consistent classification of counties avoids confounding study results with changes in county designations.

For our categories of rural counties, we used the two UICs for metropolitan counties and collapsed the UICs for non-metropolitan counties from the original seven categories into five categories.

Metropolitan categories

• Central and fringe counties in metropolitan areas of one million population or more (UIC 1); and
• Counties in metropolitan areas of fewer than one million population (UIC 2).

Non-metropolitan categories

• Counties adjacent to an MSA with a city of at least 10,000 population (UICs 3 and 5);
• Counties adjacent to an MSA without a city of at least 10,000 population (UICs 4 and 6);
• Remote counties not adjacent to an MSA with city of at least 10,000 population (UIC 7);
• Remote counties not adjacent to an MSA with town of 2,500–9,999 population (UIC 8); and
• Remote counties not adjacent to an MSA with no town of 2,500 population (UIC 9).

There is some consensus among rural health experts that the UICs are imperfect in capturing variations in characteristics among rural counties because they are based on county boundaries (Ricketts et al., 1998). Many rural counties have large land areas, and within a given rural county, there may be large local variations in population density, demographics, and health care provider supply that become lost in the larger county aggregates. Health service areas are not necessarily contiguous with county lines, and those health service areas within a given county can vary widely in the degree of rurality. In addition, many large metropolitan counties (mostly in the West) contain large rural areas.
Despite these limitations, the UICs are the preferred measure of rurality when compared to alternative measures, the most well known of which are the urban continuum codes. The Rural-Urban Continuum Codes (RUCCs) are based on the total urbanized population in a county, rather than the size of the largest city. Given the need for a “critical mass” of urban population to establish a local health care infrastructure, most analysts prefer the UICs as better representing this capability because they are based on the presence of a city of at least 10,000 population (Ricketts et al., 1998). A new classification system, called the Rural-Urban Commuting Area (RUCA) codes, was still under development at the time this research began, so it could not be used. The RUCA codes are expected to yield classifications that capture differences in extent of rurality more precisely than the existing systems do. (See Appendix B.)

Frontier Counties

Another important descriptive characteristic of rural services is location in frontier counties, which are remote, sparsely populated rural areas. Counties were classified as frontier if they were located in a western state and had a population density of six persons per square mile or fewer based on 1990 census data on population and county land area. Only a small number of counties in the eastern portion of the country had such low population densities, and they were omitted from the frontier county definition because residents in these counties had much better access to urbanized areas than those in the western frontier counties. We also tested the extent to which frontier county classifications would change if they were based on more recent (1997) population estimates. Only 18 counties had different classifications based on the 1997 population data, with 12 counties losing the frontier classification and six counties becoming frontier counties.

DATA SOURCES

The various analyses of trends in special payments for rural providers and AAPCC payments involved linking data from several sources, most of which were Medicare data files obtained from CMS. The following files were used, all of which were obtained from CMS except where noted otherwise:

1. Annual Medicare Provider of Service (POS) files for calendar years 1992 through 1998, which identified the hospitals, RHCs, and FQHCs serving Medicare beneficiaries and provided information on their location, characteristics and certification status;
2. Annual Provider Specific Files (PSFs) for calendar years 1992 through 1998, and Impact Files for 1996 through 1998, which provided data used to calculate Medicare payments for the hospitals and codes for special payment designation;
3. An extract of the 1997 HRSA Area Resource File (ARF extract), which provided county-level information on UICs, provider supply, population, and other environmental variables;
4. Quarterly Summary Files generated by CMS, containing county-level counts of Medicare beneficiaries and Medicare health plan enrollees for 1992 through 1998;
5. Annual Medicare 100 percent Denominator Files for the full Medicare population for calendar years 1996 through 1998, which provided data on the months and type of eligibility of beneficiaries;
6. County-level files of AAPCC capitation rates for calendar years 1990 through 1997;
7. Files of Medicare DRG code numbers, names, and weights for 1994 through 1998;
8. Medicare Provider Analysis and Review (MEDPAR) claims for short-term inpatient hospital services for the 100 percent sample of Medicare beneficiaries for calendar years 1992 through 1998, subset to include all claims for beneficiaries residing in non-metropolitan counties or hospitals located in these counties;
9. Medicare institutional outpatient claims from RHCs and FQHCs for the 5 percent sample of Medicare beneficiaries for calendar years 1991, 1992, 1994, 1996, and 1998; and

We used SSA state and county codes to link provider-level data or Medicare claims to county-level measures (e.g., extent of rurality, HPSA) in the ARF extract file. For population-based analyses, the data were linked based on the state and county of residence for Medicare beneficiaries; for facility-based analyses, the linkages were based on provider location.

The availability of certain county-level ARF data influenced the sets of counties we were able to include in each analysis. The Medicare program recognizes a larger set of counties (or other similar geographic jurisdictions) than those included in the ARF, which is reflected in the set of counties for which AAPCCs have been established historically. The ARF contains only one record for the entire state of Alaska, even though SSA county codes exist for a number of Alaskan boroughs. A discrepancy also existed for a set of independent cities in Virginia, which the state separates legally from historical county boundaries to form their own jurisdictions. These independent cities are recognized by Medicare. We added new records for the Alaska boroughs and the Virginia independent cities to our analysis file, for which we obtained data on the 1990 population, UICs, Metropolitan Statistical Areas, and Medicare beneficiary counts.

We could not obtain data for the new Alaska or Virginia independent cities on HPSAs, MUAs, or other county characteristics that were on the ARF. For any analyses that used these variables, we worked with the smaller set of counties for which we had the full set of data. Alaska counties were dropped from these analyses, and the Virginia independent cities were recombined with the counties from which they were extracted.

ANALYSES PERFORMED

Trends in Rural Hospital Services

To examine trends from 1992 through 1998 for the supply of rural hospitals and utilization of inpatient services, we used a combination of facility-level data on rural hospitals and MEDPAR data on inpatient utilization and spending. Using POS files and PSFs for these years, combined with geographic data from the ARF, we identified all Medicare-certified, short-term hospitals in non-metropolitan counties, and we classified them according to county location based on Urban Influence Codes, as well as by special status under Medicare payment policies. Characteristics of these hospitals were profiled using data from the Medicare POS files and PSFs.

For the rural hospitals with special designations for Medicare payments, our analyses focused on sole community hospitals, rural referral centers, those designated as both, and Medicare-dependent hospitals. We also report descriptive information for MAFs, EACH/RPCHs
and Indian Health Service hospitals in some tables to provide context regarding the relative numbers of special designation hospitals. We do not include the EACH/RPCHs or Indian Health Service hospitals in subsequent analyses, however, because there are so few of them compared to the other four groups of hospitals and they represent a very small fraction of total inpatient stays and payments.

We analyzed Medicare hospital inpatient utilization and expenditures, using MEDPAR claims data for the 100 percent beneficiary sample, taking two distinct approaches. First, we analyzed trends in utilization and Medicare spending for services provided by rural hospitals, by type of special payment status and by hospital location. Then we analyzed trends in utilization and spending on hospital inpatient services used by Medicare beneficiaries residing in rural areas, by beneficiary county of residence. Overall standardized average payments also were estimated for a standard DRG mix of patients, to decompose payment effects versus case mix effects across hospitals.

The analytic database for each year in our study period included only short-term hospitals in non-metropolitan counties that were certified in Medicare in any given year. Using merged data from the POS file and PSF for each year, we retained all hospitals that (1) were in the PSF, which indicated they were being paid by Medicare according to the provisions of the PPS, and (2) had current Medicare certification during the year, as defined by either not having a termination date or having a termination date later than January 5. These criteria eliminated all hospital units exempt from PPS (e.g., rehabilitation units), hospitals that served Medicare beneficiaries on an emergency basis (e.g., military hospitals or hospitals in Canada or Mexico), and hospitals that discontinued Medicare participation (e.g., for loss of certification or closure) before the year of interest.

We note that this approach relied on the certification data in the POS file, and to the extent that terminations are not correctly recorded in the POS, we have included some hospitals that should not be in our study population. This data problem would affect results from our analyses of provider supply but would not affect the analyses that use the MEDPAR claims, because the claims represent services actually provided by hospitals to Medicare beneficiaries, which presumes Medicare certification or status as emergency or other types of hospitals.

The MEDPAR claims for the 100 percent beneficiary sample identify the Medicare beneficiaries who use hospital inpatient services each year. From these files, we extracted all claims for non-metropolitan hospitals or for beneficiaries with counties of residence in the non-metropolitan counties, which included claims for services provided by both metropolitan and non-metropolitan hospitals. We used files from CMS with summary counts of all beneficiaries residing in each county to establish county-level data on the total beneficiary population for the analysis.

Trends in RHC/FQHC Payments

Two aspects of trends for RHCs and FQHCs from 1991 to 1998 were examined in this study: (1) trends in the numbers and geographic distribution of facilities and (2) trends in clinic utilization by Medicare beneficiaries and related costs. The facilities included were all RHCs as well as FQHCs in non-metropolitan counties. The Rural Health Clinics included some clinics in metropolitan counties, which were designated based on location in a non-urbanized area. They
were included to document their numbers, and information for these facilities is reported separately in some analyses.

RHCs and FQHCs were included in the analysis for each year if they had current Medicare certification that year, defined by either not having a termination date or having a termination date later than January 5. These data on RHCs and FQHCs rely on the accuracy of POS data on certification.

The first set of analyses describes trends in the numbers of RHCs and FQHCs from 1992 through 1998, working with data in the Provider of Service files. Counts were developed separately for provider-based and independent RHCs. Facilities were profiled based on ownership status and staffing characteristics. We analyzed collocation of facilities to assess the extent to which beneficiaries in non-metropolitan counties had access to a clinic or to more than one clinic. Finally, we described the distribution of RHCs and FQHCs across county categories based on the UICs, for frontier counties, by HHS region, and by the two types of underserved areas (MUAs and HPSAs).

To analyze clinic collocation, we first created a set of mutually exclusive categories and classified each clinic by whether it was located in a county with no other clinics; with one or more FQHCs; with one or more RHCs (either provider-based or independent); or with a combination of clinic types (at least one FQHC and one RHC, in addition to the index clinic). Then we did a county-level analysis to determine how many counties with at least one clinic had at least one FQHC, one provider-based RHC, one independent RHC, or a combination of RHCs.

We note a limitation that a county-level analysis of colocation does not account for: (1) RHCs that are located near each other but are in separate counties or (2) RHCs that are located in the same county but are far apart. We recognize that most counties contain multiple primary care service areas, and many primary care service areas straddle county lines. With a county-level analysis, it was not feasible to perform geographically detailed analyses of facility locations within primary care service areas. Therefore, the presence of two or more clinics in a county cannot be interpreted as evidence that beneficiaries residing in the county have ready access to more than one clinic.

The second set of analyses estimated utilization rates and costs for services provided by RHCs and FQHCs for beneficiaries residing in non-metropolitan counties, working with the Medicare institutional outpatient claims for RHC and FQHC services for the 5 percent beneficiary sample. These estimates were developed on the basis of beneficiary residence by category of non-metropolitan counties, in frontier counties, and in underserved areas. This population-based analysis offered useful information regarding use of RHCs and FQHCs by this population of interest. However, the 5 percent sample data could not be used to perform facility-level analyses of Medicare use and costs for RHCs and non-metropolitan FQHCs because some facilities serving Medicare beneficiaries would not have served individuals in this sample. Such an analysis would require use of claims for the 100 percent beneficiary sample, which was beyond the project resources.

**Trends in Physician Bonus Payments in Rural Areas**

As reported in Section 1, studies by the Physician Payment Review Commission and the General Accounting Office have documented trends in bonus payments made to HPSAs (PPRC, 1992, 1994a; US GAO, 1999). We extended the information from those reports by examining
trends in total Medicare payments and bonus payments for physician services provided to non-metropolitan beneficiaries for the years 1992, 1994, 1996, and 1998. We extracted physician claims from the Medicare physician/supplier claims data for the 5 percent beneficiary sample. We merged these claims with data from the ARF to identify services provided to beneficiaries in non-metropolitan counties, and to classify them by county category based on the Urban Influence Codes. We also examined bonus payments trends for primary care providers and primary care services.

An additional set of analyses was performed using claims for both physician and NPP services to examine the extent to which NPPs provided services for rural Medicare beneficiaries. We analyzed Medicare spending on NPP services as a share of total spending on physician and NPP services by HPSA designation and non-metropolitan county categories.

All trends in utilization and spending on health care services were analyzed for Medicare beneficiaries in non-metropolitan areas, by beneficiary residence rather than physician practice location or site of care. This is key to understanding and interpreting our results because bonus payments are paid based on location of care (in a HPSA) rather than location of residence. We chose this analytic approach for reasons of both policy emphasis and data requirements. The policy focus of these analyses is on access to care for rural beneficiaries, for which this analytic approach is appropriate. In addition, data requirements for establishing rural provider locations for four years of claims data would be substantial because we could not limit claims to those for beneficiaries residing in non-metropolitan counties. Furthermore, it was not possible to define county of service (and therefore rural or urban HPSA) because the physician/supplier claims data identify only the county of beneficiary residence and zip code of the provider’s official location, which is not necessarily where the service was provided. Because the sample was selected from claims for the 5 percent sample based on beneficiary residence, we were not able to analyze the number or characteristics of physicians claiming the bonus payments.

Given the well-documented migration of Medicare beneficiaries across geographic boundaries for health care services (McNamara, 1998; also see hospital service use results in Section 4), this approach allowed us to capture basic Medicare payments and bonus payments for physician services that beneficiaries in non-metropolitan counties obtained in urban HPSAs. Conversely, claims for services provided in rural HPSAs for urban beneficiaries were lost to our analyses. We expect the loss of payments for the urban beneficiaries using rural services is equal to or smaller than the additional payments captured for rural beneficiaries using urban services.

**Trends in AAPCC Capitation Rates**

Issues regarding the wide variation in AAPCC rates across metropolitan and non-metropolitan counties, as well as their volatility in the more sparsely populated non-metropolitan areas, have been well documented (PPRC, 1995; McBride et al., 1997). The purpose of our analysis was to document trends in the AAPCC rates and related measures from 1990 through 1997, the last year the AAPCCs were calculated for Medicare health plan payments. We defined three measures (see the definitions below), which we compared over time between metropolitan and non-metropolitan counties, as well as across categories of non-metropolitan counties. The first measure was the average total AAPCC rates (the sum of the Part A and Part B rates established for each county). The second measure was the Part A AAPCC rate as a percentage of the total rate, and the third measure was the volatility of the AAPCC rates (i.e., the extent to which a county’s AAPCC rate fluctuated from year to year).
Using the results of these descriptive analyses, we employed weighted linear regression methods to estimate models of the determinants of the AAPCC rates, with the county as the unit of observation. The dependent variable in the models was the 1997 AAPCC rate and the predictor variables included arrays of demographic variables (per capita income, percentage Medicare population), provider supply variables, HPSA and MUA designations, urban/rural categories, and frontier county status. The weights for the models were the county Medicare beneficiary populations for 1997.

The last component of the AAPCC analysis was a comparative analysis of enrollments in Medicare health plans by urban and rural county categories. For this analysis, we merged the data in our analysis file with CMS health plan enrollment data for 1993 and 1997. We examined the percentages of counties with health plans, average enrollments by county category, and average AAPCCs for counties with and without enrollees. Finally, we focused on the subset of health plans with enrollees who resided in rural counties to assess the urban/rural mix of enrollees in those plans.

**Rural Hospital Payment Effects on Medicare Part A per Capita Costs**

To analyze the effects of the Medicare special payment provisions on Part A costs per capita, it was necessary to simulate the payments that rural hospitals would receive in the absence of these special payment provisions. The effect on costs for hospital inpatient services was represented by the difference between the actual payments and adjusted payments from which components related to the special provisions were removed. Effects on total Part A costs were estimated by aggregating to the county level the actual and adjusted payments for hospital services and the costs for other Part A services. Actual and adjusted Part A costs were estimated by summing spending for other Part A services and the actual or adjusted inpatient payments, respectively. The difference between these two amounts represented the effects on Part A costs.

These estimates were developed for 1997, which was the last year the AAPCCs were used for capitation payments for Medicare health plans. We calculated three-year average payments using claims from calendar years 1996, 1997, and 1998 to smooth out volatility in payments for counties with small numbers of beneficiaries. The analysis included all claims for hospital inpatient stays for the 100 percent sample of beneficiaries residing in non-metropolitan counties. Data for the factors used to simulate adjusted payments were obtained from the annual PPS Impact Files for fiscal years 1996 through 1999, and these factors were applied to claims with dates of discharge in the relevant fiscal years. The resulting actual and adjusted payment amounts were analyzed on a calendar year basis.

We simulated adjusted PPS payments only for inpatient claims from hospitals with special payment designations, thus excluding any hospitals reclassified for wage index or standardized amount but not having a special designation. Adjusted payments were simulated for any inpatient stay that was:

- For a Medicare beneficiary residing in a non-metropolitan county;
- Provided by a hospital with special designation as a sole community hospital, rural referral center, both SCH and RRC, or Medicare-dependent hospital;
- Coded as a PPS service;
• A length of stay of greater than one day; and
• Paid by Medicare as primary payer.

To estimate adjusted Medicare payments for qualified claims, the basic payment amount for each claim was simulated, and then the amount paid by Medicare was calculated. The “adjusted” payments for all other claims were set equal to the actual payments. Thus, the adjustments made in simulating payments for hospitals with special designations included removal of amounts attributable to any geographic reclassification that these hospitals had obtained. (These hospitals represented 55.4 percent of all hospitals reclassified for wage index in 1992 and 39.3 percent of those reclassified in 1998 (from Table 4.17).) The payments were calculated according to the following formulas:

\[
M_i = P_{oij} + P_{cij} + L_i - \text{BENECST}_i + \text{PCOST}_{ij} \quad (2.1)
\]

\[
P_{oij} = ((S_l*W_j) + S_n)*\text{COLA}*(1+\text{DSH}_j)*\text{DRGWT}_i \quad (2.2)
\]

where:
- \(M_i\) = Medicare payment amount for claim \(i\);
- \(P_{oij}\) = PPS operating DRG price for claim \(i\) in hospital \(j\);
- \(P_{cij}\) = PPS capital price for claim \(i\) in hospital \(j\);
- \(L_i\) = outlier amount for claim \(i\);
- \(\text{BENECST}_i\) = beneficiary deductibles and coinsurance for claim \(i\);
- \(\text{PCOST}_{ij}\) = pass-through amounts for claim \(i\) at hospital \(j\);
- \(S_l\) = standardized amount for rural/other urban areas—labor portion;
- \(S_n\) = standardized amount for rural/other urban areas—non-labor portion;
- \(W_j\) = hospital wage index for hospital \(j\) for actual location;
- \(\text{COLA}\) = cost of living adjustment (for Alaska and Hawaii);
- \(\text{DSH}_j\) = disproportionate share adjustment for hospital \(j\); and
- \(\text{DRGWT}_i\) = weight for the DRG coded for claim \(i\).

The operating DRG price, \(P_{oij}\), is the component subject to the special Medicare payment provisions for rural hospitals. We simulated this amount using Eq. (2.2), which is the standard formula for calculating the operating DRG price for a PPS inpatient stay. We then calculated the Medicare payment, \(M_i\), using Eq. (2.1) and data from the claim for the actual values of the other payment components (capital price, outlier amounts, beneficiary costs, and pass-through amounts). Although the special payment provisions for disproportionate share also affect outlier payment amounts, \(L_i\), we ignored this cost as a secondary effect because it would be small for any inpatient stay and only 7 percent of claims for rural hospitals with special designations had outlier payments. For the same reason, we did not compute an adjustment for indirect medical education. We also assumed that the beneficiary costs would not be affected by the adjustment of payments because neither the deductibles nor the coinsurance for long inpatient stays are proportional to the simulated operating DRG price.

---

7 We note that the actual amounts on the claims for SCHs and Medicare-dependent hospitals are interim payments, with the final payments determined through the cost report settlement process. Therefore, the actual differences between actual and adjusted payments can be determined only empirically, so the estimated difference derived from these simulations is an approximation of the effect of special payments for these facilities.
All payment amounts were calculated and reported as payments per beneficiary. Using data from the 100 percent denominator files for 1996 through 1998, we derived counts of beneficiaries for each county by summing the number of months of Medicare eligibility and dividing by 12 to obtain person-years of eligibility. Annual and three-year average counts were tabulated by county for all Medicare beneficiaries and for beneficiaries aged 65 or older (elderly beneficiaries) based on values of the Medicare status code on the denominator file records.

**KEY VARIABLES**

Several key variables were defined that we used throughout the analyses, and others were specific to each research area. We describe the variable definitions here, including discussion of relevant measurement or interpretation issues. These variables include measures of the extent of rurality, Health Professional Shortage Areas and Medically Underserved Areas, county-level supplies of health care providers, hospital inpatient utilization and payments, RHC/FQHC utilization and payments, physician bonus payments, and AAPCCs.

**Measures of Underserved Areas**

Designations of counties as underserved areas form an important basis for the analyses performed in this project because many of the Medicare payment policies were established specifically for providers serving these designated areas. The federal government has established MUAs and HPSAs as two distinct designations, although the rules for their designation processes differ (see Section 1 for specifics). For both MUAs and HPSAs, designations may be made for either whole-county or partial-county areas. The ARF contains variables for HPSA designations, including coding for the whole- or partial-county status. We worked with variables for primary care HPSA designations for 1991, 1993, 1995, 1996, and 1997, all of which were available on the ARF. A data file with the MUA designations was obtained from HRSA, and we merged these data into our county-level analytic file. The MUA designations were as of the current date, so we did not have data on historical trends in MUAs.

**Region Groupings**

We grouped the states into HHS regions, which we used because the CMS regional offices and Medicare program administration are organized that way. The states by HHS region are given in Table 2.1.
Table 2.1
Region Groupings

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Variables for County Provider Supply

The data for defining county-level variables for provider supplies were obtained from the ARF. We defined supply measures for the following providers at the county level:

- Patient care physicians, including primary care and specialty physicians;
- General short-term hospital facilities;
- General short-term hospital beds;
- Skilled nursing facilities;
- Skilled nursing facility beds;
- Nursing home facilities, other than skilled nursing;
- Nursing home beds;
- Home health agencies; and
- Rural health clinics.

ARF data for physicians and hospitals were available for several years during the 1990s, but data for skilled nursing facilities, nursing homes, home health agencies, and rural health clinics were available only for 1994. Guided by data availability, physician supply measures were established for 1990, 1993, and 1997, and hospital supply measures were established for 1990, 1993, and 1996.

For each provider supply measure (and year), we established two variables: (1) the number of providers in a county and (2) the ratios of providers per 100,000 population based on the total county population for the year for which the variable was calculated (obtained from the...
The ratios are better measures than simple counts of the availability of providers to a county population. However, they are vulnerable to being inflated in counties with small populations that are the denominators for calculating the ratios. As a result, a rural county with few SNFs may have a much larger ratio of SNFs to population than an urban county with a much larger number of SNFs. We find this effect in our provider supply profiles reported below.

The ARF reports licensed beds, rather than staffed beds. Therefore, these measures overstate facilities’ operational capacities, given the large number of hospitals that do not staff or use the full complement of beds they officially have. Similar issues may exist for SNF and nursing home beds, although to a lesser extent. The comparisons of bed capacities across county categories control somewhat for differences in staffed bed capacities because these capacities are related to their reported licensed capacities. However, these comparisons assume that all hospitals or other types of provider have the same ratio of staffed to licensed beds, which is not likely to be true. A frequently used methodological response to this issue is to use utilization measures such as inpatient census rather than the structural measures of supply. We do not take this approach because we intend these measures to represent the existence and capacity of providers as determinants of service use and costs.

Rural Hospital Characteristics

Ownership Status. The POS file defines eight ownership categories for hospitals based on survey data obtained for the Medicare certification application. These categories include for-profit ownership, three categories for non-profit ownership (church, private, or other), and four categories for government-owned facilities (federal, state, or local government, or independent hospital authority or district). We collapsed these categories into five: for-profit, non-profit, federal or state government, local government, or hospital district/authority.

Hospital Size and Capacity. The measures used to profile the sizes of Medicare-certified hospitals were the bed size and the total staffing, using data from the Medicare POS files. We measured beds as Medicare-certified beds rather than total beds, because this measure is more relevant to utilization by Medicare beneficiaries. The preferred bed size measure is staffed beds, which represent hospitals’ actually operating capacities, but this variable was not available from the POS data. We used total staffing as an alternative measure of operating capacity, measuring it as the number of FTE staff for all categories of staff reported by the hospitals on their survey forms and contained in the POS file. We note that the POS data are only as current as the most recent recertification surveys, which typically are performed every three years and are less frequent for many rural hospitals. Resource constraints prevented us from using other sources of these data, such as hospital cost reports or American Hospital Association (AHA) survey data. We take these limitations into account when interpreting trends in capacity.

Mix of Services Offered. The POS file offers fairly rich information on specific types of services provided by hospitals, including identification of organized units for specialized inpatient services (e.g., psychiatric or physical rehabilitation), number of beds for specified services, and identification that a hospital offers specified services. We selected three measures of specific services that we used to profile hospitals in our analyses: offers home health services, offers hospice services, and has an organized psychiatric inpatient unit. Hospitals in both urban and rural locations moved increasingly into providing these services as traditional inpatient
census declined during the 1990s, accompanied by substantial growth in utilization of all of these services by Medicare beneficiaries.

### Rural Hospital Facility Type

The Provider Specific Files contain a variable that identifies the status of each hospital according to the Medicare special payment designations for rural hospitals. However, the codes used in this variable changed during the time period of the study, as payment policies were changed by Congress or regulations. We derived a new variable that collapsed the sets of codes used in the original variable into a smaller set of codes that were consistent across all years included in the study (1992 through 1998). We defined our new facility designation codes using the crosswalk shown in Table 2.2.\(^8\)

<table>
<thead>
<tr>
<th>RAND Derived Code</th>
<th>Code in Provider Specific File</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no special designation</td>
</tr>
<tr>
<td>1</td>
<td>sole community hospital</td>
</tr>
<tr>
<td>2</td>
<td>rural referral center</td>
</tr>
<tr>
<td>3</td>
<td>Indian Health Service hospital</td>
</tr>
<tr>
<td>4</td>
<td>SCH/rural referral center</td>
</tr>
<tr>
<td>5</td>
<td>Medicare-dependent hospital</td>
</tr>
<tr>
<td>6</td>
<td>Medical Assistance Facility</td>
</tr>
<tr>
<td>7</td>
<td>Essential access community hospital</td>
</tr>
<tr>
<td>8</td>
<td>EACH/rural referral center</td>
</tr>
<tr>
<td>9</td>
<td>Rural primary care hospital</td>
</tr>
<tr>
<td>10</td>
<td>Critical access hospital</td>
</tr>
<tr>
<td>20</td>
<td>other designations for rural hospitals</td>
</tr>
<tr>
<td>30</td>
<td>urban hospitals</td>
</tr>
<tr>
<td>40</td>
<td>emergency hospitals(^9)</td>
</tr>
</tbody>
</table>

**Table 2.2 Facility Designation Codes**

Inpatient Utilization and Spending

The variables for hospital inpatient utilization and spending were obtained from the MEDPAR claims, which provide detail on the reason for hospitalizations and payment amounts.

**Utilization.** We measured utilization using counts of short-term hospital inpatient admissions and the average length of stay. Length of stay was calculated as the number of days

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\(^8\)RPCHs and MAFs are additional categories of rural hospitals with special payment provisions, but we did not analyze them as separate hospital categories because there are so few of them (30 to 75 RPCHs and 4 to 12 MAFs) and they account for a very small share of total Medicare inpatient utilization.

\(^9\)These hospitals are not certified by Medicare but are used on an emergency basis (e.g., military hospitals or hospitals in Canada or Mexico).
from the “first date” and “last date” variables on the MEDPAR file. We also used the DRG codes on the claims to measure case mix as the average of the DRG weights for the claims.

**Spending for Inpatient Stays.** The MEDPAR file provided data on the amounts that Medicare paid for each inpatient stay, as well as on payments by other primary payers and amounts to be paid by beneficiaries. We calculated the following two payment amounts using variables on the MEDPAR claims:

\[
\text{Medicare payment} = \text{DRG payment amount} + \text{cost pass-through amount}.
\]

\[
\text{Total payments} = \text{Medicare payment} + \text{other primary payer payment} + \text{beneficiary service deductible} + \text{beneficiary blood deductible} + \text{beneficiary coinsurance}.
\]

We examine utilization and spending in the aggregate, and we also calculate inpatient use rates and spending per beneficiary (and in some cases per 100 or 1,000 beneficiaries). The denominator for the per beneficiary measures consisted of all beneficiaries residing in each non-metropolitan county, which included both fee-for-service beneficiaries and Medicare health plan enrollees, whereas the MEDPAR claims represent inpatient use only for fee-for-service beneficiaries. Using this denominator underestimated the use and spending rates, but the effect was quite small because Medicare health plan enrollment was very low in non-metropolitan counties. Only 1.6 percent of non-metropolitan beneficiaries were enrolled in Medicare health plans in 1993 and only 3.5 percent were enrolled in 1997 (see Table 7.10).

**Rural Health Clinics and Federally Qualified Health Centers**

**Type of Facility.** The type of clinic (FQHC, provider-based RHC, independent RHC) was determined from the provider identification numbers reported in the POS data, where these facilities were assigned numbers from within a specified range. Many FQHCs are funded as community health centers, migrant health centers, etc., which qualified them for designation as FQHCs (HRSA, 1995). These FQHCs were identified using a variable that codes for type of federal support under PHS provisions; other facilities were defined as the “look alike” providers that met requirements for federal support but did not receive funding. Our examination of these data indicated that receipt of federal program support was being underreported in the POS data.

The POS records are considered to be the “gold standard” with respect to total annual facility counts, but the ARF also includes a variable for the number of Rural Health Clinics in a county for the year 1994. We evaluated the level of agreement between clinic counts generated from the POS files and the aggregate variable in the ARF. This comparison showed that counts of clinics were somewhat higher from the 1994 POS files than from the ARF data. The POS file contained 827 provider-based RHCs and 1,318 independent RHCs, for a total of 2,145 clinics. In contrast, the ARF reported a national total of 2,032 RHCs for 1994.10

---

10 This discrepancy may be due to overcounts in the POS files because not all facilities that have stopped operation are reported to CMS. Further, some organizations with multiple clinic locations have separate provider numbers for the individual clinics (personal communication with CMS staff). In addition, the criteria we used include all
The count of certified facilities also was compared to the counts of total Rural Health Clinics with one or more Medicare beneficiary visits, generated from the claims data. From the claims data, we tabulated the number of clinics that provided services to one or more Medicare beneficiaries in the 5 percent sample through the FQHC/RHC program. The claims for the 5 percent sample of beneficiaries underestimate the total number of facilities providing services as FQHCs or RHCs because some facilities did not serve any beneficiaries in the 5 percent sample even though they did serve other beneficiaries. Thus, our analyses of utilization and costs are limited to population-based measures, for which the sample is well suited.

Differences in facility counts obtained from the 1994 POS file and provider claims for the 5 percent sample are reported in Table 2.3. As expected, the total number of facilities identified as providing services to Medicare beneficiaries in the 1994 5 percent sample was smaller than the total number of certified facilities for that year. In 1994, 1,434 certified FQHCs were in the POS file, compared to 1,078 FQHCs identified as having one or more paid Medicare claims for the 5 percent beneficiary sample. This includes FQHCs in urban and in non-urban areas. Further analyses of the 100 percent claims files would be required to identify certified facilities that did not have any claims in 1994.

**Clinic Ownership Status.** The POS defines nine ownership categories for RHCs based on survey data obtained for the RHC application. These categories include both for-profit and non-profit ownership, which are subset to individual, corporation, and partnership categories, as well as three additional categories for government facilities (state, local, or federal). We collapsed these categories into three categories of for-profit, non-profit, and government (public) operated.

<table>
<thead>
<tr>
<th>Data Source</th>
<th>FQHCs</th>
<th>Provider-based RHCs</th>
<th>Independent RHCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider of Service file</td>
<td>1,434</td>
<td>827</td>
<td>1,318</td>
</tr>
<tr>
<td>Claims for 5 percent sample</td>
<td>1,078</td>
<td>727</td>
<td>1,098</td>
</tr>
</tbody>
</table>

**NOTES:** Claims were found in the 5 percent sample file for additional facilities not in the POS file.

*aIncludes all FQHCs in metropolitan and non-metropolitan counties.*

Fewer ownership categories apply for FQHCs because for-profit facilities may not be designated as FQHCs. The full set of FQHC categories includes religious affiliated, private, other, proprietary, state/county government, and combined government and voluntary. We collapsed these categories into private (including religious affiliated, private, and proprietary), government (state-county and combined government and voluntary), and other.
RHC and FQHC Utilization and Costs

The utilization rate variables were the estimated number of beneficiaries residing in non-metropolitan counties with at least one claim for RHC or FQHC services, expressed as a percentage of the total beneficiaries residing in the counties in which users resided. The data on user counts and payments for RHC and FQHC services were obtained from the Medicare institutional outpatient claims for the 5 percent sample of beneficiaries. Therefore, we multiplied the counts of users by 20 before dividing by total beneficiary counts.

The two variables analyzed for our cost analysis were the Medicare payment amount and the total allowed payment. The total payment was calculated as the sum of the Medicare payment amount, amount paid by a primary payer, and payments by the beneficiary for service deductible, blood deductible, and coinsurance. Data for these payment components were extracted from the institutional outpatient claims.

Two different denominators were used to calculate per capita payments. The first was the counts of beneficiaries residing in counties of residence for clinic users from the CMS summary files, which is the same as the denominator used for the utilization variable. The second denominator, also derived from the CMS summary files, was the total number of beneficiaries residing in each category of counties for which the RHC and FQHC claims were aggregated in the analysis. This denominator allowed us to derive per capita payments that are normalized to the entire Medicare population, which we measured as payments per 100 beneficiaries. With this constant denominator, we could sum the per capita payments for the three types of clinics to obtain total costs per 100 beneficiaries across these facilities. Using all beneficiaries residing in a non-metropolitan county slightly underestimated the use and spending rates, as discussed above under hospital use rates, but the effect on estimates was small.

Physicians and Other Practitioners

Physicians Eligible for Bonus Payments. The enabling legislation for incentive payments authorizes bonus payments only for physician services, i.e., services provided by medical doctors, doctors of osteopathy, dentists, podiatrists, licensed chiropractors, and optometrists. This analysis used Medicare physician/supplier claims for the 5 percent sample of beneficiaries. We list in Table 2.4 all of the provider specialty codes used to identify claims for physician services that are potentially eligible for a bonus payment under the legislation (if provided in a HPSA). Only claims with one of these specialty codes were included in our analyses.

Primary Care Physicians and Other Specialties. One aim of this report is to replicate and extend analyses of the bonus payment program conducted by other studies, both to understand how those measures of program performance have changed over time and to validate our analyses. Both the PPRC (1994b) and the GAO (1999) examined the proportion of bonus payments distributed to physicians by specialty. In their analyses, they grouped physicians by whether their specialty was considered a primary care specialty or not. They included general practice (CMS specialty code “01”), family practice (“08”), and internal medicine (“11”) in the category of primary care physician specialties. All other specialties were grouped together as “other” specialties.
Table 2.4
Medicare Specialty Codes Used to Identify Physician Claims Eligible for the Medicare Bonus Payments

<table>
<thead>
<tr>
<th>Code</th>
<th>Specialty Code</th>
<th>Specialty Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>General Practice</td>
<td>25 Physical Medicine/ Rehabilitation</td>
</tr>
<tr>
<td>02</td>
<td>General Surgery</td>
<td>26 Psychiatry</td>
</tr>
<tr>
<td>03</td>
<td>Allergy/Immunology</td>
<td>28 Colorectal Surgery</td>
</tr>
<tr>
<td>04</td>
<td>Otolaryngology</td>
<td>29 Pulmonary Diseases</td>
</tr>
<tr>
<td>05</td>
<td>Anesthesiology</td>
<td>30 Diagnostic Radiology</td>
</tr>
<tr>
<td>06</td>
<td>Cardiology</td>
<td>33 Thoracic Surgery</td>
</tr>
<tr>
<td>07</td>
<td>Dermatology</td>
<td>34 Urology</td>
</tr>
<tr>
<td>08</td>
<td>Family Practice</td>
<td>35 Chiropractic</td>
</tr>
<tr>
<td>10</td>
<td>Gastroenterology</td>
<td>36 Nuclear Medicine</td>
</tr>
<tr>
<td>11</td>
<td>Internal Medicine</td>
<td>37 Pediatric Medicine</td>
</tr>
<tr>
<td>12</td>
<td>Osteopathic Manipulative Therapy</td>
<td>38 Geriatric Medicine</td>
</tr>
<tr>
<td>13</td>
<td>Neurology</td>
<td>39 Nephrology</td>
</tr>
<tr>
<td>14</td>
<td>Neurosurgery</td>
<td>40 Hand Surgery</td>
</tr>
<tr>
<td>16</td>
<td>Obstetrics/Gynecology</td>
<td>44 Infectious Disease</td>
</tr>
<tr>
<td>18</td>
<td>Ophthalmology</td>
<td>46 Endocrinology</td>
</tr>
<tr>
<td>19</td>
<td>Oral Surgery (dentists only)</td>
<td>48 Podiatry</td>
</tr>
<tr>
<td>20</td>
<td>Orthopedic Surgery</td>
<td>66 Rheumatology</td>
</tr>
<tr>
<td>22</td>
<td>Pathology</td>
<td>70 Clinic or Other Group</td>
</tr>
<tr>
<td>24</td>
<td>Reconstructive Surgery</td>
<td>Practice</td>
</tr>
</tbody>
</table>


We examined trends in distributions of basic payments and bonus payments to physicians by this primary/other specialty care designation. We also looked separately at payments for each type of primary care specialty as well as for general surgeons, cardiologists, and gynecologists.

Non-Physician Practitioners. Although non-physician practitioners are not eligible for the bonus payment program, they are important providers of primary care services in underserved regions of the country. For these analyses, we used Medicare specialty codes to define non-physician practitioners to include physician assistants (specialty code “97”), nurse practitioners (“50”), certified nurse midwives (“42”), certified clinical nurse specialists (“89”), and certified nurse anesthetists (“43”).

Primary Care Services

To examine the distributions of bonus payments according to the types of services being provided (as opposed to the type of provider), we coded each physician/supplier claim line item as a primary care service or other type of service. We identified primary care services using the definition of primary care services outlined in OBRA-87. The legislation defines primary care services as “physicians’ services which constitute office medical services, emergency department services, home medical services, skilled nursing, intermediate care, and long-term care medical services, or nursing home, boarding home, domiciliary, or custodial care medical services.” These services are categorized as Evaluation and Management services (AMA, 1997). Table 2.5 lists the services considered primary care and their corresponding HCPCS codes. These codes are found in the Level I HCPCS and those corresponding to the listed service types were
identified in the claims data and coded as primary care services. All other physician claims were categorized as “other” services.

<table>
<thead>
<tr>
<th>Service Description</th>
<th>HCPCS Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office or Other Outpatient Visit; New Patient</td>
<td>99201-99205</td>
</tr>
<tr>
<td>Office or Other Outpatient Visit; Established Patient</td>
<td>99211-99215</td>
</tr>
<tr>
<td>Emergency Department Visit</td>
<td>99281-99288</td>
</tr>
<tr>
<td>Comprehensive Nursing Facility Assessments</td>
<td>99301-99303</td>
</tr>
<tr>
<td>Subsequent Nursing Facility Care</td>
<td>99311-99313</td>
</tr>
<tr>
<td>Domiciliary, Rest Home (e.g., Boarding Home), or Custodial Care Services; New Patient</td>
<td>99321-99323</td>
</tr>
<tr>
<td>Domiciliary, Rest Home (e.g., Boarding Home), or Custodial Care Services; Established Patient</td>
<td>99331-99333</td>
</tr>
<tr>
<td>Home Services; New Patient</td>
<td>99341-99343</td>
</tr>
<tr>
<td>Home Services; Established Patient</td>
<td>99351-99353</td>
</tr>
</tbody>
</table>


Medicare Payments for Physicians

**Basic Payments.** Basic Medicare payments were defined as the amounts paid by Medicare, as reported in the line item payment amounts in the physician/supplier claims for 1992, 1994, 1996, and 1998. (The total allowed charges, also on the claim, included the coinsurance amount for which beneficiaries were liable.) Line item payments were summed across all physician claims for the 5 percent sample of beneficiaries and then multiplied by 20 to approximate the basic Medicare payments made to physicians for services provided to all rural beneficiaries. Because Medicare carriers are required to process bonus payments separately from claims, the physician claims do not include the bonus payment amounts.

**Bonus Payments.** For eligible physician services (i.e., provided in a HPSA), bonus payments are calculated as 10 percent of the Medicare payment amount. To be eligible for the bonus payment, a physician must include a HCPCS code modifier on the claim form to indicate the service was provided in a rural or urban HPSA (modifiers “QB” and “QU”). Therefore, to calculate the total bonus payments made in each year, we first identified all physician claims with the appropriate modifier in the physician/supplier claims. Then we multiplied the Medicare payment amount by 0.1 to estimate the bonus payment. These bonus payments were summed for the 5 percent sample of claims, and the sum was multiplied by 20 to estimate the total bonus payments made to all physicians providing services to beneficiaries residing in non-metropolitan counties.

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11 Beneficiaries in non-metropolitan counties obtained some services in urban HPSAs. As a result, somewhat less than 1 percent of the claims with a bonus payment modifier were coded for services provided in urban HPSAs. These payments are included in the total amounts examined in the analyses.
County Capitation Rates

We described and compared trends in Medicare AAPCC capitation rates for urban and rural counties, and among categories of rural counties. Each year through 1997, the CMS actuary calculated the county-level AAPCC rates at 95 percent of the adjusted average per capita cost for previous years (five-year averages) for Medicare fee-for-service beneficiaries residing in each county. We used the AAPCC rates that CMS established for Medicare Part A and Part B services for calendar years 1988 through 1997. To develop a comprehensive picture of how county AAPCC rates varied over time, and the extent to which trends differed for rural and urban counties, we examined the three measures described here.

Average Levels of the AAPCCs. A total AAPCC rate was calculated for each county as the sum of the county’s Part A and Part B AAPCC rates. When calculating average AAPCCs for groups of counties, we weighted the averages by the number of Medicare beneficiaries residing in each county, because these beneficiaries were candidates for health plan enrollment (if a plan was offered). For the enrollment analysis, we also weighted some of the average AAPCC rates by the number of Medicare health plan enrollees in a county to compare the average rates for total beneficiaries and plan enrollees.

Part A Share of AAPCC Rates. The Part A AAPCC rate was measured as a percentage of total AAPCC. This measure was used to explore the extent to which the AAPCCs reflected shifts of service mix from inpatient to outpatient care that occurred during this past decade.

Volatility in Total AAPCC Rates. We defined absolute volatility as the four-year average of absolute differences between the reference year and two years before and after it, and relative volatility as this four-year average difference as a percentage of the average AAPCC for the five years. The measures of AAPCC volatility were calculated for each of the years 1990 through 1995 using Eq. (2.3):

\[
\text{Relative volatility}_0 = \frac{\sum \left| A_i - A_0 \right| / 4}{\sum A_i / 5}
\]

for \( i = -2, -1, 0, +1, +2 \) (2.3)

where: \( A_i = \) AAPCC rate for year \( i \); and
\( A_0 = \) AAPCC rate for the reference year.

For example, AAPCCs for 1988 through 1992 were used to calculate the volatility measure for 1990. The numerator for the measure is the sum of the absolute deviations of the 1988, 1989, 1991, and 1992 AAPCCs from the five-year average AAPCC for 1988 through 1992. The denominator was the five-year average AAPCC. These standardized measures of relative volatility can be compared across years because they control for increases in the AAPCC levels over time. Averages of the AAPCC volatility measures are weighted by the number of Medicare beneficiaries residing in each county.

These AAPCC analyses applied and extended many of the techniques used by PPRC in its analyses of the Medicare AAPCCs, including calculation of indices of the five-year average volatility in the AAPCC rates for each year (PPRC, 1995). Our approach was to look
independently at each year to assess the extent of financial risk for health plans related to uncertainty in the next year’s AAPCC rates.

This measure of volatility differs from that used by McBride et al. (1997). They defined local volatility for the 1990 to 1997 time period as the nominal growth in AAPCC less the Consumer Price Index, that is, an inflation-adjusted measure of growth in per capita Medicare costs. They report the average absolute deviation in local volatility over the time period rather than fluctuations at specified points in time.