Cornell University
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MEDICARE CHIROPRACTIC SERVICES DEMONSTRATION

FINAL DESIGN REPORT

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Final Design Report

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The opinions, conclusions, and errors in this report are the sole responsibility of the authors, and do not represent the official views of CMS, The Medstat Group, or Cornell University.

I. Introduction and Background

The Centers for Medicare and Medicaid Services (CMS) has designed a demonstration to test an expansion in the services provided by chiropractors under Medicare – the Medicare Chiropractic Services Demonstration. Chiropractic services are defined, at a minimum, as care for neuromusculoskeletal conditions typical among eligible beneficiaries, and diagnostic and other services that a chiropractor is legally authorized to perform by the State or jurisdiction in which such treatment is provided.

Under current law, Medicare coverage for chiropractic care is limited to manual manipulation of the spine to correct a subluxation, which chiropractors define as a malfunction of the spine. Treatment must be provided for an *active* subluxation, not for prevention or maintenance. Treatment for the subluxation must be related to a neuromusculoskeletal condition where there is a reasonable expectation of recovery or functional improvement. Chiropractors are required to document the patient's complaint and establish a treatment plan, which includes the expected duration and frequency of treatment, specific goals and measures of effectiveness. This information must be maintained in the medical record and made available to Medicare upon request. Patients do not need a medical physician referral for treatment by a chiropractor under fee-for-service, however, some Medicare+Choice plans may require an enrollee to obtain a referral before seeing a chiropractor.

Previous research on the cost-effectiveness of chiropractic care is inconclusive. A number of studies indicate that access to chiropractic care can reduce health care utilization and expenditures associated with back pain. These studies also find that users of chiropractic care experience greater satisfaction with care than users of conventional therapies. The findings of some of these studies are limited by their methodologies, however, which compare users and non-users of chiropractic care and thus, are subject to potential selection bias.[1, 2] At least one study (Muse & Associates, 2001) focused on estimating the effect of chiropractic care on Medicare enrollees, finding that users of chiropractic care experienced lower overall health expenditures than those who visited other types of physicians. Again, however, the study focused the comparison of costs and utilization on users and non-users, limiting the overall conclusions that might be drawn about the cost-effectiveness of chiropractic care.

Section 651 of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 directs CMS to conduct a demonstration to evaluate the feasibility and value of expanding coverage of chiropractic services under Medicare to include services that go beyond the current coverage of treatments for correction of subluxation of the spine. Physician approval would not be required for these services.

The Act specifies that the demonstration be conducted at four sites: two rural and two urban. One site of each type must constitute a primary care geographic health professional shortage area

[1] Selection bias may arise if users of chiropractic care are, in general, healthier or otherwise differ systematically from non-users in key ways that are correlated with lower health care expenditures or other study outcomes of interest. Even when methods are used to control for observed differences between users and non-users, studies that compare users and non-users may not adequately control for selection due to unobserved differences between the two groups.

[2] See AHCPR (1994), Cherkin and Mootz (1997), Legorreta et al. (2004), and American Chiropractic Association (undated) for reviews of the cost-effectiveness literature.

(HPSA). In addition, the demonstration is to include all Part B beneficiaries utilizing providers located in the selected study sites, including those enrolled in Medicare+Choice plans.

The demonstration will last for two-years and must be designed to be cost-neutral. An evaluation of the demonstration will be conducted to assess cost-effectiveness, beneficiary satisfaction, and other issues deemed important by CMS. The findings of the evaluation must be presented in a report to Congress no later than one year after the completion of the demonstration. CMS anticipates commencing the demonstration in April 2005.

In this report, we present the design for the Medicare Chiropractic Services Demonstration. The report is organized as follows:

In ***Section II***, we describe the overall demonstration design, including the selection of study sites, sample sizes, the additional diagnoses and services to be covered by the demonstration, and the method for insuring cost neutrality of the demonstration.

In ***Section III***, we describe the evaluation issues of interest, potential sources of data that might be used by the evaluator to address the evaluation issues, and the potential analyses that might be conducted. We recognize that CMS will be issuing a solicitation for an evaluation contractor, which will address these issues in detail.

In ***Section IV***, we highlight implementation issues relevant to the demonstration, and CMS' planned approach for addressing them.

II. Demonstration Design

A. Overview of Study Design

The Medicare Chiropractic Services Demonstration is designed to evaluate whether expanding the types of services that may be provided by chiropractors leads to reduced health care expenditures among Medicare enrollees with selected neuromusculoskeletal conditions.

The demonstration will be implemented in four sites: Maine, New Mexico, a portion of Illinois (including one adjacent county in Iowa), and a portion of Virginia. Chiropractic service providers located in the demonstration areas will be permitted to provide an expanded set of chiropractic services to Medicare beneficiaries with covered diagnoses who seek their services. The demonstration will operate for two years, beginning in April 2005.

The evaluator will likely use one or more comparison groups for the impact evaluation. One potential source for a comparison group is beneficiaries in earlier years, residing in the demonstration areas. A second is beneficiaries residing in comparison areas.

The health care service utilization and total Medicare expenditures of treatment and comparison beneficiaries can be compared using Medicare claims and enrollment data, Options for comparisons include: pre-post differences (i.e., changes in outcomes in the demonstration area from the pre-demonstration period to the demonstration period); contemporaneous differences (i.e., differences in outcomes for demonstration beneficiaries and contemporaneous beneficiaries in the comparison areas); and difference-in-differences (contemporaneous differences during the demonstration years minus contemporaneous differences in one or more pre-demonstration years). The evaluation will also assess beneficiary satisfaction, using data collected via a beneficiary survey, and will potentially assess process issues related to the implementation of the demonstration using data collected via stakeholder interviews.

In the remainder of this section, we provide the details of the demonstration design. In Section III, we describe analyses that may be conducted for the evaluation.

B. Covered Diagnoses and Services

Under the demonstration, chiropractors located in the four demonstration areas may be reimbursed for delivering certain diagnostic and other services related to the treatment of neuromusculoskeletal conditions that they are legally permitted to provide according to their state practice acts. The demonstration will expand the services chiropractors are allowed to provide for the treatment of neuromusculoskeletal conditions, but not for other conditions. The Medicare patient's diagnosis must be one of the diagnoses listed in ***Appendix C***.

Chiropractic services must be related to active treatment, not maintenance or prevention. This follows current Medicare coverage for similar services, such as physical therapy. Medicare does not authorize payment for maintenance therapies for other providers. All claims under the demonstration must have the active therapy (AT) modifier.

Under the demonstration, chiropractors can:

- provide plain x-rays, electromyography (EMG) tests; and nerve conduction studies;
- order magnetic resonance imaging (MRI) scans and computed tomography (CT) scans; and
- order or provide laboratory tests(where the applicable State practice act permits chiropractors to provide these services). These diagnostic services must be related to the diagnosis and treatment of neuromusculoskeletal conditions. No limits will be imposed on chiropractors for providing diagnostic services, unless limits exist for other providers delivering these services.

The demonstration will cover CPT code 98943 for extraspinal manipulation, as it is a recognized procedure for treating neuromusculoskeletal conditions. It will also expand coverage to include other services chiropractors are legally allowed to provide and Medicare currently covers. These procedures include electrotherapy, ultrasound, transcutaneous electrical nerve stimulation (TENS) therapy, and other services that are medically necessary for the treatment of neuromusculoskeletal conditions. Chiropractors delivering these services will be subject to the same payment policies as other Medicare clinicians currently delivering these services.[3] Chiropractors will also be allowed to make referrals for these therapy services.

Under the demonstration, chiropractors will also be reimbursed for evaluation and management (E&M) services delivered for neuromusculoskeletal conditions. Chiropractors will be allowed to bill Medicare for treatment in addition to an E&M visit on the same day the first time they assess a patient, and thereafter only when they assess a patient for a new, separate problem not currently being treated. The current E&M CPT codes will apply.

Current Medicare coverage for chiropractic services--codes 98940, 98941, and 98942-- remains unchanged, however, chiropractors must submit separate claims for these services and demonstration services. Services provided under the demonstration will be processed as a regular fee-for-service claim.

[3] These requirements can be found in the Medicare Benefit Policy Manual 100-2 in Chapter 15, Sections 220 and 230 and the Medicare Claims Processing Manual 100-4 in Chapter 4, Section 20 and other manual sections.

C. Study Sites and Sample Sizes

1. Demonstration Site Selection

The legislation authorizing the demonstration outlines the following minimum criteria for the demonstration sites:

- Four sites – two urban, two rural.
- One of each urban/rural type must be a geographic, primary care Health Professional Shortage Area (HPSA).

Based on a review of information on Medicare chiropractic services, input provided to CMS by the American Chiropractic Association (ACA), and discussions with CMS, the following additional criteria were considered in the site selection:

- Treatment and comparison beneficiaries should be from the same carrier to control for differences in chiropractic claims processing and utilization management procedures.
- Spatially large, contiguous treatment areas are preferred over smaller areas pieced together from non-contiguous sub-state areas to minimize the number of beneficiaries from comparison areas who obtain services from demonstration-area providers.
- Treatment and comparison sites should not be contiguous, to avoid use of demonstration area providers by comparison-area beneficiaries.
- States with chiropractic practice regulations that deviate substantially from the norm should be avoided.
- States that will not have transitioned to the MCS claims system in time for the demonstration should be avoided.
- States that are in the extreme (high or low average values) in terms of utilization, costs, and/or provider supply should be avoided. The following factors were considered in determining high or low values:
    - Medicare per capita claims costs
    - Medicare per capita chiropractic costs
    - Per user (patient) chiropractic costs based on carrier data
    - Chiropractic service users as a percentage of Part B beneficiaries
    - Chiropractors per 10,000 state population
    - Chiropractors per 1,000 Part B beneficiaries

After applying the above criteria in the manner described in ***Appendix A***, CMS selected the following four areas as the demonstration sites:

- the state of New Mexico;
- the state of Maine;
- the northern portion of Illinois, which includes the Chicago, Rockford, and Davenport/Moline/Rock Island Metropolitan Statistical Areas (MSAs). This area includes the following 27 counties: Boone, Bureau, Carroll, Cook, DeKalb, DuPage, Grundy, Henry, Jo

Daviess, Kane, Kankakee, Kendall, LaSalle, Lake, Lee, Marshall, McHenry, Mercer, Ogle, Putnam, Rock Island, Stark, Stephenson, Whiteside, Will, and Winnebago in Illinois, plus Scott County, IA;[4]

- 17 central counties/independent cities in Virginia, located in the Richmond, Charlottesville, Lynchburg, and Danville MSAs. This area includes the following counties and independent cities: Amelia, Appomattox, Buckingham, Campbell, Caroline, Cumberland, Danville City, Fluvanna, Goochland, Hanover, Henrico, Louisa, Nelson, New Kent, Pittsylvania, Powhatan, and Richmond City.

In ***Exhibit II.1***, we provide a description of the sites. Only chiropractors providing services in the above geographic areas will be eligible to participate in the demonstration. Beneficiaries are not required to live in these areas to receive demonstration services. In ***Appendix B***, we provide the zip codes associated with the Illinois and Virginia demonstration areas. The number of beneficiaries in each area during the demonstration will likely be somewhat larger than indicated in the exhibits because of population growth, as well as a technical issue related to the availability of data on beneficiaries residing in HPSAs.

[4] Scott County, Iowa is part of the Davenport/Moline/Rock Island MSA. This MSA was included in the demonstration because it offered the opportunity to include an area with a high chiropractor-to-beneficiary ratio, and thus increase the diversity of the demonstration sites.

Exhibit II.1
Demonstration Site Characteristics

Demonstration Site	Site Type	Estimated Number of Part B Beneficiaries*						Estimated No. of Chiropractors***
		Rural Non-HPSA	Rural HPSA	Urban Non-HPSA	Urban HPSA	Total	M+C**	
Northern Illinois+	Urban	60,193	7,282	973,949	38,615	1,080,039	53,642	2,566
Virginia Counties	Urban HPSA	0	1,832	84,148	29,941	115,921	322	102
New Mexico	Rural HPSA	58,198	55,712	83,016	26,545	223,471	39,930	260
Maine	Rural	90,967	5,791	107,497	3,916	208,172	87	279
All Sites Combined		209,358	70,617	1,248,610	99,017	1,627,603	93,981	3,207

* Based on September 15, 2004 data on Health Professional Shortage Areas from the Health Resources and Services Administration (HRSA), and Part B beneficiary data from HRSA's Primary Care Service Area (PCSA) database and the 2003 Area Resource File.

**Based on June 2004 data from CMS at http://www.cms.hhs.gov/healthplans/statistics/mpsct/ accessed September 13, 2004.

*** Based on data from the 2003 Area Resource File.

+ Demonstration area includes Scott County, Iowa.

2. Comparison Beneficiaries

The evaluator is likely to compare Medicare costs and utilization for selected "treatment" beneficiaries residing in the demonstration areas during the demonstration period to those of comparison beneficiaries residing in comparison areas and/or residing in the demonstration areas in earlier years. Treatment and comparison beneficiaries may be selected on the basis of relevant diagnoses, as reported in Medicare claims data. In addition, the evaluator may use a matching methodology to select comparison group samples that are similar to the treatment group sample on several potential characteristics available from administrative data, and matched information about area characteristics obtained from various public sources:[5]

- Age;
- Sex;
- Covered diagnoses (see next section);
- Covered diagnoses in the pre-demonstration year;
- Pre-demonstration chiropractic service use;
- Pre-demonstration Medicare expenditures;
- Urban/rural area of residence;
- Primary care geographic HPSA/non-HPSA area residence;
- Characteristics of the county of residence that might affect chiropractic service utilization (racial/ethnic composition; percent in poverty or income per capita; chiropractors per thousand population); and
- Claims carrier serving the beneficiary's state of residence.

As part of the process of selecting the demonstration areas, CMS also selected an appropriate set of comparison areas -- areas that are served by the same carriers as the demonstration sites and have been determined to be comparable to the demonstration sites in other respects (***Exhibit II.2***). Technical issues related to the selection of the treatment and comparison samples are discussed in Section III.

One notable feature of the treatment group is that it will include beneficiaries who do not receive chiropractic services during the demonstration period. All included beneficiaries will have diagnoses from other claims that are comparable to those observed on chiropractic claims. The reason for including those served by other providers is related to the expectation that demonstration services are likely to increase the share of such beneficiaries that obtains chiropractic services. One cannot determine which beneficiaries from the comparison areas would use chiropractic services with certainty were the new benefit available in their area. To make unbiased comparisons, the evaluator must compare all beneficiaries with relevant diagnoses.

[5] Public sources of information on area characteristics of relevance to the evaluation include: provider and beneficiary characteristic data from the Area Resource File; HRSA data on geographic HPSAs; Medicare data on managed care enrollment; and Census data on socio-demographic and urban/rural characteristics.

Exhibit II.2
Sources of Within-Carrier Comparison Beneficiaries, by Demonstration Area and Site Type

Demonstration Sites	States with Potential Comparison Sites			
	Rural Non-HPSA	Rural HPSA	Urban Non-HPSA	Urban HPSA
Northern Illinois Counties*	ID, NC, TN, IL	ID, NC, TN, IL	ID, NC, TN, IL	ID, NC, TN, IL
Virginia Central Counties	*na*	VA, TX	DE,TX, VA	TX
New Mexico	AR, OK, NV	AR, OK, NV	AR, OK, NV	AR, OK, NV
Maine	NH, VT	NH, MA, VT	NH, MA	MA, VT

*Comparison beneficiaries for Scott county, IA beneficiaries might be identified in other parts of Iowa, or in other states sharing the same carrier as Iowa (e.g., CO, ND, SD).

3. Sample Sizes and Precision Estimates

In ***Exhibit II.3***, we present estimated samples sizes and minimum detectible effects for the four demonstration sites combined, and for areas of each of the four types (urban/rural, HPSA/non-HPSA). The beneficiary sample size estimates in the exhibit assume that all beneficiaries residing in an area of a given type (e.g., a rural HPSA area) will be pooled together for analysis purposes, regardless of the state or area in which the beneficiary resides. For example, the state of New Mexico has areas of the state corresponding to all four geographic area types. Although the entire state of New Mexico was selected to represent a rural HPSA site, the claims information for beneficiaries residing in areas of the state that are not rural HPSAs may also be used to boost sample sizes and increase precision in the other three geographic categories for purposes of analyses that attempt to estimate the impact of the demonstration by site type.

The minimum detectable effect (MDE) is the smallest effect on mean Medicare expenditures for relevant services provided to "users" (i.e., beneficiaries who use chiropractic services under the expanded benefit) that can be detected with a probability of 80 percent, given a reasonable set of assumptions about the data and statistical methodology; larger effects will be detected with a higher probability.[6] The MDEs are expressed as a percentage of what mean expenditures for users would be under the current benefit, and apply, at least approximately, to any selected set of services (e.g., all services to treat covered conditions; back surgery; all Part B services; all Medicare services). Thus, if the MDE is 5.0 percent and mean expenditures on the selected set of services would be $500 in the absence of the expanded benefit, then the MDE is equivalent to an average effect of $25. MDEs are reported for each area type and for all areas together. Details on the assumptions, calculation of the MDEs, and estimates for those who actually utilize chiropractic services appear in Section III. Further information is provided in ***Appendix A***.

[6] The assumption is that all impacts are on impacts for beneficiaries who use chiropractors under the expanded coverage. This includes possible changes in expenditures for those who would use chiropractic services under the existing benefit as well as expenditures for those who would use chiropractic services only under the expanded coverage. The estimated MDE for users depends on the utilization rate – the percentage of treatment beneficiaries that uses chiropractic services. We have assumed a value of 25 percent. The MDEs may appear large given the number of users, but this is because it is not possible to determine who the users of chiropractic services would be in the comparison areas *under the new benefit*. Hence, the evaluation will have to first estimate the impact on all treatment beneficiaries (whose counterparts can be observed in the comparison areas), then divide by the utilization rate for treatment beneficiaries to infer the impact on users. If we could identify who the users in the comparison areas would be under the new benefit, the MDEs would be much lower.

Exhibit II.3
Estimated Demonstration Sample Sizes and Minimum Detectible Effects, by Area Type*

Area Type	Estimated Number of Treatment Beneficiaries	Estimated Number of Users	Range for Minimum Detectable Effect as Percentage of Mean Expenditure	
			Minimum	Maximum
Rural	31,000	7,750	14.7%	24.5%
Rural HPSA	11,000	2,750	24.6%	41.1%
Urban	187,000	46,750	6.0%	10.0%
Urban HPSA	15,000	3,750	21.1%	35.2%
All Sites Combined	244,000	61,000	5.2%	8.7%

*Based on September 15, 2004 data on Health Professional Shortage Areas provided by the Health Resources and Services Administration (HRSA), and data available in the 2003 Area Resource File. Assumes 15 percent of demonstration area beneficiaries will have covered conditions and 25 percent of that group will use chiropractic services. See Section III for further details on the derivation of the MDEs.

D. Budget Neutrality

The Act requires CMS to ensure that the aggregate provider payments made under the Medicare program do not exceed the amount that would have been paid under the Medicare program in the absence of the demonstration. Ensuring budget neutrality requires that CMS develop a strategy for recouping funds should the demonstration incur costs.

CMS plans to evaluate budget neutrality and recoup any excess costs associated with the demonstration based on the findings of the impact analyses described in further detail in ***Section III*** of this report. In general, the methodology will involve a comparison of total Part A and Part B Medicare costs for the two years prior to the demonstration (April 2003 – March 2005) to the costs during the two years of the demonstration (April 2005 – March 2007) for Part B beneficiaries residing in the demonstration areas with any of the diagnoses listed in ***Appendix C***. The pre-post change in costs for demonstration beneficiaries will be compared to an analogous pre-post change in costs for a comparison group of Part B beneficiaries residing in comparison areas. The difference in the change in costs between the demonstration and comparison beneficiaries will be attributed to the demonstration. An independent evaluation contractor will be selected by CMS to conduct the analysis of claims and budget neutrality.

If, based on the estimated impact of the demonstration on Medicare Part A and Part B costs, the demonstration is deemed not to be cost neutral, CMS plans to recoup the excess costs via payments made to all Medicare chiropractic service providers. Because it will take approximately two years to complete the claims analysis, CMS anticipates that any necessary reduction will be made in the 2010 and 2011 fee schedules. If CMS determines that the adjustment for budget neutrality would be greater than two percent of the chiropractor fee schedule, it will implement the adjustment over a two-year period. CMS will include the detailed analysis of budget neutrality and the proposed offset in the 2009 *Federal Register* publication of the physician fee schedule.

III. Data Collection and Evaluation

The legislation authorizing the demonstration requires CMS to conduct an evaluation that will:

- determine whether eligible beneficiaries who use chiropractic services use a lesser overall amount of items and services for which payment is made under the Medicare program than eligible beneficiaries who do not use such services;
- determine the cost of providing payment for chiropractic services under the Medicare program; and
- determine the satisfaction of eligible beneficiaries participating in the demonstration projects and the quality of care received by such beneficiaries.

In addition, CMS may evaluate other issues that it deems appropriate.

In the sections below, we describe: specific issues that might be addressed in the evaluation of the demonstration; that data that can be used to address the evaluation issues; and specific analyses that might be conducted.

A. Evaluation Questions

As noted previously, the purpose of the study is to test the feasibility and effectiveness of implementing an expansion in the Medicare-covered services that chiropractors are permitted to provide to beneficiaries. Given the nature of the intervention and the goals of CMS in implementing the demonstration, the objective of the evaluation will be to collect and analyze information on the demonstration in a manner to potentially address the following broad questions:

1. Do chiropractors offer and provide expanded services to beneficiaries?
2. Do Medicare beneficiaries utilize the expanded services provided by chiropractors?
3. How does the demonstration affect beneficiary health care utilization and Medicare expenditures?
4. How satisfied are beneficiaries who use chiropractic services for covered diagnoses in the demonstration areas?
5. What is the net impact of the new coverage on net Medicare program expenditures?
6. What are the other benefits and costs of the expansion in coverage?

The study questions and objectives can be conceptualized in the framework presented as ***Exhibit III.1***. In this framework, the *direct effects* represent the direct actions or results of the demonstration. These are the means by which the demonstration produces the intended final outcomes, and include provider delivery of services and beneficiary participation. If the initiative fails to produce these direct effects, it presumably cannot work, at least according to the assumptions underlying the means that will lead to the desired outcomes.

If direct effects are substantial, they can have an impact on *intermediate* and *final* outcomes. An intermediate outcome is an outcome of the initiative, narrowly related to the specific activities of the initiative. In the case of the demonstration, intermediate outcomes would include changes in physician/chiropractor utilization, health status improvements, and reduced health care costs by

Medicare beneficiaries. Intermediate outcomes can act as indicators of program success, but do not necessarily represent the primary goal or purpose of the initiative.

Final outcomes represent the broad goals or purposes of the initiative. While health improvements and cost savings are a primary goal of the expanded benefit, there may be other social costs and benefits that might be relevant for implementation decisions, and therefore should be considered in the assessment of final outcomes for the program.

Exhibit III.1
Evaluation Framework

Program Initiative	Chiropractic Services Demonstration
⇓	(expand the types of Medicare-covered services that may be delivered by chiropractors)
Direct Effects	1. Do chiropractors offer and provide expanded services to beneficiaries?
⇓	2. Do Medicare beneficiaries utilize the expanded services provided by chiropractors?
Intermediate Outcomes	3. How does the demonstration affect beneficiary health care utilization and Medicare expenditures?
⇓	4. How satisfied are beneficiaries who use chiropractic services for covered diagnoses in the demonstration areas?
Final Outcomes	5. What is the net impact of the new coverage on Medicare program expenditures?
	6. What are the other benefits and costs of the expansion in coverage?

Under each of the primary evaluation questions, there is a set of sub-issues that the evaluation might address to varying degrees. Below, we list the primary evaluation questions and associated issues that might be analyzed during the course of the evaluation.

1. Do chiropractors offer and provide expanded services to beneficiaries?

- How many and what are the characteristics of chiropractors providing demonstration services?
- How is chiropractor participation in Medicare affected by the expanded coverage? How are chiropractor outreach/marketing/service delivery activities affected by the expanded benefit?
- How frequently do chiropractors bill for expanded services and what are the service patterns (e.g., E&M, lab tests, referrals for CT, MRI, and other diagnostic and therapeutic procedures)?
- How does the expanded coverage affect service delivery in Medicare+Choice plans? To what extent are these plans implementing the expanded benefit?

2. Do Medicare beneficiaries utilize the expanded services provided by chiropractors?

- How many beneficiaries in the demonstration areas use chiropractic services? Why do they seek chiropractic services over physician services? How are they referred to chiropractic services?
- How many chiropractic services are used, and what are Medicare expenditures per user? What are Medicare expenditures for all services used for covered diagnoses?

- What covered diagnoses do they use the services for, and is there any substantial use of uncovered services and/or covered services for uncovered diagnoses?
- What are the demographic (age, sex, race, marital status), clinical (i.e., major co-morbidities) and area type (e.g., urban/rural, HPSA/non-HPSA) characteristics of users and non-users?
- How many treatment beneficiaries are in the demonstration areas (i.e., beneficiaries with covered diagnoses)?
- What is the relationship between chiropractor use (i.e., utilization) and the demographic, clinical and area type of beneficiaries?
- How do service utilization and Medicare expenditures for covered diagnoses by non-users in the treatment group compare to those for users?

3. How does the demonstration affect beneficiary health care utilization and Medicare expenditures?

- What is the impact of the demonstration on Medicare-covered chiropractic service use?
- What is the impact of the demonstration on Medicare chiropractic service expenditures?
- What is the impact of the demonstration on other Medicare-reimbursed health care utilization (physician visits, other provider visits, hospitalization, diagnostic and laboratory services)?
- How do the above impacts differ across urban/rural and HPSA/non-HPSA subgroups?
- How do the above impacts vary by area chiropractor supply?
- Is there evidence that the demand for covered chiropractor services increased because of the demonstration?

4. How satisfied are beneficiaries who use chiropractic services for covered diagnoses in the demonstration areas?

- How satisfied are users with the availability and quality of chiropractic care?
- How satisfied are users with the level of out-of-pocket expenditures required for care?

5. What is the net impact of the new coverage on overall Medicare expenditures?

- What is the net impact of the new coverage on Medicare expenditures in the Demonstration areas:
  - per user?
  - per beneficiary?
  - in total?
- How does the net impact of the new coverage vary with:
  - the type of area (urban/rural, HPSA/non-HPSA)?
  - covered diagnoses?
- What would the net impact of national implementation be on Medicare expenditures?

6. What are the other benefits and costs of the expansion in coverage?

- What is the impact of the new coverage on indicators of the quality of life of beneficiaries (e.g., back surgery, hospital or long-term care facilities admissions/days, and mortality)?
- What is the impact of the new coverage on health care service expenditures by:
  - beneficiaries (i.e., out-of-pocket)?
  - Medicaid?
  - private insurers?

B. Sources of Data for the Evaluation

1. Medicare Administrative Data

CMS expects that the Medicare Denominator and Claims Files will be the principal sources of data for the evaluation of utilization and expenditure impacts. The Denominator File contains information on the enrollment status of the beneficiary (Part A, Part B, managed care vs. fee-for-service), whether Medicare is the primary insurer, basic demographic characteristics, county of residence, and mortality. CMS expects the evaluator to only use data for beneficiaries who are enrolled in Part B fee-for-service.

The Medicare Claims Files contain information from Medicare claims. There are multiple files. The MEDPAR file contains summary information on claims from each hospital and skilled nursing facility (SNF) stay. The eight Standard Analytic Files (SAFs) contain data on all individual claims for inpatient, SNF, outpatient, home health, hospice, clinical laboratory, and physician/supplier services, as well as for durable medical equipment. If the demonstration starts during 2005 and ends during 2007, as planned, the evaluator might find it useful to create extracts from as early as 2003 (two years prior to the demonstration) and as late as 2007.

The administrative data can potentially be used to:

- Identify users of chiropractic services ("users");
- Identify all individuals in demonstration areas who appear to be potential users, i.e., those with diagnoses covered by the demonstration ("treatment" group – including users);
- Identify a large sample of comparable beneficiaries in earlier periods in the treatment area, and/or comparison areas ("comparison" group);
- Determine demographic characteristics of treatment and comparison beneficiaries and county of residence;
- Measure utilization of, and Medicare expenditures for, chiropractic services for the treatment and comparison groups;
- Measure utilization of, and Medicare expenditures for, other services for the treatment and comparison groups; and
- Measure selected health outcomes that might be sensitive to the use of chiropractic services (e.g., back surgery) for the treatment and comparison groups.

Because the number of Medicare beneficiaries is so large, especially in the comparison areas, the evaluator may decide to develop an efficient process for extracting samples of manageable size. We expect the number of users, and even treatment group members, to be a relatively small share

of the beneficiaries in the demonstration areas (estimated to be 15 percent). The evaluator will likely need to sift through the administrative records for 100 percent of the beneficiaries in the demonstration areas, in each of the demonstration years, as well as in some pre-demonstration years. As the demonstration and evaluation proceed, it might become apparent from utilization statistics that a sample would be adequate. The sifting process is likely to be complicated, because it might require information in three files: the Denominator File, the Physician/supplier and Outpatient claims files.

There are many more beneficiaries in the comparison areas than in the demonstration areas. CMS will need a comparison group sample that is approximately as large as the treatment group sample. One approach would be to perform a one-to-one match to the treatment group.

The evaluator might find it best to develop an extraction process with the following steps. The first step would be to use the Physician/supplier file to identify all treatment area beneficiaries residing in the treatment areas and having at least one of the covered diagnoses during at least one of the relevant years. The next step would be to create extracts of all enrollment and claims records for the selected individuals. The third step would be to construct comparison beneficiary files in a comparable fashion, from the comparison areas. Initial analysis of the treatment group file might lead to refinement of the definition of the treatment and comparison samples. It is likely that the evaluator will only use a subset of the comparison sample records, for reasons to be discussed later.

The evaluator might also decide that it is worthwhile to create longitudinal records for the beneficiaries in the treatment and comparison groups. Doing so would allow the evaluator to control for prior service utilization and to follow possible effects on utilization and expenditures for individuals over multiple years. Building a longitudinal file would, however, require substantial additional effort because, for each selected beneficiary, the evaluator would need to extract claims and enrollment data for multiple years, perhaps starting even before the year in which the beneficiary is first identified as meeting the selection criteria. Under this scenario, the evaluator might develop "cohort files," with each selected beneficiary's cohort year determined by the year in which the beneficiary is first identified as meeting the selection criteria (e.g., those first observed in each of the two pre-demonstration years, those first observed in the first demonstration year, and those first observed in the second demonstration year). Each cohort's file would contain longitudinal data for all variables of relevance to the evaluation – (utilization and expenditure measures for various types of services, various health outcomes, etc.), plus cohort year characteristics (e.g., demographic characteristics and county of residence).

2. Stakeholder Interviews

Semi-structured interviews could be conducted to gather qualitative information about how the demonstration was implemented, the experiences of demonstration stakeholders, and to identify important issues and challenges that arose during the conduct of the demonstration. Interviewees could include chiropractors in the demonstration areas, representatives from the demonstration claims carriers, staff of Medicare+Choice plans in the demonstration areas, CMS staff, and representatives of the ACA. It might be worthwhile to conduct two sets of interviews, one as soon as possible after implementation, to identify any implementation issues that CMS might be able to readily address, and the other towards the end of the Demonstration.

3. Beneficiary Survey

It appears that the only feasible way to assess beneficiary satisfaction with care, and potentially other issues related to the manner in which the demonstration was implemented, the factors affecting beneficiaries' decisions to seek chiropractic services, and the costs and benefits of care from the beneficiary perspective, is to conduct a beneficiary survey. A beneficiary survey could be designed to address several domains of potential interest to the evaluation, including:

- Why and how beneficiaries decide to use or not use chiropractic services;
- Past/current use of chiropractic services and how those services were/are paid for (e.g., out-of-pocket costs);
- Perceived effectiveness of chiropractic and non-chiropractic services used to treat covered diagnoses;
- Various aspects of beneficiary satisfaction with chiropractic and non-chiropractic services used to treat covered diagnoses, including:
  - Overall quality of care
  - Availability of providers
  - Wait time to obtain an appointment
  - Wait time to see a provider
  - Ease and convenience
  - Out-of-pocket expenditures
  - Information about diagnoses
  - Follow-up care
  - Provider concern for overall health
  - Reasons for dissatisfaction with services
  - Suggestions for improvement; and
- Beneficiary characteristics not available from Medicare administrative data:
  - General health status
  - Race/ethnicity
  - Education
  - Income
  - Marital status
  - Living arrangement

The specific issues addressed in the survey would depend, in part, on whether users, non-users, or both types of beneficiaries would be surveyed. We provide a discussion of the potential survey samples and analyses in the next section.

C. Analyses

1. Process

A process analysis would use administrative, survey, and qualitative data to document how the demonstration was implemented, assess the experiences of providers and beneficiaries, and provide contextual information to help CMS interpret impact analysis findings. A process evaluation would have the following broad objectives:

- To describe the demonstration implementation plan and compare it to actual implementation, including a description of the characteristics of the providers, managed care organizations, claims carriers, and others involved in educating providers and beneficiaries about the expanded services, delivering services, and submitting and processing claims for services;
- To determine if the demonstration was implemented as intended, and, if not, understand the factors contributing to deviations;
- To identify problems in the implementation process;
- To identify changes in the process, and when and why they occurred;
- To understand the participation experiences of providers and Medicare+Choice health plans, and the factors affecting their service delivery approaches and outcomes;
- To identify important economic and environmental factors that affect program implementation and outcomes;
- To describe and develop a qualitative understanding of demonstration operations, needed for interpreting the findings of the quantitative participation and impact analyses;
- To assess whether operations proceeded as expected and if intermediate outcomes and goals, were achieved; and
- To identify lessons from the experiences of providers and beneficiaries that may assist CMS in evaluating the feasibility of full-scale implementation of the expanded service coverage.

In addition to describing the general implementation and operations of the demonstration and the environmental context in which it is operating, a process analysis would address a number of specific issues primarily related to evaluation questions 1 and 2 related to provider and beneficiary participation in demonstration services. The process analysis would rely heavily on the qualitative information obtained via interviews with program stakeholders (CMS, chiropractic service providers, Medicare+Choice plans, and claims carriers), and on administrative data on claims and beneficiary characteristics.

2. Utilization

a. Utilization Questions

The utilization questions of interest to CMS include the following:

- How many beneficiaries in the demonstration areas use chiropractic services?
- How many and what types of chiropractic services are used? What are Medicare expenditures per user? What are Medicare expenditures for all services used for covered diagnoses?
- What covered diagnoses do beneficiaries use the services for, and is there any substantial use of uncovered services?
- What are the demographic (age, sex, race, marital status), clinical (i.e., major co-morbidities) and area type (e.g., urban/rural, HPSA/non-HPSA, chiropractors per thousand beneficiaries) characteristics of users?
- How many treatment beneficiaries are in the demonstration areas (i.e., beneficiaries with covered diagnoses)?

- What is the relationship between chiropractor use (i.e., utilization) and the demographic, clinical and area type of beneficiaries?
- How do service utilization and Medicare expenditures for covered diagnoses by non-users in the treatment group compare to those for users?

b. Users, Utilization, and User Characteristics

The first step in the utilization analysis is to determine how many beneficiaries use chiropractic services in the demonstration areas, the diagnoses that services are used for, the quantities of the services they use, and the characteristics of users. It might also be useful to examine diagnoses and services for users that are unrelated to chiropractic services. It might be, for instance, that beneficiaries who visit physicians for unrelated chronic conditions are not likely to use chiropractors, while beneficiaries who rarely visit physicians are more likely to use chiropractors, although this is just speculation. The main reason to consider such variables is that all beneficiary and area characteristics that are predictive of utilization are likely to be useful to the impact evaluation, as will be discussed later.

c. Define and Identify Treatment Beneficiaries

We have defined treatment beneficiaries as all beneficiaries in the demonstration areas who, based on claims data, have covered diagnoses. The evaluator will likely need to develop an operational definition of treatment beneficiaries to support the remainder of the utilization analysis and, more importantly, the impact analysis. The operational definition does not necessarily need to include all beneficiaries with covered diagnoses, because some such beneficiaries might be poor candidates for chiropractic services for other reasons (e.g., they are in a long-term care facility). It could also exclude beneficiaries with diagnoses that are covered, but rarely found on chiropractic claims (if any).

Ideally, the evaluator would be able to develop a definition that minimizes the number of treatment beneficiaries subject to the constraint that the definition includes essentially all users. The reason for this is that, for the impact analysis, the evaluator will need to compare outcomes for *all* treatment beneficiaries, not just users, to those for comparably defined comparison beneficiaries, because it is not possible to definitively determine which beneficiaries in the comparison sample would be users. The more non-users among the treatment beneficiaries (i.e., the lower the utilization rate, defined as users divided by treatment beneficiaries), the less precise the impact estimates. In fact, if the evaluator can substantially reduce the number of treatment beneficiaries (e.g., by 20 percent) by using a definition that excludes a very small share of users (e.g., one percent), it would likely be worthwhile to do so. Under these circumstances, such an exclusion would substantially increase the accuracy of impact estimates for those in the treatment group at the expense of an inconsequential bias from the omission of a small share of users.

Development of the definition might proceed in three stages, as follows:

In the first stage, the evaluator would identify all beneficiaries in demonstration areas who received Part B services for covered diagnoses. Call the group identified in this way the First Preliminary Treatment (PT1) group. The PT1 group will include all users, by definition.

In the second stage, the evaluator would compare the diagnoses and services received by the non-users in the PT1 group to those received by the users. The purpose of this comparison is to

find diagnoses and services that distinguish the two groups. Hence, it is important to include potentially distinguishing non-chiropractic diagnoses and services, as well as chiropractic diagnoses and services. Exclusion criteria can be developed on the basis of diagnoses or service types that are very rare for users, or present for all but a very few users. For instance, if Alzheimer's disease is almost never found among users, then all those with Alzheimer's disease can be excluded from the treatment group. Application of the exclusions to the PT1 group will produce the smaller PT2 group.

The third step is to conduct a multivariate analysis for the PT2 group that can potentially be used to reduce the size of the group further. This involves the estimation of a binomial model (e.g., logistic regression) to predict users as a function of independent variables for diagnoses, services, demographic characteristics, and area characteristics. The independent variables should not include any variables constructed from claims related to chiropractic services other than the covered diagnoses. Once the model is estimated, the evaluator can use it to predict the probability of utilization for each beneficiary in the PT2 group. Those beneficiaries with a predicted probability below a cut-off value could be dropped from the final treatment group. To select the cut-off value, it would be useful to first compare the distribution of predicted values for users to the predicted values for non-users. That comparison is likely to show that a very large share of non-users (e.g., 20 percent) can be dropped from the analysis by selecting a cut-off that eliminates only a very small percentage of users (e.g., one percent).

d. Characteristics of Treatment Beneficiaries

Once the treatment beneficiaries have been identified, the evaluator could proceed to determine the relationships between use and beneficiary characteristics. This could include descriptive statistics for users and non-users in the treatment group as well as the estimation of a binomial model. If the strategy outlined above for reducing the size of the treatment group were followed, this might essentially amount to re-estimation of the binomial utilization model initially estimated for the larger PT2 group.

Urban/rural and HPSA/non-HPSA status are critical characteristics for this analysis. Potentially the evaluator could estimate separate models for each of the four groups defined by these two characteristics. It might also be that the carrier is an important determination of utilization, because of variation in carrier claims processing practices.

e. Comparison Group Selection

The evaluator could potentially use the findings from the utilization analysis in the selection of comparison samples. Recall that the evaluation could potentially use beneficiaries from one or both of two sources as comparison groups: contemporaneous beneficiaries residing in comparison areas, and beneficiaries residing in the treatment areas in earlier years ("past beneficiaries"). One approach to selection would be to ignore the utilization analysis and simply select all beneficiaries from each source used who meet the treatment group criteria during the relevant period. An alternative would be to select samples using a matching methodology that improves comparability of the observed beneficiary and area characteristics of the treatment and comparison group samples.

While matching methodologies have existed for many years, they have generated considerable interest in the non-experimental evaluation literature in recent years as an alternative to relying solely on multivariate analysis methods (e.g., multiple regression) to control for differences in

observed characteristics. One appeal of matching relative to multivariate analysis is that it generally imposes fewer restrictions on the relationships between control variables and outcomes because it is non-parametric, or semi-parametric. While generally true, the importance of this feature depends on the exact method employed and the richness of the multivariate specification to which the method is compared. With respect to the latter, in large samples multivariate models can be very unrestrictive through the use of categorical variables defined over small ranges of values for continuous variables, and/or the inclusion of quadratic and high-order interactions.

A significant challenge in matching is the choice of methodology. Because exact matches become harder and harder to find as more matching characteristics are considered, a wide variety of techniques have been developed to reduce the dimensionality of the problem and define near matches. One method of matching, especially, has obtained substantial attention recently—propensity score matching. Briefly, this methodology begins with specification and estimation of a model for the probability that a subject will participate in an intervention, conditioned on the subject's observed characteristics. The utilization model discussed earlier in this section is just such a model. Treatment and comparison subjects are matched on the basis of the model's predicted probability, or propensity, to participate (i.e., to use chiropractic services). The appeal of this methodology comes from a finding attributed to Rubin (1973)—if a subject's outcome in the absence of the intervention (i.e., the "counterfactual outcome"), conditional on the subject's observed characteristics, is independent of participation, then the same outcome conditioned on the subject's propensity score only is also independent of participation. This means that the evaluator only has to control for differences in propensity score to produce unbiased impact estimates. Thus, the propensity score serves as a convenient way to reduce the multi-dimensional problem of matching on many observed characteristics to one of matching on a single variable. No parametric restrictions are imposed on the effects of characteristics on outcomes, although the model used to estimate propensity scores is generally a parametric or semi-parametric model.

Heckman, Ichimura, Smith and Todd (1998) provide a detailed and useful analysis of the use of matching and other approaches to the elimination of selection bias in non-experimental evaluations. They first show that the selection bias from comparisons of outcomes that make no attempt to adjust for subject characteristics can be decomposed into three components: (a) differences in the "supports" of the characteristics in the two groups (i.e., some combinations of values for the characteristics are observed in one group, but not the other); (b) differences in the shapes of the distributions of the characteristics in the two groups (i.e., some combinations of values are more prevalent in one group than in the other); and (c) selection bias, rigorously defined at common values of the characteristics for both groups. As they point out and illustrate in an empirical example, propensity score matching eliminates the bias due to (a) and (b). Elimination of bias due to (a) occurs because the impact estimator is defined as the mean impact only for those subjects whose characteristics are supported in both groups. Matching does not address bias due to (c), which might still be large. This latter point is illustrated in an example presented in Smith and Todd (2000). In that illustration, the characteristics that lack common support over significant ranges are environmental characteristics. The evaluator might find that lack of common support for health care market variables will be a significant problem in some analyses.

The value of matching may be greatest in the selection of contemporaneous comparison groups, because the number of beneficiaries with covered diagnoses in the comparison areas is likely to

be much larger than the number in the treatment areas, and their characteristics may differ in substantial ways.

3. Beneficiary Satisfaction

The legislation requires that CMS "determine the satisfaction of eligible beneficiaries participating in the demonstration projects and the quality of care received by such beneficiaries." The very narrow interpretation of this statement is that CMS is not required to estimate the *impact* of the demonstration on beneficiary satisfaction, rather, CMS is only required to conduct a descriptive assessment of satisfaction among beneficiaries who use the expanded services. However, "participation in the demonstration projects" might also be interpreted as including non-users in the demonstration areas, as they are participating in the demonstration, even if they choose not to utilize the expanded services offered by chiropractors.

Regardless of the interpretation of the legislative requirement, there are a number of potential problems with conducting an assessment of beneficiary satisfaction for purposes of evaluating the demonstration:

- Assessing the satisfaction of demonstration service users only provides no context for the findings. For example, what is the meaning of a finding that X% of users are satisfied, or X% of users pay out-of-pocket costs for chiropractic care, in the absence of a meaningful benchmark?
- Attempting to compare findings between users and non-users is misleading. The differences that make individuals users versus non-users are also likely to lead to differences in satisfaction levels that have nothing to do with the demonstration.
- Attempting to compare findings between treatment and comparison group members may also be misleading if no measure of baseline (pre-demonstration) satisfaction is available. The simple differences in satisfaction levels between treatment and comparison beneficiaries may be due to factors unrelated to the demonstration.

The most rigorous way to assess satisfaction would be to employ a pre-post difference-in-difference methodology in the manner more fully described in the next section with respect to the estimation of demonstration impacts on costs. This, however, would require that a baseline (pre-demonstration) survey be implemented for samples of both treatment and comparison beneficiaries, as well as a similarly implemented post-demonstration survey. Given the short time period before the demonstration will be implemented (currently planned for April 2005) it is unlikely that a baseline survey could be designed and executed. In addition, CMS may wish not to incur the additional costs of baseline and comparison group surveys, given that the legislation does not require it and the fact that impacts of the demonstration on beneficiary satisfaction may be very difficult to detect, even under the best of circumstances.

Based on the above considerations, we would recommend that CMS assess beneficiary satisfaction by administering a phone survey to a random sample of both users and non-users with covered diagnoses residing in the demonstration area (i.e., treatment group members). The survey would be relatively brief (a 15 minute interview) and would elicit information related to:

- Why and how beneficiaries decide to use or not use chiropractic services;
- Past/current use of chiropractic services and how those services were/are paid for (e.g., out-of-pocket costs);

- Perceived effectiveness of chiropractic and non-chiropractic services used to treat covered diagnoses;
- Various specific aspects of beneficiary satisfaction with chiropractic and non-chiropractic services used to treat covered diagnoses (e.g., extent and duration of symptomatic relief, waits for appointments, waiting times in office, provider explanations of care, etc.);
- Changes in choice of provider (e.g., from physician to chiropractor or vice versa); and
- Beneficiary characteristics not available from Medicare administrative data.

The findings from the survey would provide descriptive information about the experiences of beneficiaries seeking services to treat the selected demonstration-covered diagnoses. Comparisons between users and non-users would NOT be used to evaluate the effectiveness of the demonstration, but rather, would provide descriptive information about the differences between users and non-users, as well as descriptive information about beneficiary satisfaction with chiropractic services.

To enhance response rates, the survey should be administered by phone (rather than by mail). If feasible, a small stipend of $5 or $10 might also be offered as compensation for the beneficiary's time. To minimize recall bias, the survey should be administered to a sample of treatment group members who received treatment for their demonstration-covered conditions relatively recently, for example, in the previous six months. Roughly equal numbers of users and non-users would need to be surveyed. A sample of 600 for each group (1,200 total) would produce estimates for all percentages with confidence interval half widths no greater than 4.0 percentage points. The sample sizes would have to be increased substantially to obtain estimates with equal precision by area type for beneficiaries with specific characteristics (e.g., sex or age range).

4. Cost-Benefit

In this section we discuss approaches that the evaluator might use to address the following evaluation questions concerning the costs and benefits of the demonstration services:

- What are the impacts of the demonstration services on utilization of and Medicare expenditures for chiropractic services?
- What are the impacts of the demonstration services on utilization of and Medicare expenditures for other services?
- What are the net costs of the newly covered services to Medicare under the demonstration?
- What would be the net effect of a national program on Medicare expenditures?
- What are the social benefits and costs of allowing the expanded services?

a. Chiropractic Services

We describe potential approaches that the evaluator could use to estimate the impact of the demonstration on chiropractic service utilization and expenditures: pre-post, contemporaneous comparison, and difference-in-differences. The last of these approaches is essentially a combination of the first two.

i. Pre-post Approach

Under the "pre-post" approach, the evaluator would compare per-beneficiary utilization and expenditures for treatment beneficiaries to utilization and expenditures for a comparable sample of beneficiaries from the demonstration areas in the years just prior to the demonstration, using a comparison sample of past beneficiaries.[7] To estimate the impact per (treatment) beneficiary in the demonstration years, the analysis could simply subtract measures of utilization and expenditures per beneficiary for the pre-demonstration years from corresponding measures for the demonstration years. Expenditure changes would need to be adjusted for medical price inflation.

One way to adjust for inflation would be to assume that changes in Medicare expenditures per chiropractic service from the pre period to the demonstration period reflect inflation only. Expenditures for pre-period services would be inflated by the estimated growth rate in expenditures per chiropractic service user before subtracting them from expenditures in the demonstration year. It is possible, however, that the expansion of Medicare coverage under the demonstration will increase expenditures per chiropractic service user. The evaluator would need to assess whether this assumption is reasonable in some other fashion. Another approach would be to use a medical price index of some sort. Conceptually, the index should reflect what medical price inflation for chiropractic services in the demonstration areas would have been in the absence of the demonstration. The third approach, which we describe below, addresses this issue in a direct way.

Changes in the characteristics of treatment beneficiaries from the pre period to the post period might cause changes in utilization and expenditures that would potentially be confounded with the estimated impacts of the demonstration's expanded coverage. Use of a matching methodology in the selection of the comparison sample would reduce bias by ensuring that changes in mean characteristics are small. With or without matching, it would likely be useful to apply multivariate analysis methods to control for changes in characteristics for treatment beneficiaries that are observed in administrative data. Such characteristics include past diagnostic, utilization, and expenditure information, along with basic demographic characteristics and characteristics of the individual's county or other area. These variables could be used as control variables in regression models. Doing so would likely improve the precision of estimates as well as control for any changes in mean characteristics that might occur, even after matching (i.e., for any variables that are not matched exactly).

An important limitation of the pre-post approach is that it cannot control for changes in factors other than observable characteristics of beneficiaries that might cause changes in utilization and expenditures for chiropractic services over the demonstration period. The most obvious of these has already been mentioned: medical cost inflation. Others could include the economy, technological advances, and shifts in the supply of chiropractic services caused by other factors (e.g., changes in other employment opportunities for potential chiropractic providers). This limitation is addressed by the difference-in-differences approach described later.

Another potentially important limitation is that the pre-post approach assumes that the Medicare expansion of coverage for chiropractic services does not increase the number of beneficiaries

[7] If longitudinal data were used, this approach would compare treatment area beneficiary cohorts from the treatment years to treatment area beneficiary cohorts from the pre-treatment years.

identified as having covered diagnoses in the claims data. If some users of chiropractic services during the demonstration would not have sought treatment for the covered diagnoses in the absence of the expanded coverage, or would have been treated under an uncovered diagnostic code, then one impact of the demonstration will be to increase the number of beneficiaries with covered diagnoses on their claims. This assumption can be checked by comparing the prevalence of covered diagnoses in the demonstration and pre-demonstration periods. If this assumption is violated in a substantial manner, it will be necessary to revise the impact analysis in some fashion. We continue to maintain this assumption in the discussion below, but return to the implications of its possible violation at the end of this section.

ii. Contemporaneous Comparisons

The second approach is essentially the same as the pre-post approach, except that the comparison group is selected from beneficiaries residing in the comparison areas at the time of the demonstration.[8] Differences between outcomes for treatment and comparison beneficiaries would be used to measure impacts. Controls for differences in beneficiary and area characteristics are more important for contemporaneous comparisons than for pre-post analyses, because differences in characteristics across areas are likely to be much larger than differences over time. The main advantage of this approach relative to the pre-post approach is that it does not require controls for unobserved factors that might cause changes in outcomes from the pre-period to the post-period.

There is, however, a very significant limitation to this approach, in addition to the greater need to control for observed beneficiary and area characteristics. It is well known that, in general, medical "practice patterns" vary greatly across areas for reasons that cannot be explained simply by differences in beneficiary characteristics and a few area characteristics. Other factors, such as medical institutions, unmeasured cultural factors, unique features of the geography, etc., may play a major role.[9] The most obvious way to control for such factors is to make adjustments for cross-area differences in outcomes that existed prior to the demonstration. The difference-in-differences approach, discussed next, provides a way to do just that, by combining the pre-post approach with the contemporaneous comparison approach.

iii. Difference-in-Differences Approach

Conceptually, the difference-in-differences (DD) approach can be described in two equivalent ways. First, the DD can be viewed as application of the pre-post approach to samples of beneficiaries from both the treatment areas and the comparison areas, followed by subtraction of the estimated comparison area changes from the estimated treatment area changes. From this perspective, DD controls for changes in the effects of other factors that are common to both areas (including, but not limited to, price changes). Alternatively, DD can be viewed as application of the contemporaneous comparison methodology in the pre-period and subtraction of the estimated pre-period differences from post-period (i.e., contemporaneous) differences. From this

[8] If longitudinal data are used, this approach involves comparison of treatment period cohorts of beneficiaries from the demonstration and comparison areas. Data for pre-demonstration cohorts would not be used. Data from the pre-demonstration period would be used only to the extent that it is captured in the longitudinal records of the treatment period cohort samples.

[9] If longitudinal data are used for treatment period cohorts, the evaluator could at least partially control for these differences through the use of data on past service utilization. The adequacy of such controls will depend on the extent to which past utilization predicts future utilization.

perspective, DD controls for pre-existing differences in outcomes across the treatment and comparison areas due to factors that do not change over time. [10]

b. Other Services

In this section we describe how the evaluation can estimate the impact of the new services on expenditures for services other than chiropractic services. Increased use of chiropractic services, might have significant consequences for utilization and expenditures of other medical services. We would expect the main impact to be on other (i.e., non-chiropractic) services to treat covered diagnoses. It seems likely that the coverage expansion will lead some beneficiaries to use chiropractors rather than other providers for treatment of covered diagnoses. It is also possible that chiropractic treatment will reduce the need for other, more intensive services (e.g., surgery). Both of these effects would reduce utilization and expenditures for services to treat covered diagnoses. It is also possible, however, that the expanded coverage will induce utilization of other services for covered diagnoses. Services, such as X-rays, may be recommended by the chiropractor.

The evaluation would also consider the impact of the expanded coverage on all Medicare expenditures in each of Medicare's major expenditure groups. Total impacts may prove difficult to detect because expenditures for treatment of the covered diagnoses may represent a very small share of total expenditures per treatment beneficiary, and highly variable expenditures for other services may statistically mask the impacts of the expanded chiropractic coverage unless the latter are very large.

Although impacts on expenditures are of more interest to CMS than impacts on utilization measures, it might be easier to detect impacts on utilization than on expenditures, because high variation in expenditure per unit of utilization adds to the difficulty of detecting impacts on expenditures. Thus, for instance, the evaluator might be able to detect impacts on the number of inpatient stays, but not on hospital expenditures, because of the high level of variation in hospital expenditures per stay. Similarly, detection of impacts on physician visits for covered diagnoses might be easier to detect than impacts on expenditures for such visits. If variation in expenditures per unit of utilization makes it impossible to detect effects on expenditures, even when effects are detected for utilization, the evaluator could opt to infer impacts on expenditures from estimated impacts on utilization, using a fixed estimate of expenditures per unit of utilization. This approach assumes that chiropractic services do not affect the distribution of expenditures per unit of utilization for the relevant services, just the distribution of the units of utilization themselves.

The three approaches to the estimation of impacts on utilization of chiropractic services described above can be applied to the estimation of impacts on utilization and expenditures for other services. The potential for confounding effects under the pre-post approach is greatest when considering all services received by treatment beneficiaries (i.e., including those for uncovered diagnoses) because of changes in treatment and prices for all services.

[10] The DD approach can be applied to longitudinal data. In effect, differences between means for pre-period cohorts from the demonstration and comparison areas would be subtracted from differences between means for post-period cohorts, after using matching methods and/or multivariate methods to control for the beneficiary's past utilization of services.

c. Net Medicare Expenditures

Estimated net Medicare expenditures in each demonstration year can be obtained by adding the estimated impact on Medicare expenditures for chiropractic services (presumably positive) to the estimated impact on Medicare expenditures on all other services (which could be positive or negative).

CMS will likely wish to produce projections of the impact of a national program on Medicare expenditures. The simplest approach would be to assume that impacts per beneficiary nationwide would be equal to impacts per beneficiary in the demonstration areas. Beneficiaries in the demonstration areas, and the areas themselves, will not be nationally representative, however. If impacts vary substantially with beneficiary characteristics (e.g., prior use of chiropractors) or area characteristics (e.g., urban/rural, HPSA/non-HPSA, and chiropractors per thousand population), then the simple approach could result in substantial projection errors.

As a first step in addressing this possibility, the evaluator could analyze the extent to which impacts vary with beneficiary and area characteristics. This could be done by applying the methods described above to sub-groups of beneficiaries, defined by beneficiary or area characteristics. If that analysis reveals that impacts vary substantially with some beneficiary and/or area characteristics, it would be worthwhile to pursue a more complex approach to the projection of national impacts. This would involve use of national means for beneficiary and area characteristics to adjust for differences between national means and mean in the demonstration area. Relevant national means for beneficiary characteristics can be determined from CMS's 5% administrative samples and/or the Medicare Current Beneficiary Survey. National means of relevant county or other area characteristics would be obtained from the same sources as for the demonstration and comparison areas.

d. Impact on Prevalence of Covered Diagnoses

As indicated earlier, the approach to impact estimation assumes that the expansion of Medicare coverage for chiropractic services will not have a material impact on the prevalence of covered diagnoses. That assumption should be tested, as noted earlier. If it is violated in a material fashion, then the methodologies described will likely produced biased estimates of impacts on service utilization and expenditures. There are two components of the bias. One is the bias for the estimates of impacts on net expenditures per treatment group member. This bias arises because comparison group members are not as well matched to treatment group members as we had planned, because the former include individuals who would have been excluded had they lived in comparison areas. This bias could be in either direction. The second component of the bias arises when we consider national projections, because the prevalence of covered diagnoses at the national level would be higher under expanded chiropractic coverage than it is under existing coverage.

Given the non-experimental design of the demonstration, there is no easy way to correct for the bias in the estimate per treatment beneficiary. A general approach would be to expand the definition of the comparison group to incorporate beneficiaries who are likely to have a covered diagnoses under the expanded chiropractic coverage, but not in its absence. This would likely require expansion of the treatment group as well. Comparison of beneficiaries in the treatment group (as previously defined) and pre-demonstration beneficiaries with covered diagnoses might reveal a reasonable way to expand the inclusion criteria. In the extreme, all beneficiaries in the

demonstration areas could be included, but that would likely make the estimated impacts very imprecise. Ideally, most of the bias could be addressed through a small expansion of the inclusion criteria, but this might not be possible.

Another approach would be to consider impacts for sub-groups that are less likely to be affected by this potential source of bias – beneficiaries that are most likely to have covered diagnoses in the absence of expanded coverage. One such group might be treatment group beneficiaries (as previously defined) who received services for covered diagnoses in the pre-demonstration period. Unbiased estimates of impacts per beneficiary for this group could be obtained following the procedures described above. The evaluator could assume that the impact per beneficiary in the entire treatment group is the same as the impact per beneficiary in this smaller group. This estimate might also be biased, but would be a reasonable alternative to the estimate obtained as described above.

The bias in the per beneficiary estimates might be much less important than the bias from ignoring the possible effect of the coverage expansion on the national prevalence of covered diagnoses. The evaluator can project the national increase in prevalence from the estimate of the increase in the demonstration areas. If the impact of the demonstration on prevalence varies with beneficiary and/or areas characteristics, then the national projection methodology should adjust for differences between national and demonstration beneficiary/area characteristics.

e. Social Costs and Benefits

In determining whether to implement a national benefit, policymakers are likely to look beyond the effects of the new services on Medicare expenditures – especially if the net effect is positive. Social benefits not captured by the Medicare program may, in the minds of policymakers, more than offset the possibly positive impacts on Medicare expenditures. At the same time, however, social costs incurred by entities other than the Medicare program could have the opposite effect

It will not be possible to fully evaluate the social benefits of the demonstration services, but it will be possible to produce evidence of such benefits, assuming that they exist. The most important benefit that will be difficult to observe directly is improvement in the quality of life of the beneficiary. At best, only correlates of quality of life can be observed in administrative data. Demonstrable reductions in emergency service episodes, inpatient stays, or long-term care stays, especially for covered diagnoses, would suggest improvement in the quality of beneficiaries lives. Mortality is another important outcome to consider. Significant changes in the quality of life for any reason could affect mortality, especially among those who have substantial co-morbidities. Although no impact may materialize, it seems worthwhile to check. While information about quality of life indicators can be collected via the beneficiary surveys, as noted previously, such indicators may be biased and inappropriate for other than simple descriptive purposes.

Expanded Medicare chiropractic coverage is likely to affect medical service expenditures that are borne by parties other than Medicare, including most importantly the beneficiary, private insurance, and Medicaid. To the extent that the coverage expansion changes Medicare payments for services, it will also change co-payments for those services made by other parties. In addition, increases in Medicare payments for chiropractic services might replace payments that other parties would have made for the same services, with no change in service utilization,

thereby reducing other party expenditures. Hence, even if the Medicare coverage expansion increases Medicare expenditures, it might reduce expenditures by other parties.

We are not aware of other major sources of external benefits or costs.

f. Assessment of Border Effects

All beneficiaries served by providers in demonstration areas are eligible to receive the newly funded services, even if they live in a different area that is a comparison area. Thus, some beneficiaries living just outside the boundaries of demonstration areas as well as beneficiaries who live in other areas but visit demonstration areas for extended periods (e.g., in the winter or summer), may receive the new services. Some such beneficiaries will reside in the comparison areas and might even be included in the comparison group. It is also likely that some beneficiaries who live in demonstration areas will not use the new services only because they are served by providers in comparison areas.

For this reason, the evaluation needs to consider the location of the provider as well as the beneficiary's place of residence. As defined above, the treatment group would only include beneficiaries who live in demonstration areas, so those who live in other areas but receive services in the demonstration areas will be excluded. No symmetric exclusion restriction appears in the definition of the comparison beneficiaries; that is beneficiaries who live in comparison areas but obtain services in the demonstration areas can be included in the comparison group.

The evaluator will need to assess whether there is a substantial increase in utilization of chiropractic services in the demonstration areas by beneficiaries who reside in non-demonstration areas. If there is, then it would be important to develop a restriction that excludes some beneficiaries in the comparison areas from the comparison group. One option is to exclude those living in any comparison area, perhaps defined by zip code, where beneficiaries who are served by demonstration area chiropractors happen to reside.

g. Estimator Precision

We conducted an analysis of the level of precision that is likely to be attained for the estimate of impacts on Medicare expenditures in a given expenditure category in each year. We summarize the nature and the findings of the analysis here. Among other things, the findings illustrate why it is important to: a) minimize the size of the treatment group subject to the requirement that it includes essentially all users, and b) examine impacts on Medicare expenditures for service groups that are most likely to be sensitive to introduction of the new services, as well as on total Medicare expenditures.

Like all such analyses, this analysis is based on a set of assumptions about the data and methodologies employed to estimate impacts. Further, because the demonstration is non-experimental, we also have to make assumptions about the independence of subjects' behavior within each of the treatment and comparison groups. If behavior within each group is influenced by a set of common, but unobserved factors, variation in those factors will reduce the precision of the estimates.

The precision analysis produces estimates of the "minimum detectable effect" (MDE) of the demonstration services on Medicare expenditures per beneficiary in the treatment group. The MDE is the smallest effect that can be detected with a high probability (power) using a statistical test that has a low probability of finding an effect when there is none (significance level). We

specified 80 percent power at a five percent level of significance. MDEs are measured as a percent of the mean of the relevant expenditure variable. For example, if the mean of an expenditure variable is $100 and the MDE is 5 percent, then the evaluation will be able to detect an effect of $5 or more with a probability of 80 percent; if the mean expenditure is $2,000, the evaluator will be able to detect an effect of $100 or more with the same probability.

We assume that the evaluation will use the DD analysis described previously.[11] In ***Exhibit III.2***, we show how the MDE for expenditures per treatment beneficiary, as a percentage of the mean, varies with the number of treatment beneficiaries, *n*, and the expenditure variable's coefficient of variation (CV). The CV is the variable's standard deviation relative to its mean. We assume that treatment and comparison groups have the same CV, as well as the same sample size. The size of the MDE relative to the expenditure variable's mean is proportional to the size of the CV, and inversely proportional to the square root of *n*. We expect the CV for most expenditure variables to be approximately two. We expect utilization variables to have lower CVs, because variation in expenditures reflects both variation in utilization and variation in expenditures per unit of utilization.

The precision analysis also assumes that the DD estimators will control for Medicare expenditures for the same services on behalf of the beneficiary in the pre-demonstration period. We assume that the correlation between pre-demonstration expenditures and demonstration period expenditures is 0.25.[12]

As discussed previously, we expect about 15 percent of beneficiaries to have covered diagnoses. Based on existing estimates of the number of beneficiaries in the demonstration areas, this implies that the size of the treatment group sample will be approximately 250,000 beneficiaries. If correct, then the MDE for an expenditure variable with a CV of 2.0 will be just under two percent of its mean (first row of ***Exhibit III.2***). MDEs for subgroups of beneficiaries defined by urban/rural and HPSA/non-HPSA status will be smaller. The smallest subgroup is beneficiaries residing in rural HPSA demonstration areas. If our estimates are correct, a little over 10,000 beneficiaries in these demonstration areas will have covered diagnoses, implying the MDE for this subgroup will be on the order of eight percent of the mean for an expenditure variable with a CV of 2.0.

The MDEs for the treatment group seem small, especially for sample sizes above 50,000, but it must be remembered that they reflect average impacts over all beneficiaries with covered diagnoses, not just those who use chiropractic services. Presumably, the effects for non-users are essentially zero. Hence, the MDE *per user* is very likely to be higher than the MDE *per treatment beneficiary*. Put differently, the effect on the average user of chiropractic services must be substantially larger than the effect on the average beneficiary with a covered diagnosis if it is to be detected.

[11] For any given sample size, the pre-post and contemporaneous comparison methods will have greater precision than the DD method, but may be biased for reasons discussed previously. The MDEs would be about 30 percent lower for both.

[12] This is equivalent to assuming that the R^2 in a regression of demonstration period expenditures on pre-demonstration expenditures is 6.25 percent.

Exhibit III.2
Estimated Minimum Detectable Effects for Mean Expenditures[13]

Size of Treatment Group	5,000	10,000	20,000	50,000	100,000	150,000	200,000	250,000
MDE for Treatment Group	12.2%	8.6%	6.1%	3.9%	2.7%	2.2%	1.9%	1.7%
MDE for Users								
10% Utilization	121.8%	86.1%	60.9%	38.5%	27.2%	22.2%	19.3%	17.2%
25% Utilization	48.7%	34.5%	24.4%	15.4%	10.9%	8.9%	7.7%	6.9%
50% Utilization	24.4%	17.2%	12.2%	7.7%	5.4%	4.4%	3.9%	3.4%

The MDE per user is obtained by dividing the MDE per beneficiary by the utilization rate (users under the demonstration divided by the number of treatment beneficiaries). Thus, if the utilization rate is 10 percent, the MDE for all users is just under 20 percent in the above example (treatment group sample size is approximately 250,000); if the utilization rate is 25 percent the MDE for users is just under seven percent; and if the utilization rate is 50 percent, the MDE for users is just under four percent. Analysis of Medicare claims data by Muse & Associates (2001) indicates that the utilization rate for covered diagnoses under current policy is about 25 percent. The relevant rate for the precision analysis is the rate under expanded chiropractic coverage, which we expect to be somewhat higher.

This analysis illustrates why the size of the treatment group should be minimized, subject to inclusion of essentially all users. Holding the sample size of users constant, the *lower* the treatment group sample size, the *smaller* the MDE per user. For instance, if there are 10,000 users and 100,000 treatment beneficiaries (10 percent utilization rate), the MDE per user, given the above assumptions, is about 27 percent, but if there are the same number of users and just 20,000 treatment beneficiaries (50 percent utilization rate), the MDE per user is about 12 percent.[14] Intuitively, the fewer irrelevant (i.e., non-user) observations in the sample, the easier it is to detect an effect of a given size for the relevant (i.e., user) observations.

The reason that examination of impacts on sensitive services is important is that impacts that are likely to occur will probably be very small as a percentage of all user expenditures, but much larger as a percentage of expenditures on sensitive services. Thus, for instance, impacts on Medicare expenditures for chiropractic services of 20 percent per user, or even greater, would not be surprising, and could easily be detected even with a utilization rate of 25 percent. Muse & Associates estimated that Medicare spent an average of just under $400 for chiropractic services to beneficiaries who used those services in 1999, so a 20 percent impact would amount to $80 per user – somewhat more today due to higher rates. The impact on Medicare expenditures for non-chiropractic services for covered diagnoses is likely smaller in percentage terms, but could still be detected if they are at least eight percent of mean expenditures. Muse & Associates estimated that Medicare spent an average of just under $600 per beneficiary for beneficiaries with covered diagnoses who were not treated by chiropractors, so an eight percent change is approximately $50.

[13] MDE's are expressed as percentage of the variable's mean. The estimates assume that: the DD estimation methodology is used, the comparison sample size equals treatment group sample size, coefficient of variation for the expenditure variable is 2.0, and the correlation between demonstration and pre-period expenditures is .25..

[14] Holding the number of users constant, the MDE per user is proportional to the square root of the size of the Treatment group, as shown in the appendix.

Impacts on Medicare expenditures for all services in major categories are likely to be very small in percentage terms, even for users. For instance, Muse & Associates found that mean Medicare expenditures for physician and outpatient services for all those with covered diagnoses in 1999 were about $2,750, so the mean in the demonstration is likely to be on the order of $3,000. An impact of $240 per user or less on expenditures for these services (i.e., an eight percent impact) might well go undetected.

By definition, the magnitude of the effects of the coverage expansion on expenditures for sensitive services is larger in percentage terms; otherwise they would not be considered sensitive. Hence, even if the evaluator cannot detect an impact on total Part B expenditures, for example, it might well detect impacts for sensitive components of Part B expenditures, and reasonably conclude that there is an impact on Part B expenditures, even if no total impact can be directly detected.

IV. Demonstration Implementation

A. Modifications to Billing Codes and Billing Procedures

Codes already exist for the services that will be covered under this demonstration by chiropractors. Edits will be needed to recognize chiropractors in these four geographic areas and allow them to be reimbursed for medical, diagnostic, and therapy services they are legally authorized to provide and that will be covered under this demonstration. As noted previously, the diagnosis must be one of the diagnoses listed in Appendix C. It is inappropriate for chiropractors in this demonstration to bill any of the osteopathic manipulation codes since these codes are valued specifically for the manipulation services done by osteopaths.

Current Medicare coverage for chiropractic services--codes 98940, 98941, and 98942-- remains unchanged. Chiropractors must submit separate claims for these services and demonstration services. Chiropractors will continue to be paid according to the current fee schedule rates for these three codes. While some carriers impose frequency thresholds on current chiropractic services, limits will not be imposed on chiropractors providing diagnostic and other services in this demonstration, unless limits exist for other providers delivering these services.

Services provided under this demonstration must apply demonstration code 45 to all claims. These claims should be processed as a regular FFS claim. In addition, services provided under this demonstration must be related to acute or active treatment, not maintenance or prevention of neuromusculoskeletal conditions. For Medicare purposes, a chiropractor must place an AT modifier on a claim when providing active/corrective treatment to treat acute or chronic subluxation.

Additional information about demonstration billing procedures is outlined in *Medlearn Matters* Number SE0514 available at www.cms.hhs.gov/medlearn/matters/mmarticles/2005/SE0514.pdf.

B. Informing Beneficiaries and Chiropractors in Demonstration Areas

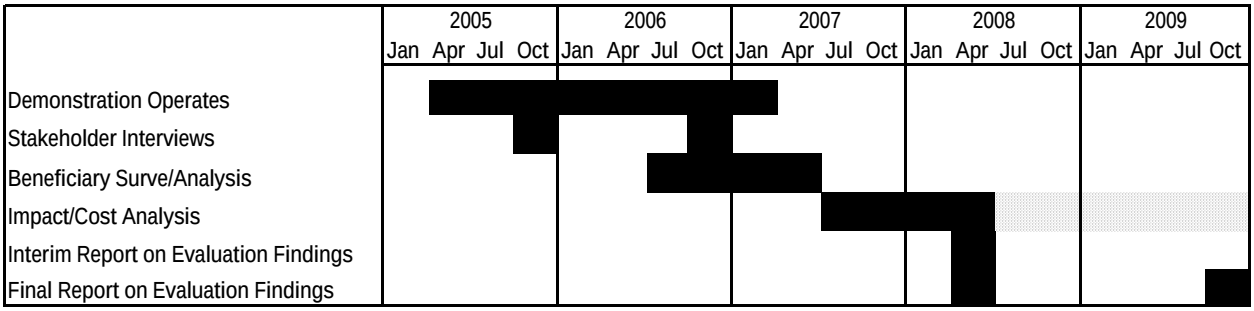
This demonstration will not involve a solicitation of sites, beneficiaries, or providers. Participation is voluntary among beneficiaries and services providers located in the four demonstration areas.

CMS plans to work with its implementation contractor to develop the means to publicize the demonstration to both chiropractors and beneficiaries. Ideas being considered include direct mail to chiropractors in the target areas, information in the Medicare Summary Notices, a FAQ sheet developed for beneficiaries, and briefing sessions with professional and other organizations representing providers and beneficiaries. The CMS Office of Public Affairs may plan to announce this demonstration. In addition, CMS will be working with the American Chiropractic Association, the areas, and the chiropractic press to disseminate information about the demonstration.

C. Timeframe for Implementation and Evaluation

CMS plans to begin the demonstration on April 1, 2005. The demonstration will run for a two-year period, ending March 30, 2007. CMS is required to submit a report to Congress on the evaluation findings no later than one year after the completion of the demonstration. CMS plans to submit an interim report to Congress in the Spring of 2008, and a final report in late 2009. In ***Exhibit IV.1*** we show the planned schedule for the demonstration and evaluation activities.

Exhibit IV.1
Demonstration Timeline



References

Agency for Health Care Policy and Research. 1994. Acute Low Back Problems in Adults. Clinical Practice Guideline No. 14. AHCPR Publication No. 95-0642. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services.

American Chiropractic Association. Undated. Synopsis of Cost Effectiveness Research. http://www.amerchiro.org/media/research/more_research.shtml. Accessed November 15, 2004.

Cherkin, D.C. and R.D. Mootz. (eds.) 1997. Chiropractic in the United States: Training, Practice, and Research. AHCPR Publication 98-N002. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services.

Heckman, James, Hidehiko Ichimura, Jeffrey Smith, and Petra Todd. 1996. "Sources of Selection Bias in Evaluating Social Programs: An Interpretation of Conventional Measures and Evidence on the Effectiveness of Matching as a Program Evaluation Method," *Proceedings of the National Academy of Sciences* 93(23): 13416-13420.

Legorreta, A., R. Metz, C. Nelson, S. Ray, H. Chernicoff, and N. DiNubile. 2004. Comparative Analysis of Individuals with and without Chiropractic Coverage. *Archives of Internal Medicine*. Vol. 164, pp. 1985-1992.

Muse & Associates. 2001. Utilization, Cost, and Effects of Chiropractic Care on Medicare Program Costs. Arlington, VA: American Chiropractic Association.

Rubin, D. B. (1973). Matching to Remove Bias in Observational Studies. *Biometrics*, 29, pp. 159-183.

APPENDIX A

SITE SELECTION METHODOLOGY AND SAMPLE SIZE ESTIMATES

Demonstration Site Selection Methodology

This Appendix presents the methods used for identify potential demonstration sites to be included in Medicare's Chiropractic Services Demonstration. In ***Section A***, we describe the minimum criteria for the sites, as noted in the legislation, and discuss other general factors considered in the site selection process. In ***Section B***, we describe the process used to obtain a subset of states for more detailed analysis and consideration. In ***Section C***, we present a set of potential sites, provide eight options for site combinations, and discuss their relative strengths and limitations.

A. General Considerations

The legislation authorizing the demonstration outlines the following minimum criteria for the demonstration sites:

- Four sites – two urban, two rural.
- One of each urban/rural type must be a geographic, primary care Health Professional Shortage Area (HPSA).

Based on a review of information on Medicare chiropractic services, input provided to CMS by the American Chiropractic Association (ACA), and discussions with CMS, it was agreed that the following additional criteria should be considered in the site selection:

- Treatment and comparison beneficiaries should be from the same carrier to control for differences in chiropractic claims processing and utilization management procedures.
- Spatially large, contiguous treatment areas are preferred over smaller areas pieced together from non-contiguous sub-state areas to minimize the number of beneficiaries from comparison areas who obtain services from demonstration-area providers.
- Treatment and comparison sites should not be contiguous, to avoid use of demonstration area providers by comparison-area beneficiaries.
- States with chiropractic practice regulations that deviate substantially from the norm should be avoided.
- States that will not have transitioned to the MCS claims system in time for the demonstration should be avoided.
- States that are in the extreme (high or low average values) in terms of utilization, costs, and/or provider supply should be avoided.

B. State Selection Process

As the initial step in developing possible demonstration sites, we narrowed the list of potential states by applying the criteria noted in ***Section A*** in the following sequential steps:

- Exclude practice outlier states. The ACA recommended that Michigan, Washington, and the Virgin Islands be avoided due to state practice regulations that are substantially more restrictive than other states.
- Exclude states that will not have transitioned to the MCS system in time for the demonstration. The states excluded are Kansas, Missouri, Nebraska, and New York.

- Exclude states that are ranked in the top or bottom 5 values in two or more of the following six statistics:
  - Medicare per capita claims costs
  - Medicare per capita chiropractic costs
  - Per user (patient) chiropractic costs based on carrier data
  - Chiropractic service users as a percentage of Part B beneficiaries
  - Chiropractors per 10,000 state population
  - Chiropractors per 1,000 Part B beneficiaries

  As an example, the state of Iowa was excluded as a potential demonstration state because it was among the top five states in terms of Medicare per capita chiropractic costs, chiropractic users as a percentage of Part B beneficiaries, and chiropractors per 10,000 state population. A total of 16 states were excluded at this step (AL, AZ, CA, CO, DC, FL, HI, IA, LA, MD, MS, MN, ND, NJ, SD, WV).
- Among the remaining states, exclude those served uniquely by a carrier, and thus, would lack a potential comparison state. For example, the state of Connecticut was excluded because the only other state to share its carrier (Florida) had been removed from consideration by the preceding exclusion step. At this step, an additional six states were excluded (CT, GA, PA, RI, WI, UT).

At the end of this process, 22 states (AK, AR, DE, IN, ID, IL, KY, MA, ME, NC, NH, NM, NV, OH, OK, OR, SC, TN, TX, VA, VT, WY) comprising seven carrier groups remained as candidates for further analysis.

Next, we assessed the comparability of the states within each of the seven carrier clusters in terms of two criteria: percent of population age 65 and over with incomes below poverty; and the percent of Part B beneficiaries enrolled in managed care plans. We wanted to ensure that the states within each cluster did not vary substantially from one another on these two dimensions, and thus, compromise their potential comparability. Based on this assessment, one carrier cluster containing two states, South Carolina and Ohio, was removed from further consideration. Ohio has a very high rate of managed care enrollment (15%) compared to South Carolina (0%), and South Carolina has a higher-than-average rate of poverty (13.1%), while Ohio has a lower-than-average rate (7.6%).

Next, data collected from a variety of sources were used to estimate the number of beneficiaries residing in Urban/Rural and HPSA/nonHPSA areas, and to determine which of the remaining 20 states could support a demonstration site or sites.[1]

[1] Urban and rural areas were defined based on the 2003 Rural-Urban Continuum Codes for Metro and Nonmetro Counties. The codes form a classification scheme that distinguishes metropolitan counties by size and nonmetropolitan counties by degree of urbanization or proximity to metropolitan areas. All U.S. counties and county equivalents are grouped according to the official metropolitan status announced by the Office of Management and Budget in June 2003. For our analysis, counties were categorized as Urban if coded as a metro county (codes 1-3), and Rural if coded as a nonmetro county (codes 4-9). We used September 2004 data obtained from HRSA to determine the areas of the states with primary care geographic HPSA designations.

Based on a precision analysis, we concluded that inclusion of approximately 500,000 Part B beneficiaries in the Demonstration areas combined would allow the evaluators to detect impacts on expenditures as low as 5% of mean expenditures. In addition, approximately 75,000 beneficiaries at each site type would be sufficient to detect impacts on expenditures as low as 10% of the mean, and approximately 35,000 would be sufficient to detect impacts as low as 15% of the mean.[2] Three additional states (AK, OR, WY) from the same carrier group were eliminated due to beneficiary sample sizes being too small to support demonstration and comparison sites for two or more site types.[3]

The remaining 17 states represent five carrier groups. Each carrier group was assessed to determine its ability to support treatment and comparison groups for one or more site types. HPSA status proved to be the most constraining criterion. Few states had enough beneficiaries residing in HPSAs to be considered for one of the HPSA demonstration sites.

C. Potential Demonstration Sites and Options for Site Combinations

Two states (IL and TX) have enough beneficiaries in all four groups to allow the demonstration to be conducted wholly within a single state (***Exhibit A-1***). Conducting the demonstration in a single state, however, is not advisable for several reasons:

- including all of either state would result in a demonstration that is much larger than it needs to be;
- in Illinois, a large majority of the beneficiaries are in the two non-HPSA areas; and

[2] The minimum detectable effects (MDEs) indicated in this paragraph are the smallest effects on mean Medicare expenditures in relevant categories that can be detected with a probability of 80 percent, given a reasonable set of assumptions about the data and statistical methodology. These include: a) the standard deviation (SD) of the relevant expenditure measure is between two and three times the size of the mean; b) the number of comparison beneficiaries will be the same as the number of treatment beneficiaries; c) 15 percent of demonstration and comparison beneficiaries will have diagnoses in Medicare claims data that would be consistent with use of chiropractic services, and would therefore be included in the evaluator's analysis samples; d) the evaluator will estimate impacts by comparing changes (i.e., before to after) in pertinent expenditure measures in the treatment areas to corresponding changes in the comparison areas; e) a one-tailed significance test is used; and f) the significance level for the test (probability of concluding there is an effect when there is no effect) is 5.0%. Under these assumptions, the MDE is the smallest effect that will be detected with a probability of 80 percent; larger effects will be detected with a higher probability. The range of assumptions for SDs implies a range of results for MDEs. For this and other reasons, the values in the text should be considered to be approximate. For 500,000 beneficiaries, the range of MDEs implied by the range of SDs is 3.6 percent to 5.5 percent; for 75,000 it is 9.4 percent to 14.1 percent; and for 35,000 it is 14.1% to 21.1%. Another important reason to consider the estimates approximate is the possibility that unobserved area factors could change relevant expenditures in the demonstration areas relative to expenditures in comparison areas, which would reduce precision. Two of our assumptions are deliberately conservative, however. First, there will likely be considerably more comparison beneficiaries than treatment beneficiaries, because the carriers that will be involved have many more beneficiaries in non-demonstration areas under every option considered. Second, the precision analysis treats the behavior of relevant beneficiaries during the demonstration period as if it is independent of the behavior of the corresponding beneficiaries in the pre-demonstration period, whereas many will be the same individuals; this will reduce some of the idiosyncratic variation in outcomes between periods and, therefore, increase the precision of the evaluator's estimates.

[3] We used a sample size of 35,000 beneficiaries as the minimum for consideration as a demonstration site, corresponding to MDEs between 14.1% and 21.1% of expenditures.

- comparison beneficiaries for Texas would be limited to a much smaller number of beneficiaries in Virginia and Delaware, having a substantially different demographic mix.

Further, conducting the demonstration in a single state is risky because of unanticipated idiosyncratic state or carrier factors that might limit the validity of the results for the rest of the country. Without at least some state and carrier diversity in demonstration sites, such factors might go entirely unrecognized.

Based on the information contained in ***Exhibit A-1***, we selected the states that appeared promising for further analyses of the distribution of beneficiaries across counties. We looked for ways to eliminate geographically contiguous counties from states, or only include geographically contiguous counties, that would allow us to meet sample size and type requirements; that is, we sought to define sites as geographically distinct parts of states, rather than scattered areas of an entire state, that would allow us to meet sample size requirements. All of the options we have developed are larger than they need to be to meet sample size requirements; reducing sample sizes to the minimum would require use of scattered areas, which is problematic from both administrative and evaluation perspectives. In conducting this analysis, we focused on the HPSA site types because the sample sizes for these site types were most limited.

Beneficiary and chiropractor estimates for 15 potential demonstration sites are shown in ***Exhibit A-2***. The estimated numbers of beneficiaries shown in the exhibits are likely underestimates, due to the manner in which they were generated for purposes of categorizing HPSA and non-HPSA areas.[4] In ***Exhibit A-3***, we group together potential demonstration sites into eight options that achieve the four-site criteria, and show their estimates for total numbers of beneficiaries and chiropractors. We also show the estimates for the minimum detectable effect, based on the beneficiary samples associated with all four site types combined, and with the smallest site type in the grouping. The eight options are grouped into three subgroups, according to the number of states contained in the combination (from two to four). Within each group, we start with areas that have sufficient numbers of beneficiaries overall, but relatively low numbers in the HPSA subgroups and little or no geographic diversity. We then add beneficiaries in predominantly HPSA areas.

All of the site combinations include a significant part of Illinois. Illinois is key because it includes a large number of beneficiaries residing in HPSA areas, and the state can be divided in a

[4] Because geographic HPSAs may be defined at the county or sub-county level, we were required to analyze the number of beneficiaries and assign geographic primary care HPSA status at the zip code level, and then aggregate zip codes up to the county level. This involved utilizing 1999 zip code-level data on Medicare beneficiaries obtained from HRSA's Primary Care Service Areas (PCSA) database (http://datawarehouse.hrsa.gov/pcsa.htm), and an algorithm developed by the Missouri Census Data Center (http://mcdc2.missouri.edu/websas/geocorr2k.html), to attribute zip codes to county and sub-county areas. Because zip codes can cross multiple county and sub-county areas, a decision rule was needed to attribute a single zip code to a single area for purposes of assigning HPSA status. In our analysis, if 50% or more of the zip code's population resided in the county or sub-county area, the zip code was assigned to that area. Summing the zip code-level data up to the county level and comparing beneficiary counts from our analysis with data in the 2003 Area Resource File indicated that our analysis resulted in a significant undercount of Part B beneficiaries. While we attempted to adjust our estimates upwards based on the 2003 ARF data, it is likely that they represent underestimates of the number of beneficiaries who will reside in the demonstration areas when the demonstration is implemented due to the older data that was used, the suppression rules imposed on the PCSA zip code-level data (if the number of beneficiaries, as represented by Part B eligibility in the Denominator File in a zip code tabulation area is less than 11 then all Medicare data are suppressed for the area), and the method for attributing zip codes to counties.

logical manner that reduces the number of beneficiaries in other groups where sample size is already more than sufficient.[5] Other potential divisions of the state are possible; we present only three here.

Hidalgo, TX is listed as a potential urban HPSA site. Hidalgo is unusual in that it includes a large number of urban HPSA beneficiaries; most such beneficiaries are in smaller groups within counties that include many more non-HPSA beneficiaries. While Hidalgo might be considered for inclusion to increase sample sizes in the urban HPSA category, it may not be desirable because of the unique demographic composition of the county's population. Hidalgo's population is 88% Hispanic. While suitable comparison counties are likely to be found in other parts of Texas, including such a large number of beneficiaries in the demonstration that correspond to a rather small ethnic group, in terms of Medicare beneficiaries as a whole, might result in demonstration findings that would not be even remotely representative of the potential experience of the broader Medicare population should the policy change be implemented nationally. A substantial, but more reasonable number of Hispanic beneficiaries is included in the many options that include New Mexico.

Several of the options include various combinations of New Mexico, New Hampshire and Vermont, or parts thereof; all of these states have large rural populations, including substantial populations in rural HPSA areas, and are relatively small overall, so adding all or most of any one of these states to the Demonstration adds relatively few beneficiaries to the total to be included. New Mexico is particularly significant in that it also has a large number of beneficiaries residing in rural and urban HPSA areas. The inclusion of New Mexico enhances the precision of the estimates for the urban and rural HPSA groups.

We include several four-state options that add the Virginia site. Adding Virginia further enhances the precision of the urban HPSA group without having a large impact on the overall sample size. In addition, the urban HPSA area in Virginia adds racial diversity to the demonstration population in such areas; the percentage of beneficiaries in this area that are African American is high relative to other the urban HPSA areas represented in the various options.

To obtain estimator precision in the 15 percent range for the smallest beneficiary group, CMS will need to incorporate areas from at least two states. Attractive three-state options further improve precision in the smallest of the site types (urban HPSA), and add geographic and demographic diversity. The three-state options will improve precision to the 10 percent range for the smallest beneficiary group. The four-state options continue to improve the precision of the urban HPSA group, and add additional diversity.

[5] Texas also could have provided large numbers of HPSA beneficiaries if the entire state were included, however, this was rejected for several reasons: Texas is much larger than Illinois, and thus, would cause the demonstration to be much larger than necessary; Texas has a very large population of persons of Hispanic ethnicity, and thus, would not be as representative of the country as a whole; and the within-carrier comparison states for Texas were not as comparable, in terms of managed care enrollment, as were the comparison states for Illinois.

Exhibit A-1

Unadjusted* Beneficiary Counts by Urban/Rural and HPSA Status

State	RURAL NO HPSA Beneficiaries	RURAL HPSA Beneficiaries	URBAN NO HPSA Beneficiaries	URBAN HPSA Beneficiaries
Arkansas	148,425	31,042	154,152	13,675
Oklahoma	177,455	20,650	180,543	16,723
New Mexico	40,415	38,689	57,650	18,434
Nevada	12,541	10,111	104,059	4,456
Idaho	40,015	16,693	69,574	2,777
Illinois	233,325	42,260	961,686	41,985
North Carolinia	318,011	21,986	535,814	23,494
Tennessee	172,182	45,122	406,498	19,484
Indiania	158,620	31,966	499,268	23,573
Kentucky	189,311	34,106	217,285	21,075
Massachussetts	0	3,301	584,629	19,611
Maine	79,102	5,036	93,476	3,405
New Hampshire	63,055	875	66,817	0
Vermont	53,887	2,080	17,673	906
Delaware	27,656	0	63,322	2,049
Texas	282,456	131,179	1,039,289	152,297
Virginia	114,231	44,756	520,229	34,569

*The methodology for assigning HPSA status to zip codes and zip codes to counties results in an underestimate of beneficiaries. In states such as TX and NM with a large number of sparsely-populated counties, the underestimate for the state as a whole is on the order of 30% - 40%. For individual counties, the underestimate appears to be on the order of 15%. In subsequent analyses (and Exhibits) of beneficiary sample sizes, we adjust the estimates upwards based on county-level data available in the 2003 Area Resource File (ARF).

Exhibit A-2
Beneficiary* and Chiropractor Estimates for Potential Treatment Sites

			TREATMENT SITES							POTENTIAL COMPARISON SITES			
			RURAL		URBAN					RURAL		URBAN	
Site	Description	State	NO HPSA Beneficiaries	HPSA Beneficiaries	NO HPSA Beneficiaries	HPSA Beneficiaries	BENES	CHIROS	M+C BENES	NO HPSA	HPSA	NO HPSA	HPSA
IL1	Whole state	IL	282,323	51,135	1,163,640	50,802	1,547,900	2600	84,273	ID, NC, TN	TN	ID, NC, TN	NC/TN
IL2	Northern 26 counties + Scott, IA	IL	60,193	7,282	973,949	38,615	1,080,039	2566	53,642	ID, NC, TN	TN	ID, NC, TN	NC/TN
IL3	Chicago MSA	IL	0	0	803,271	33,309	836,580	1765	44,023			ID, NC, TN, IL	ID, NC, TN, IL
TX	Hidalgo County	TX	0	0	0	53,763	53,763	47	86				TX
VA	17 Central Counties	VA	0	1,832	84,148	29,941	115,921	102	322			DE,TX, VA	TX
NM1	Whole state	NM	58,198	55,712	83,016	26,545	223,471	260	39,930	AR, OK	AR/OK/NV	AR, OK, NV	
NM2	Whole state - Bernalillo	NM	52,540	50,296	32,885	22,264	157,984	134	12,480	AR, OK	AR/OK/NV	AR, OK, NV	
NM3	Whole state - (Bernalillo+3)	NM	50,057	50,296	17,332	20,055	137,739	70	5,052	AR, OK	AR/OK/NV		
NM4	Whole state - (Bernalillo+4)	NM	50,057	50,296	0	17,783	118,135	52	4,900	AR, OK	AR/OK/NV		
ME1	Whole state	ME	90,967	5,791	107,497	3,916	208,172	279	87	NH, VT		NH, MA	
ME2	Whole state - 4 urban	ME	90,967	5,791	19,825	3,916	120,499	132	26	NH, VT			
NH1	Whole state	NH	77,558	1,076	82,185	0	160,819	297	1,286	ME, VT		ME, MA	
NH2	Whole state - 3 urban	NH	77,558	1,076	0	0	78,634	108	45	ME, VT			
VT1	Whole state	VT	61,970	2,392	20,324	1,042	85,728	155	0	ME, NH			
VT2	Whole state - 3 urban	VT	61,970	2,392	0	1,042	65,404	96	0	ME, NH			

*Beneficiary estimates were adjusted upwards to account for the underestimates associated with the methodology used to assign HPSA status to county and sub-county areas.

Exhibit A-3
Beneficiaries,* Chiropractors, and Minimum Detectable Effects for Selected Site Combinations

Site Combination Number	Site Combination	Beneficiaries	Chiros	Range for Min Detectable Effect as Percent of Mean Expenditure					Beneficiaries by Group			
				All Sites Combined		Smallest Site			RURAL		URBAN	
				MIN	MAX	MIN	MAX	Type	NO HPSA	HPSA	NO HPSA	HPSA
Two State												
1	IL1, ME2	1,668,399	2,732	2.0%	3.0%	11.0%	16.5%	Urban HPSA	373,291	56,926	1,183,465	54,718
2	IL2, VA	1,195,960	2,668	2.4%	3.5%	27.0%	40.5%	Rural HPSA	60,193	9,114	1,058,097	68,556
Three State												
3	IL1, VT2, NM2	1,771,288	2,830	1.9%	2.9%	9.5%	14.2%	Urban HPSA	396,833	103,822	1,196,525	74,108
4	IL2, ME2, NM1	1,424,009	2,958	2.2%	3.2%	9.8%	14.7%	Urban HPSA	209,358	68,786	1,076,790	69,076
5	IL3, ME2, NM1	1,180,550	2,157	2.4%	3.6%	10.4%	15.6%	Rural HPSA	149,165	61,504	906,112	63,769
Four State												
6	IL2, ME1, NM1, VA	1,627,603	3,207	2.0%	3.0%	9.7%	14.5%	Rural HPSA	209,358	70,618	1,248,610	99,017
7	IL3, ME1, NM1, VA	1,384,144	2,406	2.2%	3.3%	10.2%	15.4%	Rural HPSA	149,165	63,336	1,077,933	93,711
8	IL3, ME2, NM2, VA	1,230,984	2,133	2.3%	3.5%	10.7%	16.1%	Rural HPSA	143,507	57,919	940,129	89,429
9	IL3, VT2, NM2, VA	1,175,889	2,097	2.4%	3.6%	11.0%	16.6%	Rural HPSA	114,510	54,520	920,304	86,556

*Beneficiary estimates were adjusted upwards to account for the underestimates associated with the methodology used to assign HPSA status to county and sub-county areas.

APPENDIX B

ZIP CODES FOR ILLIINOIS AND VIRGINIA DEMONSTRATION SITES

Illinois Zip Codes (including Scott County, Iowa)

ZIP CODE	COUNTY	ZIP CODE	COUNTY	ZIP CODE	COUNTY
61008	BOONE	60068	COOK	60422	COOK
61011	BOONE	60070	COOK	60425	COOK
61012	BOONE	60074	COOK	60426	COOK
61038	BOONE	60076	COOK	60428	COOK
61065	BOONE	60077	COOK	60429	COOK
61312	BUREAU	60078	COOK	60430	COOK
61314	BUREAU	60082	COOK	60438	COOK
61315	BUREAU	60090	COOK	60439	COOK
61317	BUREAU	60091	COOK	60443	COOK
61320	BUREAU	60093	COOK	60445	COOK
61322	BUREAU	60094	COOK	60452	COOK
61323	BUREAU	60095	COOK	60453	COOK
61328	BUREAU	60104	COOK	60454	COOK
61329	BUREAU	60107	COOK	60455	COOK
61330	BUREAU	60130	COOK	60456	COOK
61337	BUREAU	60131	COOK	60457	COOK
61338	BUREAU	60133	COOK	60458	COOK
61344	BUREAU	60141	COOK	60459	COOK
61345	BUREAU	60153	COOK	60461	COOK
61346	BUREAU	60154	COOK	60462	COOK
61349	BUREAU	60155	COOK	60463	COOK
61356	BUREAU	60159	COOK	60464	COOK
61359	BUREAU	60160	COOK	60465	COOK
61361	BUREAU	60161	COOK	60466	COOK
61362	BUREAU	60162	COOK	60467	COOK
61368	BUREAU	60163	COOK	60469	COOK
61374	BUREAU	60164	COOK	60471	COOK
61376	BUREAU	60165	COOK	60472	COOK
61379	BUREAU	60168	COOK	60473	COOK
61014	CARROLL	60171	COOK	60475	COOK
61046	CARROLL	60173	COOK	60476	COOK
61051	CARROLL	60176	COOK	60477	COOK
61053	CARROLL	60179	COOK	60478	COOK
61074	CARROLL	60192	COOK	60480	COOK
61078	CARROLL	60193	COOK	60482	COOK
61285	CARROLL	60194	COOK	60499	COOK
60004	COOK	60195	COOK	60501	COOK
60005	COOK	60196	COOK	60513	COOK
60006	COOK	60201	COOK	60525	COOK
60007	COOK	60202	COOK	60526	COOK
60008	COOK	60203	COOK	60534	COOK
60009	COOK	60204	COOK	60546	COOK
60016	COOK	60208	COOK	60558	COOK
60017	COOK	60209	COOK	60601	COOK
60018	COOK	60296	COOK	60602	COOK
60019	COOK	60297	COOK	60603	COOK
60022	COOK	60301	COOK	60604	COOK
60025	COOK	60302	COOK	60605	COOK
60026	COOK	60303	COOK	60606	COOK
60029	COOK	60304	COOK	60607	COOK
60038	COOK	60305	COOK	60608	COOK
60043	COOK	60402	COOK	60609	COOK
60053	COOK	60406	COOK	60610	COOK
60055	COOK	60409	COOK	60611	COOK
60056	COOK	60411	COOK	60612	COOK
60062	COOK	60412	COOK	60613	COOK
60065	COOK	60415	COOK	60614	COOK
60067	COOK	60419	COOK	60615	COOK

60616	COOK	60691	COOK	60399	DU PAGE
60617	COOK	60693	COOK	60504	DU PAGE
60618	COOK	60694	COOK	60514	DU PAGE
60619	COOK	60695	COOK	60515	DU PAGE
60620	COOK	60696	COOK	60516	DU PAGE
60621	COOK	60697	COOK	60517	DU PAGE
60622	COOK	60699	COOK	60519	DU PAGE
60623	COOK	60701	COOK	60521	DU PAGE
60624	COOK	60706	COOK	60522	DU PAGE
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60630	COOK	60804	COOK	60540	DU PAGE
60631	COOK	60805	COOK	60555	DU PAGE
60632	COOK	60827	COOK	60559	DU PAGE
60633	COOK	60111	DE KALB	60561	DU PAGE
60634	COOK	60112	DE KALB	60563	DU PAGE
60636	COOK	60115	DE KALB	60565	DU PAGE
60637	COOK	60129	DE KALB	60566	DU PAGE
60638	COOK	60135	DE KALB	60567	DU PAGE
60639	COOK	60145	DE KALB	60570	DU PAGE
60640	COOK	60146	DE KALB	60572	DU PAGE
60641	COOK	60150	DE KALB	60597	DU PAGE
60643	COOK	60178	DE KALB	60598	DU PAGE
60644	COOK	60520	DE KALB	60599	DU PAGE
60645	COOK	60548	DE KALB	60407	GRUNDY
60646	COOK	60550	DE KALB	60416	GRUNDY
60647	COOK	60552	DE KALB	60424	GRUNDY
60649	COOK	60556	DE KALB	60437	GRUNDY
60651	COOK	60101	DU PAGE	60444	GRUNDY
60652	COOK	60103	DU PAGE	60447	GRUNDY
60653	COOK	60105	DU PAGE	60450	GRUNDY
60654	COOK	60106	DU PAGE	60474	GRUNDY
60655	COOK	60108	DU PAGE	60479	GRUNDY
60656	COOK	60116	DU PAGE	61233	HENRY
60657	COOK	60117	DU PAGE	61234	HENRY
60659	COOK	60122	DU PAGE	61235	HENRY
60660	COOK	60125	DU PAGE	61238	HENRY
60661	COOK	60126	DU PAGE	61241	HENRY
60663	COOK	60128	DU PAGE	61254	HENRY
60664	COOK	60132	DU PAGE	61258	HENRY
60666	COOK	60137	DU PAGE	61262	HENRY
60668	COOK	60138	DU PAGE	61273	HENRY
60669	COOK	60139	DU PAGE	61274	HENRY
60670	COOK	60143	DU PAGE	61413	HENRY
60673	COOK	60148	DU PAGE	61419	HENRY
60674	COOK	60157	DU PAGE	61434	HENRY
60675	COOK	60172	DU PAGE	61443	HENRY
60677	COOK	60181	DU PAGE	61468	HENRY
60678	COOK	60184	DU PAGE	61490	HENRY
60679	COOK	60185	DU PAGE	61001	JO DAVIESS
60680	COOK	60186	DU PAGE	61025	JO DAVIESS
60681	COOK	60187	DU PAGE	61028	JO DAVIESS
60682	COOK	60188	DU PAGE	61036	JO DAVIESS
60684	COOK	60189	DU PAGE	61041	JO DAVIESS
60685	COOK	60190	DU PAGE	61059	JO DAVIESS
60686	COOK	60191	DU PAGE	61075	JO DAVIESS
60687	COOK	60197	DU PAGE	61085	JO DAVIESS
60688	COOK	60199	DU PAGE	61087	JO DAVIESS
60689	COOK	60199	DU PAGE	60109	KANE
60690	COOK	60398	DU PAGE	60110	KANE

60118	KANE	61342	LA SALLE	61375	MARSHALL
60119	KANE	61348	LA SALLE	61377	MARSHALL
60120	KANE	61350	LA SALLE	61424	MARSHALL
60121	KANE	61354	LA SALLE	61537	MARSHALL
60123	KANE	61358	LA SALLE	61540	MARSHALL
60134	KANE	61360	LA SALLE	61541	MARSHALL
60136	KANE	61364	LA SALLE	61565	MARSHALL
60140	KANE	61370	LA SALLE	60001	MCHENRY
60144	KANE	61371	LA SALLE	60012	MCHENRY
60147	KANE	61372	LA SALLE	60013	MCHENRY
60151	KANE	61373	LA SALLE	60014	MCHENRY
60170	KANE	60002	LAKE	60021	MCHENRY
60174	KANE	60010	LAKE	60033	MCHENRY
60175	KANE	60011	LAKE	60034	MCHENRY
60177	KANE	60015	LAKE	60039	MCHENRY
60183	KANE	60020	LAKE	60050	MCHENRY
60505	KANE	60030	LAKE	60051	MCHENRY
60506	KANE	60031	LAKE	60071	MCHENRY
60507	KANE	60035	LAKE	60072	MCHENRY
60510	KANE	60037	LAKE	60081	MCHENRY
60511	KANE	60040	LAKE	60097	MCHENRY
60539	KANE	60041	LAKE	60098	MCHENRY
60542	KANE	60042	LAKE	60102	MCHENRY
60554	KANE	60044	LAKE	60142	MCHENRY
60568	KANE	60045	LAKE	60152	MCHENRY
60901	KANKAKEE	60046	LAKE	60156	MCHENRY
60910	KANKAKEE	60047	LAKE	60180	MCHENRY
60913	KANKAKEE	60048	LAKE	61231	MERCER
60914	KANKAKEE	60049	LAKE	61260	MERCER
60915	KANKAKEE	60060	LAKE	61263	MERCER
60917	KANKAKEE	60061	LAKE	61272	MERCER
60922	KANKAKEE	60064	LAKE	61276	MERCER
60935	KANKAKEE	60069	LAKE	61281	MERCER
60940	KANKAKEE	60073	LAKE	61412	MERCER
60941	KANKAKEE	60075	LAKE	61442	MERCER
60944	KANKAKEE	60079	LAKE	61465	MERCER
60950	KANKAKEE	60083	LAKE	61466	MERCER
60954	KANKAKEE	60084	LAKE	61476	MERCER
60961	KANKAKEE	60085	LAKE	61486	MERCER
60964	KANKAKEE	60086	LAKE	60113	OGLE
60969	KANKAKEE	60087	LAKE	61007	OGLE
60512	KENDALL	60088	LAKE	61010	OGLE
60536	KENDALL	60089	LAKE	61015	OGLE
60537	KENDALL	60092	LAKE	61020	OGLE
60538	KENDALL	60096	LAKE	61030	OGLE
60541	KENDALL	60099	LAKE	61043	OGLE
60543	KENDALL	60530	LEE	61047	OGLE
60545	KENDALL	60553	LEE	61049	OGLE
60560	KENDALL	61006	LEE	61052	OGLE
60470	LA SALLE	61021	LEE	61054	OGLE
60518	LA SALLE	61031	LEE	61061	OGLE
60531	LA SALLE	61042	LEE	61064	OGLE
60549	LA SALLE	61057	LEE	61068	OGLE
60551	LA SALLE	61058	LEE	61084	OGLE
60557	LA SALLE	61310	LEE	61091	OGLE
61301	LA SALLE	61318	LEE	61326	PUTNAM
61316	LA SALLE	61324	LEE	61327	PUTNAM
61321	LA SALLE	61331	LEE	61335	PUTNAM
61325	LA SALLE	61353	LEE	61336	PUTNAM
61332	LA SALLE	61367	LEE	61340	PUTNAM
61334	LA SALLE	61378	LEE	61363	PUTNAM
61341	LA SALLE	61369	MARSHALL	61560	PUTNAM

61201	ROCK ISLAND	60434	WILL	52805	SCOTT, IA
61204	ROCK ISLAND	60435	WILL	52806	SCOTT, IA
61232	ROCK ISLAND	60436	WILL	52807	SCOTT, IA
61236	ROCK ISLAND	60440	WILL	52808	SCOTT, IA
61237	ROCK ISLAND	60441	WILL	52809	SCOTT, IA
61239	ROCK ISLAND	60442	WILL	52769	SCOTT, IA
61240	ROCK ISLAND	60446	WILL		
61242	ROCK ISLAND	60448	WILL		
61244	ROCK ISLAND	60449	WILL		
61256	ROCK ISLAND	60451	WILL		
61257	ROCK ISLAND	60468	WILL		
61259	ROCK ISLAND	60481	WILL		
61264	ROCK ISLAND	60490	WILL		
61265	ROCK ISLAND	60491	WILL		
61266	ROCK ISLAND	60544	WILL		
61275	ROCK ISLAND	60564	WILL		
61278	ROCK ISLAND	61016	WINNEBAGO		
61279	ROCK ISLAND	61024	WINNEBAGO		
61282	ROCK ISLAND	61063	WINNEBAGO		
61284	ROCK ISLAND	61072	WINNEBAGO		
61299	ROCK ISLAND	61073	WINNEBAGO		
61421	STARK	61077	WINNEBAGO		
61426	STARK	61079	WINNEBAGO		
61449	STARK	61080	WINNEBAGO		
61479	STARK	61088	WINNEBAGO		
61483	STARK	61101	WINNEBAGO		
61491	STARK	61102	WINNEBAGO		
61013	STEPHENSON	61103	WINNEBAGO		
61018	STEPHENSON	61104	WINNEBAGO		
61019	STEPHENSON	61105	WINNEBAGO		
61027	STEPHENSON	61106	WINNEBAGO		
61032	STEPHENSON	61107	WINNEBAGO		
61039	STEPHENSON	61108	WINNEBAGO		
61044	STEPHENSON	61109	WINNEBAGO		
61048	STEPHENSON	61110	WINNEBAGO		
61050	STEPHENSON	61111	WINNEBAGO		
61060	STEPHENSON	61112	WINNEBAGO		
61062	STEPHENSON	61114	WINNEBAGO		
61067	STEPHENSON	61115	WINNEBAGO		
61070	STEPHENSON	61125	WINNEBAGO		
61089	STEPHENSON	61126	WINNEBAGO		
61037	WHITESIDE	61130	WINNEBAGO		
61071	WHITESIDE	61131	WINNEBAGO		
61081	WHITESIDE	61132	WINNEBAGO		
61230	WHITESIDE				
61243	WHITESIDE	52722	SCOTT, IA		
61250	WHITESIDE	52726	SCOTT, IA		
61251	WHITESIDE	52728	SCOTT, IA		
61252	WHITESIDE	52745	SCOTT, IA		
61261	WHITESIDE	52746	SCOTT, IA		
61270	WHITESIDE	52748	SCOTT, IA		
61277	WHITESIDE	52753	SCOTT, IA		
61283	WHITESIDE	52756	SCOTT, IA		
60401	WILL	52758	SCOTT, IA		
60408	WILL	52765	SCOTT, IA		
60410	WILL	52767	SCOTT, IA		
60417	WILL	52768	SCOTT, IA		
60421	WILL	52773	SCOTT, IA		
60423	WILL	52801	SCOTT, IA		
60431	WILL	52802	SCOTT, IA		
60432	WILL	52803	SCOTT, IA		
60433	WILL	52804	SCOTT, IA		

Virginia Zip Codes

ZIP CODE	COUNTY
22427	CAROLINE
22428	CAROLINE
22446	CAROLINE
22501	CAROLINE
22514	CAROLINE
22535	CAROLINE
22538	CAROLINE
22546	CAROLINE
22552	CAROLINE
22580	CAROLINE
22920	NELSON
22922	NELSON
22938	NELSON
22949	NELSON
22954	NELSON
22958	NELSON
22963	FLUVANNA
22964	NELSON
22967	NELSON
22969	NELSON
22971	NELSON
22974	FLUVANNA
22976	NELSON
23002	AMELIA
23004	BUCKINGHAM
23005	HANOVER
23011	NEW KENT
23014	GOOCHLAND
23015	HANOVER
23022	FLUVANNA
23024	LOUISA
23027	CUMBERLAND
23038	GOOCHLAND
23039	GOOCHLAND
23040	CUMBERLAND
23047	HANOVER
23055	FLUVANNA
23058	HENRICO
23059	HENRICO
23060	HENRICO
23063	GOOCHLAND
23065	GOOCHLAND
23067	GOOCHLAND
23069	HANOVER
23075	HENRICO
23083	AMELIA
23084	FLUVANNA
23089	NEW KENT
23093	LOUISA
23101	POWHATAN
23102	GOOCHLAND
23103	GOOCHLAND
23105	AMELIA
23111	HANOVER
23116	HANOVER
23117	LOUISA
23123	BUCKINGHAM
23124	NEW KENT
23129	GOOCHLAND
23139	POWHATAN
23140	NEW KENT
23141	NEW KENT
23146	HANOVER
23150	HENRICO
23153	GOOCHLAND
23160	GOOCHLAND
23162	HANOVER
23170	LOUISA
23173	RICHMOND CITY
23192	HANOVER
23218	RICHMOND CITY
23219	RICHMOND CITY
23220	RICHMOND CITY
23221	RICHMOND CITY
23222	RICHMOND CITY
23223	RICHMOND CITY
23224	RICHMOND CITY
23225	RICHMOND CITY
23226	HENRICO
23227	HENRICO
23228	HENRICO
23229	HENRICO
23230	HENRICO
23231	HENRICO
23231	HENRICO
23232	RICHMOND CITY
23233	HENRICO
23234	RICHMOND CITY
23238	HENRICO
23240	RICHMOND CITY
23241	RICHMOND CITY
23242	HENRICO
23249	RICHMOND CITY
23250	HENRICO
23255	HENRICO
23260	RICHMOND CITY
23261	RICHMOND CITY
23269	RICHMOND CITY
23272	RICHMOND CITY
23273	RICHMOND CITY
23274	RICHMOND CITY
23275	RICHMOND CITY
23276	RICHMOND CITY
23278	RICHMOND CITY
23279	RICHMOND CITY
23280	HENRICO
23282	RICHMOND CITY
23284	RICHMOND CITY
23285	RICHMOND CITY
23286	RICHMOND CITY
23288	HENRICO
23289	HENRICO
23290	RICHMOND CITY
23291	RICHMOND CITY
23292	RICHMOND CITY
23293	RICHMOND CITY
23294	HENRICO
23295	RICHMOND CITY
23298	RICHMOND CITY
23921	BUCKINGHAM
23936	BUCKINGHAM
23939	APPOMATTOX
23958	APPOMATTOX
24069	PITTSYLVANIA
24139	PITTSYLVANIA
24161	PITTSYLVANIA
24464	NELSON
24502	CAMPBELL
24517	CAMPBELL
24522	APPOMATTOX
24527	PITTSYLVANIA
24528	CAMPBELL
24530	PITTSYLVANIA
24531	PITTSYLVANIA
24538	CAMPBELL
24540	DANVILLE CITY
24541	DANVILLE CITY
24543	DANVILLE CITY
24544	DANVILLE CITY
24549	PITTSYLVANIA
24550	CAMPBELL
24553	NELSON
24554	CAMPBELL
24557	PITTSYLVANIA
24562	BUCKINGHAM
24563	PITTSYLVANIA
24565	PITTSYLVANIA
24566	PITTSYLVANIA
24569	PITTSYLVANIA
24571	CAMPBELL
24576	CAMPBELL
24581	NELSON
24586	PITTSYLVANIA
24588	CAMPBELL
24590	BUCKINGHAM/FLU
24593	APPOMATTOX
24594	PITTSYLVANIA
24599	BUCKINGHAM

APPENDIX C

DIAGNOSIS CODES

Diagnosis (ICD-9) Codes

Code	Description	Specific Codes within the Range*
307	Special symptoms	307.81
138	Late effects of poliomyelitis	
340	Multiple sclerosis	
346	Migraine	346.0, 346.1, 346.2, 346.8, 346.9
350	Trigeminal neuralgia	350.1, 350.2
352	disorder cranial nerve	352.4
353	disorder, nerve root and plexus	353.0, 353.1, 353.2, 353.4, 353.6
354	Mononeuritis, upper limb and multiple	354.0, 354.1, 354.2, 354.3, 354.4, 354.8, 354.9
355	Mononeuritis, lower limb	355.0, 355.1, 355.2, 355.3, 355.4, 355.5, 355.6, 355.71, 355.79, 355.8, 355.9
356	Neuropathy, hereditary and idoiopathic	356.1, 356.4, 356.8, 356.9
358	disorders myoneural	358.00, 358.01
715	Arthritis, osteoarthritis*	715.0x, 715.1x, 715.2x, 715.3x, 715.8x, 715.9x
716	Arthropathies, NEC/NOS*	716.1x, 716.2x, 716.3x, 716.4x, 716.5x, 716.6x, 716.8x, 716.9x
717	derangement, knee internal	717.0-3, 717.40-43, 717.49, 717.5-7, 717.81-84, 717.85, 717.89, 717.9
718	derangement, other joint*	718.0x, 718.1x, 718.6x, 718.8x, 718.9x, 718.48
719	disorder, joint NEC/NOS*	719.0x, 719.1x, 719.2x, 719.3x, 719.4x, 719.5x, 719.6x, 719.7x, 719.8x, 719.9x
720	Spondylitis, ankylosing and other inflammatory spondylopathies	720.0, 720.1, 720.2, 720.81, 720.89, 720.9
721	Spondylosis and allied disorders	721.0, 721.1, 721.2, 721.3, 721.4, 721.5, 721.6, 721.7, 721.8, 721.90, 721.91
722	disorder, intervertebral disc	722.0, 722.10-.11, 722.2, 722.30-.32, 722.39-.4, 722.51-.52, 722.6, 722.70-.73, 722.81-.83, 722.91-.93
723	disorder cervical spine	723.0, 723.1, 723.2, 723.3, 723.4, 723.5, 723.6, 723.7, 723.8, 723.9
724	disorders, back NEC/NOS	724.00-03, 724.1-6, 724.70, 724.71, 724.79, 724.8, 724.9
725	Polymyalgia rheumatica	
726	enthesopathies, peripheral and allied syndromes	726.0, 726.10-.12, .19, 726.2, 726.30-.32, .39, 726.4, .5, 726.60-.65, .69, 726.70-.73,.79, 726.8, .90, .91
727	disorders, synovium tendon and bursa	727.00-.06, 727.09,.1, .2, .3, 727.40-.43, 727.49, 727.50-.51, 727.59, 727.60-.69, 727.81-.83, 727.89-.9
728	disorders, muscle, ligament and fascia	728.10-.12, 728.2, .3, .4, .5, .6, 728.71, 728.79, 728.81, 728.83, 728.85, 728.87, 728.89, 728.9
733	Other disorders of bone and cartilage	733.6, 733.92
734	Pes planus	

735	deformity, toe acquired	735.0, 735.1, 735.2, 735.4, 735.5, 735.8, 735.9
736	Deformity, limbs acquired	736.00-.07, 736.09-.1, 736.20-.22, 736.29-.32, 736.39, 736.41-.42, 736.6,.70-.76, 736.79, 736.81, 736.89
737	Curvature spine	737.0, 737.10, 737.11, 737.12, 737.19, 737.20-22, 737.29, 737.30-34, 737.40-43, 737.8, 737.9
738	deformity, acquired	738.2-9
739	Lesions, nonallopathic NEC	739.0-9
754	Congenital musculoskeletal deformities	754.1, 754.2, 754.40-44, 754.50-53, 754.59, 754.60-62, 754.69, 754.70, 754.71, 754.79
756	other congenital musculoskeletal abnormalities	756.10-15, 756.17, 756.19, 756.2, 756.3, 756.4, 756.82, 756.83, 756.89
840	Sprains and strains of shoulder and upper arm	840.1-9
841	Sprains and strains of elbow and forearm	841.0-.3,
842	Sprains and strains of wrist and hand	842.00-02, 842.09-13, 842.19
843	Sprains and strains of hip and thigh	843.0, 843.1, 843.8, 843.9
844	Sprains and strains of knee and leg	844.0-844.3, 844.8, 844.9
845	Sprains and strains of ankle and foot	845.00-03, 845.09-13, 845.19
846	Sprains and strains of the sacroiliac region	846.0-3, 846.8, 846.9
847	Sprains and strains of back NEC/NOS	847.0-4, 847.9
848	Sprains and strains, ill-defined, NEC	848.3, 848.40-42, 848.49, 848.8, 848.9
905	Late effects, musculoskeletal and connective tissues injuries	905.1-9
907	Late effects, injuries to the nervous system	907, 907.1-5, 907.9
922	Contusion, trunk	922.1, 922.31, 922.33, 922.33, 922.8
923	Contusion, upper limb	923.00-03, 923.09-11, 923.20-21, 923.3, 923.8, 923.9
924	Contusion, lower limb	924.00, 924.01, 924.10-11, 924.20-21, 924.3-5, 924.8, 924.9
955	Injury, peripheral nerve(s) of shoulder girdle and upper limb	955.0-9
956	Injury, peripheral nerve(s) of pelvic girdle and lower limb	956.0-5, 956.8, 956.9
958	Certain traumatic complications	958.6
784	Symptoms involving head and neck	784.0

*Note: "x" specifies anatomic site, and any value would be appropriate