The Impact of Medicare's Payment Rates on the Volume of Services Provided by Skilled Nursing Facilities

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CBO

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Note

Unless otherwise indicated, all payment rates reflect payments per resident per day received by a skilled nursing facility from Medicare and from patients.

Preface

Rising costs in Medicare, Medicaid, and other federal health-related programs represent the central long-term fiscal challenge facing the nation. The Congressional Budget Office (CBO) is therefore increasingly focusing on analyzing the causes of those rising costs and potential policy responses.

Medicare's spending under the fee-for-service portion of the program depends on the rates that Medicare pays to medical providers and the volume of services that medical providers supply to beneficiaries. The Congress has periodically limited growth in Medicare's payments to providers to reduce spending. The effect on Medicare's spending of changes in Medicare's payment rates depends on whether and to what extent the volume of services adjusts in response.

In this background paper, CBO examines changes in the volume of services provided by skilled nursing facilities (SNFs) in response to changes in Medicare's payment rates for SNFs. As with other CBO background papers, it is designed to make the agency's analyses more transparent by explaining CBO's methods and assumptions. In keeping with CBO's mandate to provide objective, nonpartisan analysis, this paper makes no recommendations.

Peter R. Orszag
Director

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Summary and Introduction

The central long-term fiscal challenge facing the nation involves rising costs in Medicare, Medicaid, and other federal health-related programs. The Congressional Budget Office (CBO) is therefore expanding its work in examining the rising costs within the nation's federal health programs as well as possible policy responses.

Medicare's benefit package includes coverage for short-term posthospitalization care in skilled nursing facilities (SNFs). Medicare beneficiaries can qualify to receive Medicare-covered SNF care if they previously had an inpatient hospital stay of at least three days and if they require skilled nursing services. SNFs' covered services include rehabilitation and medical services such as intravenous drug therapy.

Medicare spent $19.5 billion on SNF care in 2006, which is about 6.6 percent of total Medicare spending in the fee-for-service sector.[1] The system Medicare uses to determine SNF payment rates has undergone several major revisions in the past decade, the most significant of which was the introduction of a prospective payment system (PPS) in 1998. Under that system, Medicare pays a daily rate for SNF care that is calculated by combining a national base rate, a local wage index adjustor, and a case-mix adjustor. In the years since the PPS was implemented, payment rates have been changed repeatedly, with the impact of those changes varying substantially across SNFs.

This Congressional Budget Office background paper measures how the volume of Medicare-covered SNF ser-

vices adjusts in response to changes in Medicare's SNF payment rates (the so-called volume response). The payment rate equals the payment received by a medical provider in exchange for providing a single unit of medical service; that rate comprises payments both from Medicare and from the patient. Although Medicare's payment rates for SNFs have been changed repeatedly over the past decade, beneficiaries' coinsurance for SNF care and other factors that affect the demand for that care have remained relatively stable. The volume response measured in this paper, therefore, reflects mainly a supply-driven phenomenon.

This paper includes two separate analyses. The two analyses take similar approaches, but they measure changes in payment rates and volume using different units of analysis over different periods. The use of two separate analyses provides a robustness check and offers some evidence on the sensitivity of the key findings to the analytical approach taken. In the geographic-level analysis, changes from 1997 to 2001 in SNF volume and payment rates are measured for 3,436 different hospital service areas, or HSAs. (HSAs are geographic areas corresponding to local health care markets.) The years 1997 and 2001 were chosen for the geographic analysis because they fall on either side of the implementation of the SNF prospective payment system. In the provider-level analysis, year-to-year changes in SNF volume and payment rates are measured for each SNF from 1999 through 2003. During those years, there were several legislative changes to Medicare's SNF payment rates under the PPS.

Although most SNFs operate as units within freestanding nursing facilities, a significant share of SNFs are hospital based. Freestanding and hospital-based SNFs differ in several important ways. At the median, Medicare-covered

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1. Congressional Budget Office, "Fact Sheet for CBO's March 2007 Baseline: Medicare (Components of Benefits Payments)," p. 2.

SNF days made up 11 percent of total patient days in freestanding facilities in 2005 (the remaining patients in freestanding SNFs are non-Medicare patients or long-term care residents).[2] On average, hospital-based SNFs tend to largely serve Medicare beneficiaries. To account for that and other differences, this analysis measures volume responses among freestanding and hospital-based SNFs separately.

The geographic-level and provider-level analyses together provide evidence that the volume of Medicare-covered SNF days varies positively with Medicare's SNF payment rates. For example, a change of 1 percent in Medicare's payment rate for SNFs is estimated to result in a modest change of 0.13 percent in volume (based on the geographic-level analysis) or 0.23 percent (based on the provider-level analysis), with volume changing in the same direction as payment rates. In both the geographic-level and provider-level analyses, that same direction of volume response is found among hospital-based and freestanding SNFs.

The geographic-level analysis suggests that SNFs increase the volume of services they provide in response to an increase in payment rates and likewise decrease volume in response to a decrease in payment rates, with the magnitude of those responses being roughly similar. The provider-level analysis also suggests a modest and statistically significant increase in the volume of SNF services in response to payment increases (in that analysis, the response to payment decreases was not statistically significant). Overall, those findings imply that the impact on Medicare's spending of a change in Medicare's SNF payment rates will be magnified to some extent by the volume response, meaning that an increase in payment rates will lead to a somewhat larger percentage increase in Medicare's spending on skilled nursing facilities.

Background Information

Volume response refers to a change in the volume of medical services in response to a change in the payment rate that medical providers receive. The measurement of volume response is relevant to CBO's estimates of the impact on Medicare's spending of proposed changes in

Medicare's payment rates. For example, a proposed increase of 1 percent in Medicare's payment rates for SNFs could increase Medicare's spending on that care by more than 1 percent if volume increased as a result of the change in payment rates, or by less than 1 percent if volume decreased.[3] To date, there has been little research on changes in Medicare's payment rates for skilled nursing facilities and how they affect Medicare's spending.

In theory, providers will respond in certain ways to changes in payment rates. This section of the paper examines providers' responses and reviews the relevant empirical research. It also looks at Medicare's payment system for SNFs and the payment changes that underlie the analyses in this paper.

The Volume Response: A Theoretical Framework

In general, a change in the volume of medical services provided in response to a given change in the payment rate may stem from supply-side factors, demand-side factors, or both. An example of a demand-side volume response would be a coinsurance arrangement in which beneficiaries' out-of-pocket payment equals a fixed share of the payment rate. Changes in the payment rate would lead directly to changes in the out-of-pocket payment, which would affect beneficiaries' demand for services. In the case of Medicare's SNF services, however, the out-of-pocket payment does not vary with the payment rate.

For the first 20 days of a SNF stay, Medicare beneficiaries face no cost sharing for SNF care. Beginning on the 21st day of a SNF stay, Medicare beneficiaries pay a daily coinsurance amount. In recent years, that amount has increased roughly in line with general inflation, rising from $95 in 1997 to $119 in 2007. The out-of-pocket payment for Medicare's SNF services does not vary across types of services, across the facilities themselves, or across regions, and it has remained stable over time. That fact implies that changes in SNF volume in response to changes in Medicare's payment rate mainly reflect changes in the supply or availability of SNF care (which depends on factors such as input prices and licensing requirements) rather than changes in the demand for

2. Medicare Payment Advisory Commission, *Report to Congress: Medicare Payment Policy* (March 2007), p. 171.

3. In cases in which a decrease in the payment rate has been found to lead to an increase in volume, the volume response has been referred to in the literature as a "volume offset." That term is used because some of the savings to Medicare from the decrease in payment rates would be offset by the increase in volume.

SNF care (which depends on factors such as beneficiaries' coinsurance, health status, and income).

Most previous research on the volume response of health care providers has focused on physicians. The behavior of physicians has been analyzed as a labor-supply decision, with a trade-off between working longer hours and earning more income or having more leisure time and earning less income.[4] An increase in fees paid to physicians will, according to the standard theoretical model, have two supply-side effects, which work in opposite directions. First, physicians will substitute work for leisure time because working has become more financially rewarding; second, physicians will decrease their supply of labor (work hours) because their potential income has increased and they can afford to "buy" more leisure time ("potential income" equals the amount a physician could earn if he or she only worked and spent no time on leisure activities).

In the case of Medicare's payments to physicians, changes in physicians' fees also have a demand-side effect because of Medicare's cost-sharing arrangements. Medicare beneficiaries' cost sharing for physicians' services is set equal to a percentage of the physicians' fees. (Different approaches are used to determine beneficiaries' cost sharing for SNF care and for other nonphysician services.) A change in physicians' fees results in a proportional change in the coinsurance amount, which affects the demand for physicians' services. The net effect of an increase in physicians' fees on the volume of services provided could be either positive or negative, depending on the relative magnitudes of the two supply-side effects (the substitution effect that increases work hours and the income effect that decreases work hours) and the demand-side coinsurance effect.[5]

Researchers have also proposed theories regarding volume responses in institutional settings, such as hospitals, nursing facilities, and laboratories. In those settings, volume responses have been characterized as firms' choosing their level of output in response to the payment rate, prices for

medical inputs (primarily wages paid to their workers), and factors that affect demand. The key difference between firms' and physicians' choice of output level is that physicians have a demand for leisure time, whereas firms do not. Because of that difference, in the standard theoretical model of the behavior of an institutional provider, output would generally be assumed to rise in response to an increase in the payment rate and to fall in response to a decrease in the payment rate.[6]

One assumption underlying the analyses in this paper is that medical providers have some influence over the volume of medical services consumed. If that were not the case—if, for example, the consumption of medical services was determined solely by patients' preferences or by some objective assessment of medical "need"—then changes in payment rates would not be expected to affect the volume of services consumed. In fact, the availability of medical services has been shown to exert a strong influence over the volume of medical services consumed, in particular the volume of so-called supply-sensitive services.[7] In the specific case of post-acute care, the level of availability of different types of services has been shown to be a strong predictor of whether patients use post-acute care and what type of that care they use.[8]

Changes in Medicare's payment rates for SNF care could lead to supply-driven changes in the volume of SNF services provided. For example, in response to changes in Medicare's payment rates, SNFs could alter the availability of the care they provide through changes in the num-

4. See, for example, Thomas G. McGuire and Mark V. Pauly, "Physician Response to Fee Changes with Multiple Payers," *Journal of Health Economics,* vol. 10, no. 4 (1991), pp. 385–410.

5. Congressional Budget Office, *Factors Underlying the Growth in Medicare's Spending for Physicians' Services* (June 2007).

6. For a theoretical analysis of hospitals' responses to payment changes and a summary of early evidence on the effects of Medicare's PPS for hospitals, see Dominic Hodgkin and Thomas G. McGuire, "Payment Levels and Hospital Response to Prospective Payment," *Journal of Health Economics,* vol. 13, no. 1 (March 1994), pp. 1–29. A volume offset could occur in the hospital setting if a hospital, facing a reduction in the payment rate, increased its output to maintain its total revenues. That type of behavior might be expected if the hospital had large fixed costs and was concerned primarily with its own survival rather than maximizing its profits.

7. John E. Wennberg, Elliott S. Fisher, and Jonathan S. Skinner, "Geography and the Debate over Medicare Reform," *Health Affairs*, Web exclusive (February 13, 2002), pp. W96–W114.

8. Melinda Beeuwkes Buntin and others, *How Much Is Post-Acute Care Use Affected by Its Availability?* Working Paper No. 10424 (Cambridge, Mass.: National Bureau of Economic Research, 2004), available at http://papers.nber.org/papers/w10424.pdf.

ber of patients they treat, changes in their target mix of patients, or changes in their marketing practices (or all three). It is beyond the scope of this analysis to determine the exact mechanisms by which SNF volume could adjust in response to changes in payment rates, however.

Previous Empirical Research

Most of the recent empirical research on the volume response of health care providers has focused on the effect of fees paid to physicians on the volume of services provided by physicians.[9] The results of those studies are mixed: Some studies find that an increase in physicians' fees is associated with a decrease in the volume of services provided;[10] other studies find the opposite.[11]

Although hospitals account for a large share of total Medicare spending, there has been little empirical work done on volume responses in that setting. One recent paper found that increases in Medicare's payment rates for hospitals were associated with upcoding (toward diagnosis-related groups whose prices have been raised) rather than increases in the volume of admissions.[12] A separate study, which focused on the home health care

setting, linked lower payment rates with a lower volume of home health care services.[13]

The lack of agreement in the empirical literature on physicians' volume response almost certainly stems, at least in part, from differences in research methods and data sources. That lack of agreement may also reflect the fact that the direction of the physicians' volume response is theoretically ambiguous and may, in reality, vary over time and across types of services. That theoretical ambiguity does not apply to services provided by institutions such as hospitals or nursing facilities. Perhaps as a consequence, the little research that has been done on those types of facilities points consistently toward volume varying positively with payment rates.

Medicare's Payment Rates for Skilled Nursing Facilities

From the 1980s through the mid-1990s, Medicare's outlays for SNFs increased rapidly. Between 1983 and 1997, annual growth in those outlays averaged 26 percent.[14] Since 1997, Medicare's system for paying for skilled nursing care has undergone a series of major revisions, with substantial impacts on the payment rates SNFs receive. Prior to those revisions, SNFs were paid by Medicare on a cost-reimbursement basis, meaning that SNFs were reimbursed for the actual costs they reported, subject to certain limits. Those limits were applied to routine costs, such as nursing and housekeeping, but not to ancillary

9. Several decades ago, prior to the rise of managed care and government-run administered pricing systems, physicians had a great deal of discretion over the fees they charged and the payment rates they received. In that context, an appropriate model of physicians' volume responses would treat both the volume of physicians' services and payment rates as jointly determined outcomes of interest (see, for example, Martin S. Feldstein, "The Rising Price of Physicians' Services," *Review of Economics and Statistics,* vol. 52, no. 2, May 1970, pp. 121–133; and Mark V. Pauly and Mark A. Satterthwaite, "The Pricing of Primary Care Physicians Services: A Test of the Role of Consumer Information," *Bell Journal of Economics,* vol. 12, no. 2, Autumn 1981, pp. 488–506). More-recent research on physicians' volume responses, reflecting the institutional changes that have occurred, generally assumes that payment rates are not chosen by the physician or patients and that physicians and patients respond to externally driven changes in payment rates.

10. Sandra Christensen, "Volume Responses to Exogenous Changes in Medicare's Payment Policies," *Health Services Research,* vol. 27, no. 1 (April 1992), pp. 65–79; Xuan Nguyen Nguyen and Frederick William Derrick, "Physician Behavioral Response to a Medicare Price Reduction," *Health Services Research,* vol. 32, no. 3 (August 1997), pp. 283–298; and Winnie C. Yip, "Physician Response to Medicare Fee Reductions: Changes in the Volume of Coronary Artery Bypass Graft (CABG) Surgeries in the Medicare and Private Sectors," *Journal of Health Economics,* vol. 17, no. 6 (December 1998), pp. 675–699.

11. Jon Gruber and others, "Physician Fees and Procedure Intensity: The Case of Cesarean Delivery," *Journal of Health Economics,* vol. 18, no. 4 (August 1999), pp. 473–490; Jean M. Mitchell and others, "Spillover Effects of Medicare Fee Reductions: Evidence from Ophthalmology," *International Journal of Health Care Finance and Economics,* vol. 2, no. 3 (2002), pp. 171–188; and Jean M. Mitchell and others, "Physicians' Responses to Medicare Fee Schedule Reductions," *Medical Care,* vol. 38, no. 10 (2000), pp. 1029–1039.

12. Leemore S. Dafny, "How Do Hospitals Respond to Price Changes?" *American Economic Review,* vol. 95, no. 5 (December 2005), pp. 1525–1547.

13. Robin McKnight, *Home Care Reimbursement, Long-Term Care Utilization, and Health Outcomes,* Working Paper No. 10414 (Cambridge, Mass.: National Bureau of Economic Research, 2004), available at http://papers.nber.org/papers/w10414.pdf.

14. Centers for Medicare and Medicaid Services, "2006 Medicare and Medicaid Statistical Supplement," available at www.cms.hhs.gov/MedicareMedicaidStatSupp/.

services, such as physical and occupational therapy. As a result, Medicare's reimbursements to SNFs for ancillary services grew more rapidly than its reimbursements for routine costs.

In part to rein in Medicare's spending, lawmakers enacted the Balanced Budget Act of 1997, which replaced the cost-reimbursement system for SNFs with a prospective payment system. Under that system, SNFs are paid a fixed rate per resident per day.[15] The daily payment rate is set separately for different categories of residents and equals a national base rate multiplied by a local wage adjustor and a case-mix adjustor. The base rate is updated annually on the basis of changes in the SNF market basket (an index of input prices for SNFs calculated by the Centers for Medicare and Medicaid Services, or CMS). The local wage adjustor used by CMS in setting payment rates reflects differences across geographic regions in local hospital wages.[16] The case-mix adjustor is assigned separately to each SNF resident and reflects the estimated resource costs of caring for that resident.[17] To assign case-mix adjustors, CMS groups residents into resource utilization groups (RUGs) on the basis of a detailed assessment of each resident that is filled out by SNF staff.

After the initial implementation of the PPS, several large nursing facility chains reported large financial losses and

filed for bankruptcy. In part, those bankruptcies prompted the Congress to pass an additional set of legislative changes that temporarily increased Medicare's SNF payment rates.[18] Both the Balanced Budget Refinement Act of 1999 (BBRA-1999) and the Benefits Improvement and Protection Act of 2000 (BIPA-2000) increased SNF payment rates across the board and also provided targeted increases for certain case-mix categories. For example, BBRA-1999 temporarily increased by 20 percent payment rates for 15 of the 44 RUGs. The expiration of those temporary increases in 2002 resulted in a decline in average payment rates between 2002 and 2003 (see Table 1).

The shift in Medicare's payment method for SNFs from cost reimbursement to prospective payment resulted in only fairly modest changes in the national average payment rates. The mean inflation-adjusted Medicare payment rate dropped from $357 in 1997 (pre-PPS) to $317 in 1999 (immediately post-PPS) and then rose again to $343 in 2001 (see Table 1). The impact on individual SNFs was much more varied; many experienced substantial increases in payment rates, but many others experienced sizable decreases.

In general, the introduction of the PPS compressed payment rates. That compression in the distribution of payment rates reflects the switch from a system in which payment rates depended on each SNF's costs to a system in which a uniform national formula was used (albeit with geographic-level and patient-level adjustors). SNFs that in the pre-PPS period had higher costs per patient-day (and, therefore, higher payment rates) generally faced declines in payment rates, whereas SNFs that had lower costs (and, therefore, lower payment rates) generally faced increases in payment rates.

Before the PPS was implemented, hospital-based SNFs received much higher payment rates, on average, than

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15. Each SNF began the transition to the new payment system beginning with its first cost-reporting period on or after July 1, 1998. During the three-year transition period, part of the payment rate that each SNF received was based on the facility's specific historical unit cost. By fiscal year 2002, all SNFs were paid the PPS federal rate.

16. CBO includes in the regression analyses a measure of the change over time in local hospital wages (measured by aggregating salaries and hours for all hospitals in each county or HSA). That measure differs from the wage adjustor used by CMS in setting payment rates. CBO calculated changes over time in the wages paid by hospitals during the periods corresponding to the changes in SNF volume. The local wage adjustor calculated by CMS was not used because, by the time it could have been applied in setting payment rates, it would have been based on data that were several years out of date.

17. Julie Stone, *Medicare's Skilled Nursing Facility Payment,* CRS Report for Congress RL33921 (March 14, 2007), available at www.congress.gov/erp/rl/pdf/RL33921.pdf. At different times during a single stay, SNF residents may be assigned to different case-mix categories if their resident assessments change over the course of their stay.

18. For a discussion of the bankruptcies and the adequacy of Medicare's payment rates for SNFs, see the statement of Laura A. Dummit, Associate Director, Health Financing and Public Health Issues, Health, Education, and Human Services Division, General Accounting Office (now the Government Accountability Office), before the Senate Special Committee on Aging, *Nursing Homes: Aggregate Medicare Payments Are Adequate Despite Bankruptcies,* GAO/T-HEHS-00-192 (September 5, 2000), available at www.gao.gov/archive/2000/he00192t.pdf.

Table 1.

Medicare's Payment Rates for SNFs and the Volume of SNF Services Provided

	Geographic-Level Analysis		Provider-Level Analysis				
	1997	2001	1999	2000	2001	2002	2003
Average Medicare Payment Rate (2003 dollars)							
All SNFs	357	343	317	316	343	348	315
Freestanding SNFs	332	341	308	311	341	350	317
Hospital-Based SNFs	463	350	356	344	350	338	303
Volume of SNF Services Provided (Days per beneficiary for geographic-level analysis and days per facility for provider-level analysis)							
All SNFs	1.36	1.35	2,786	2,933	3,275	3,649	3,964
Freestanding SNFs	1.11	1.18	2,659	2,846	3,215	3,636	3,983
Hospital-Based SNFs	0.25	0.17	3,550	3,506	3,700	3,741	3,806

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility.

Payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index. For the geographic-level analysis, payment rates and the volume of SNF services are calculated at the level of the hospital service area, and statistics are weighted by the number of fee-for-service beneficiaries in each area in 1997. For the provider-level analysis, payment rates and the volume of SNF services are calculated at the level of the SNF, and statistics are weighted by the average payments each SNF receives for Medicare-covered services. The number of SNFs included in the provider-level analysis is about 14,000 in each year.

freestanding SNFs did. With the implementation of the PPS, therefore, they tended to face decreases in payment rates. Conversely, most freestanding SNFs faced increases in payment rates. Among both hospital-based and free-standing SNFs, however, there was a great deal of variation from one SNF to the next in the impact of the new system on payment rates.[19] The variation across SNFs both in the initial impact of the prospective payment system and in the impact of the changes from BBRA-1999 and BIPA-2000 provides a valuable opportunity for research into how SNFs respond to changes in payment rates.

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19. The average SNF payment rate (in 2003 dollars and keeping the case mix constant) declined by 4.7 percent during the 1997–2001 period but by only 2.1 percent during the 1999–2003 period. One measure of variation—the range in payment rate changes between the 75th and 25th percentiles—was 44.6 percent in the former period and 20.4 percent during the latter period. (Those data underlie Figures 1 and 2.)

Methods for Measuring the Volume Response Among Skilled Nursing Facilities

This paper uses two approaches to measure the effect on volume of changes in Medicare's SNF payment rates. The first is a geographic-level analysis, and the second is a provider-level analysis. Although those two empirical approaches are broadly similar, they use different data sets, units of analysis, and time periods. In both analyses, the percentage change in the volume of Medicare-covered SNF services is explained by the percentage change in the real (inflation-adjusted) payment rate and other control variables. Each approach identifies a component of the change in SNF payment rates that is directly attributable to changes in Medicare's payment formula and is not attributable to other factors (such as changes in the demographics of the SNF patient population or changes in the types of services provided by SNFs).

Both analyses focus exclusively on the services provided to Medicare beneficiaries who are enrolled in the traditional fee-for-service program. Medicare beneficiaries enrolled in private managed care plans (termed Medicare Advantage) are excluded because data on SNF volume

and payment rates are not available for those beneficiaries. CBO chose to use resident-days, rather than spending or admissions, as the measure of the volume of SNF services because resident-days are used as Medicare's basis of payment for SNFs as well as Medicare beneficiaries' coinsurance payments for SNFs.

Empirical Specification for Both Analyses

The following general empirical specification is used in all the regression analyses in this paper:

$$\Delta Q_i = \beta \Delta P_i + X_i \gamma + \varepsilon_i$$

where i indexes either the geographic area or the SNF, ΔQ_i equals the arc percentage change in the volume of Medicare-covered SNF days, ΔP_i equals the arc percentage change in case-mix-constant real SNF payment rates, X_i includes a set of control variables, and ε_i is an error term. The change in SNF volume, ΔQ_i, is defined using an arc percentage change formula:

$$\Delta Q_i = \frac{Q_{i, t2} - Q_{i, t1}}{(Q_{i, t1} + Q_{i, t2})/2}$$

where the subscript $t1$ denotes the base year and $t2$ denotes a later year.[20]

The change in the SNF payment rate, ΔP_i, is also defined using an arc percentage change:

$$\Delta P_i = \frac{\sum_c P_{i, c, t2} Q_{i, c, t1}/I_{t2} - \sum_c P_{i, c, t1} Q_{i, c, t1}/I_{t1}}{\left(\sum_c P_{i, c, t2} Q_{i, c, t1}/I_{t2} + \sum_c P_{i, c, t1} Q_{i, c, t1}/I_{t1}\right)/2}$$

where the subscript c denotes a case-mix group (that is, a group of SNF residents with similar clinical characteristics and resource needs), where I_{t1} and I_{t2} denote a national index of input prices for SNFs, and where $P_{i, c, t}$ denotes the payment rate for unit i (either a geographic area or a SNF) for case-mix group c in time t.[21]

Defining the arc percentage change in SNF payment rates in that way holds the case mix constant using the base-year distribution and adjusts for inflation in prices of inputs. CBO's method for calculating the change in payment rates is referred to as a Laspeyres-type index because payment rates in the base year and the later year are both multiplied by the case-mix distribution in the base year. The change in the payment rate, ΔP_i, is attributable solely to real changes in payment rates within each case-mix group, rather than changes in the distribution of patients across case-mix groups.

In the regression analyses, the dependent variable, ΔQ_i, measures the arc percentage change in SNF volume. Because the dependent variable captures a change over time, the coefficient vector, γ, captures differential time trends that vary with the control variables included in X_i. The control variables in X_i include state indicator variables, an indicator for rural location, and an indicator for large urban location, as well as percentage changes in local real income per capita and local hospital wages.[22] The coefficients on the state indicator variables capture the impact of state-specific trends that might affect SNF utilization, such as changes in Medicaid's payment rates

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20. Arc percentage changes are used rather than simple percentage changes $((Q_{i, t2} - Q_{i, t1})/Q_{i, t1})$ or natural logarithm-based changes $(l_n(Q_{i, t2}/Q_{i, t1}))$ for two reasons: First, the arc percentage change is defined (that is, nonmissing) even when volume is zero in either the base year or the later year; and, second, the arc percentage change is naturally bounded by the range [-2, 2], which reduces the need to screen for extreme values.

21. All payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index.

22. Income per capita is inflated using the consumer price index for all urban consumers. The percentage change in hospital wages is used as a proxy for local changes in SNFs' input prices. The provider-level analysis includes additional controls that are not in the geographic-level analysis: an indicator variable for whether the SNF is hospital based, an indicator variable for nonprofit ownership, an indicator variable for for-profit ownership (the government-owned reference category is omitted), and an indicator variable for whether the SNF is a member of a large national chain (independence from a large chain is the reference category).

or changes in other health sectors, such as home health care.[23]

The coefficient of interest, β, captures the volume response, and it may be interpreted as follows. If, for example, β equals 0.2, then an increase of (arc) 1 percent in the payment rate (that is, ΔP_i equals 0.01) is associated with an increase of (arc) 0.2 percent in SNF volume (that is, the estimated ΔQ_i increases by 1 percent multiplied by 0.2).

In addition to estimating an overall SNF volume response, the analyses also estimate separate volume responses for hospital based and freestanding SNFs. In the geographic-level analysis, SNFs are first split into two groups, hospital based and freestanding, and then the changes in SNF volume and payment rates are calculated separately for those groups of SNFs, and separate regression models are run. In the provider-level analysis, separate regressions are run for hospital-based and freestanding SNFs. That approach allows the coefficient on the payment rate, β, and the vector of coefficients on the control variables, γ, to vary for hospital-based versus freestanding SNFs.

CBO used additional models to estimate separate volume responses for SNFs that received real increases and real decreases in payment rates. Two separate variables are used to capture the changes in payment rates: $\Delta P_i increase$, which equals ΔP_i if the SNF or the geographic area faced an increase in the payment rate and

equals zero, otherwise; and $\Delta P_i decrease$, which equals ΔP_i if the SNF or the geographic area faced a decrease in the payment rate and zero, otherwise. The volume responses for increases and decreases in payment rates are calculated separately for hospital-based versus freestanding SNFs, which produces four separate volume response coefficients (increases to hospital-based SNFs, decreases to hospital-based SNFs, and so on).[24]

Specific Methods for the Geographic-Level Analysis
As a first step in the geographic-level analysis, CBO grouped Medicare fee-for-service beneficiaries into hospital service areas on the basis of their zip code of residence. HSAs, which were developed by the Center for the Evaluative Clinical Sciences at Dartmouth Medical School, represent local health care markets and are defined on the basis of observed patterns of health care utilization.[25] The analytical data set includes one observation for each HSA. There are 3,436 HSAs, and each has an average of around 10,000 Medicare fee-for-service beneficiaries.[26]

The volume of SNF services, which is measured at the HSA level in 1997 and 2001, equals the mean Medicare-covered SNF days per beneficiary per year. The volume of SNF services is defined on the basis of a beneficiary's residence; SNF days are attributed to the beneficiary's HSA regardless of the location of the SNF used. SNF volume is

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23. Several major changes to Medicare policy were implemented around the same time as the new prospective payment system for SNFs. Those changes include clarification of the eligibility standards for Medicare's home health benefit and transitions to prospective payment for the following types of providers: home health agencies, hospital outpatient departments, inpatient rehabilitation facilities, long-term care hospitals, and psychiatric facilities. The impact of the changes in the home health care sector was particularly striking, with Medicare's spending on home health care falling by more than half from 1997 to 1999 and then rebounding sharply beginning in 2001. The changes occurring in sectors outside SNFs may have affected trends in SNF utilization if SNFs have the potential to serve as substitutes for those other sectors. The state indicator variables are included in the analyses to help control for the changes that were occurring in other sectors.

24. In the geographic-level analysis, areas with large concentrations of hospital-based SNFs are highly correlated with areas facing a payment rate decrease. Estimating responses to increases and decreases separately for hospital-based versus freestanding SNFs helps avoid confusing the effect of having a large concentration of hospital-based SNFs with the effect of facing a decrease in payment rates. In the provider-level analysis, however, because hospital-based SNFs are more likely than freestanding SNFs to experience decreases in payment rates, controlling for hospital-based and freestanding SNFs can be done directly by including the hospital-based/freestanding fixed effects and their interactions with the price variable on the right-hand side of the regression equation.

25. Dartmouth Medical School, Center for the Evaluative Clinical Sciences, *The Dartmouth Atlas of Health Care* (Hanover, N.H.: American Hospital Publishing, 1996).

26. In 2002, 90 percent of HSAs had a Medicare fee-for-service population of between 700 and 37,000.

adjusted for beneficiaries' age and sex.[27] The year 1997 was chosen as the initial year because it was just before the prospective payment system was implemented; 2001 was chosen as the end year because the system had been phased in by then, and SNFs had had an opportunity to respond to the new payment rates.

For a given HSA, the arc percentage change in the payment rate is calculated on the basis of the payment rates for SNFs serving beneficiaries living in that HSA. To calculate that change in payment rates, case-mix-constant payment rates are first calculated for each SNF in 1997 and 2001, and then HSA-level payment rates are calculated as weighted means of the SNF-level payment rates. The first step is to calculate the mean SNF payment rate for each SNF in 1997. The second step is to simulate the mean payment rate for each SNF in 2001, assuming that each SNF's case mix is held constant.[28] Then HSA-level mean SNF payment rates are calculated for 1997 and 2001 from SNF-level payment rates using the following weight: the fraction of SNF days provided by each facility

in 1997 to beneficiaries living in a given HSA. The HSA-level change in payment rates equals the arc percentage difference between the 1997 HSA-level mean payment rate and the simulated case-mix-constant 2001 payment rate. That arc percentage change is attributable solely to the implementation of the prospective payment system and does not reflect changes in SNFs' case mix or SNFs entering or exiting the market. For the geographic-level analysis, each HSA is weighted by the number of Medicare fee-for-service beneficiaries living in that HSA in 1997.

Data Sources for the Geographic-Level Analysis

Data on Medicare beneficiaries' zip code of residence, utilization of SNF services, and payments to SNFs are all taken from Medicare administrative records that include 100 percent of fee-for-service beneficiaries and SNF days. Beneficiaries' zip code of residence and fee-for-service enrollment are taken from the "Denominator" file, SNF utilization (Medicare-covered days and payments) is taken from the "MEDPAR" file, and SNF characteristics are taken from the "Provider of Services" file. County-level characteristics (urbanization and income) are taken from the 2004 Area Resource File (ARF).[29] The "crosswalk" from zip code to HSA is provided by the *Dartmouth Atlas of Health Care*.[30] Hospital wages are calculated from Medicare's hospital cost reports.

Specific Methods for the Provider-Level Analysis

The provider-level analysis measures the SNF volume response using data at the provider level from 1999 (the first full year after implementation of Medicare's new payment system) through 2003 (one year after the full transition to the PPS in 2002). The analysis reflects the payment add-ons by BBRA-1999 and BIPA-2000, which

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27. To adjust SNF volume for beneficiaries' demographics, the volume of SNF services (SNF days per beneficiary) is first measured for the year 1998 for different demographic cells. Those demographic cells are defined by combinations of age group (under 65, 65 to 74, 75 to 84, and 85 and up) and sex. The 1998 SNF volume by demographic cell is then multiplied by the number of beneficiaries in each HSA in each demographic cell in each year—that calculation yields a predicted SNF volume for each HSA for each year. The adjusted SNF volume for a given HSA is then calculated by multiplying the actual SNF volume in the HSA by the inverse of the ratio of predicted SNF volume in that HSA to the national mean SNF volume for that year.

28. Simulated 2001 payment rates are used instead of observed 2001 payment rates, for several reasons. A mean payment rate could be calculated for each SNF for 2001, but the differences between the observed 1997 payment rates and the observed 2001 payment rates reflect not just legislative changes to Medicare's payment formula (which is the focus of the analysis) but also changes in SNFs' patient populations and in the services SNFs provide. In addition, some SNFs exited the market between 1997 and 2001; for those facilities, the mean 2001 payment rate cannot be calculated. A detailed explanation of the process of simulating 2001 payment rates for each SNF is available in Chapin White, "Medicare's New Prospective Payment System for Skilled Nursing Facilities: Effects on Staffing and Quality of Care," *Inquiry*, vol. 43, no. 1 (Winter 2005/2006), pp. 351–366.

29. The county-level data from the ARF are aggregated to generate HSA-level measures by taking the weighted means of the county-level measures (using as the weight the fraction of Medicare fee-for-service beneficiaries living in a given HSA who also live in a given county).

30. Dartmouth Medical School, Center for the Evaluative Clinical Sciences, *Zip Code to HSA to HRR Crosswalk File* (accessed May 15, 2003).

Table 2.

Year-to-Year Changes in Total SNF Days from the Exit and Entry of SNFs, 1999 to 2003

	1999–2000	2000–2001	2001–2002	2002–2003
Total SNF Days (Millions)				
In originating year	41	43	48	53
In ending year	43	48	53	57
Change in total SNF days (Millions)	**1.9**	**4.7**	**5.1**	**4.5**
Days lost from exit of SNFs (Thousands)	435	386	388	444
Days gained from entry of SNFs (Thousands)	316	299	14	4
Net change in total SNF days (Thousands)	**-119**	**-87**	**-374**	**-440**
Net Change as a Percentage of				
Total SNF Days in Ending Year	-0.3	-0.2	-0.7	-0.8

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility.

A SNF is defined as an "entrant" if it provided Medicare-covered SNF services in a given year but not in the prior year, and it is defined as an "exiter" if it provided Medicare-covered SNF services in a given year but not in the next year.

Total SNF days are the number of Medicare-covered SNF days provided by all SNFs in a given year.

produced substantial price variations across SNFs (most of those add-ons ended in 2003).[31]

Volume is measured by the number of Medicare-covered SNF days provided by a given facility in a given year. The data set used for the provider-level analysis includes one observation for each combination of SNF and year-pair. For example, for a given SNF, there is one observation for 1999–2000 (changes in volume and payment rates are measured from 1999 to 2000), another observation for 2000–2001, and so forth. The changes in payment rates are calculated using a Laspeyres-type index, in which the mix of patients in the base year is used to generate an average payment rate in both the base year and the next year.

For SNFs that entered or exited the system during that five-year span, the arc percentage changes are calculated differently. A SNF is defined as an "entrant" if it provided Medicare-covered SNF services in a given year but not in the prior year, and it is defined as an "exiter" if it provided Medicare-covered SNF services in a given year but not in the next year. For exiters, the arc percentage changes in payment rate and volume are calculated using the standard formulas. For entrants, although it is possible to calculate the arc percentage change in volume using the standard formula, there is no information available on the distribution of patients across case-mix groups in the base year. Therefore, for entrants, the arc percentage change in payment rates in the year-pair in which they enter is calculated using a Paasche-type index, which incorporates the case-mix distribution in the later year.

The data show that the impact on total SNF days from the exit and entry of SNFs during the 1999–2003 period was not substantial (the net change was never larger than 1 percent; see Table 2). The net loss of days resulting from the exit of SNFs, however, increased throughout the period, rising from 0.3 percent of total days during the 1999–2000 period to 0.8 percent during the 2002–2003 period.

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31. The real average payment per day declined by 9.5 percent in 2003 (see Table 1). That drop would have been even larger had RUG refinement been implemented in 2003. (The 20 percent increase to 15 RUG groups and the 6.7 percent increase to 14 rehabilitation RUG groups initiated by BBRA-1999 and BIPA-2000 still remained in 2003 because RUG refinement was not implemented that year.)

To examine whether SNFs responded differently to payment decreases than to payment increases, CBO created separate variables for increases and decreases in payment rates using the same approach as in the geographic-level analysis. In the provider-level analysis, each provider is weighted by payments it receives from Medicare-covered services.[32]

Data Sources for the Provider-Level Analysis

The primary data source for the provider-level analysis is a set of Medicare administrative records that summarize claims for each combination of SNF, case-mix group, and year. Payment rates are computed for each case-mix group within each facility for each year. Each facility's characteristics are taken from the "Provider of Services" file and Medicare's SNF cost reports. County-level characteristics (urbanization and income) are taken from the 2004 Area Resource File, and hospital wages are computed from Medicare's hospital cost reports.

Results of the Analyses

The results of the geographic- and provider-level analyses indicate that the volume of SNF services varies positively with the SNF payment rate and that those responses occur among both freestanding and hospital-based SNFs. In both analyses, increases in payment rates are found to result in modest increases in volume. In the geographic-level analysis, decreases in payment rates are found to result in decreases in volume, whereas in the provider-level analysis, decreases in payment rates are found not to affect volume significantly.

Descriptive Statistics

CBO's analysis of Medicare administrative data provides descriptive statistics on the volume of SNF services and changes in SNF payment rates (all payment rates are expressed in 2003 dollars).

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32. Several edits are performed on the provider-level data to limit the influence of observations with extreme values. First, an editing screen is used to identify and remove observations with unusual changes in volume or payment rate. Second, observations that are found to be very highly influential in the basic model are removed from all provider-level analyses. Those edits are based on information in David A. Belsley and others, *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity* (New York: Wiley-Interscience, 1980).

The geographic-level analysis shows that the mean Medicare payment per SNF day declined by 4 percent between 1997 and 2001, falling from $357 to $343, while the volume of SNF services was nearly unchanged at 1.36 days per beneficiary in 1997 and 1.35 days in 2001 (see the left panel of Table 1). In 1997, prior to the implementation of the prospective payment system, mean payment rates were much higher for hospital-based SNFs than for freestanding SNFs, $463 versus $332. By 2001, after the payment system had been fully implemented, that gap had almost entirely disappeared, reflecting a sharp drop in mean payment rates for hospital-based SNFs and a slight increase in mean payment rates for freestanding SNFs. The volume of hospital-based SNF services declined fairly sharply from 1997 to 2001, from 0.25 days per beneficiary to 0.17 days, while the volume of freestanding SNF services increased slightly, from 1.11 days to 1.18 days. It is notable that both payment rates and volume declined among hospital-based SNFs but increased among freestanding SNFs. That fact provides some preliminary evidence that SNF volume varies positively with the payment rate.

The provider-level analysis shows that in 2003, the mean SNF payment rate was almost identical to the mean payment rate in 1999 ($315 versus $317), but payment rates fluctuated sharply in the intervening years (see the right panel of Table 1). Changes legislated by BBRA-1999 and BIPA-2000 raised SNF payment rates in 2001 and 2002, but those rates dropped sharply in 2003. Mean SNF days for each facility increased substantially from 1999 to 2003, particularly among freestanding SNFs.

CBO's analysis also shows the distribution of the changes in Medicare's payment rates. In the geographic-level analysis, there is a great deal of variation in the distribution of changes in payment rates across areas—at the 90th percentile, the SNF payment rate increased by 23.2 percent, whereas at the 10th percentile, the SNF payment rate decreased by 33.0 percent (see Figure 1). In the provider-level analysis, the distribution of changes in payment rates is narrower, but there is still a substantial amount of variation across SNFs and from year-pair to year-pair (see Figure 2).
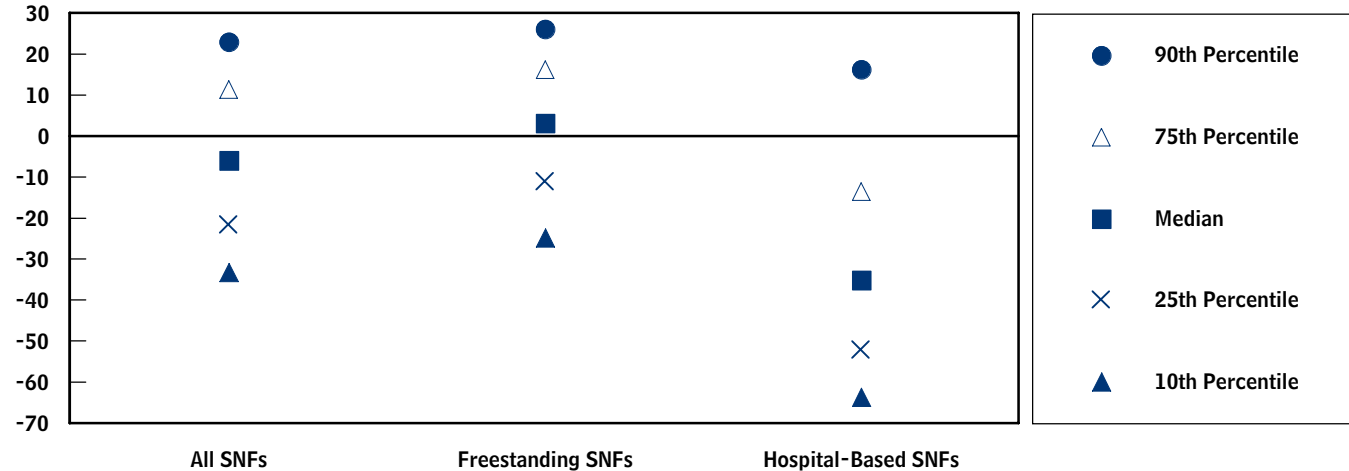
Key Results for the Geographic-Level Analysis

The key regression results for the geographic-level analysis indicate that increases in SNF payment rates are

Figure 1.

Changes in Medicare's Payment Rates, 1997 to 2001, Based on CBO's Geographic-Level Analysis

(Arc percentage change)

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility.

This figure presents statistics on the distribution of the arc percentage changes in Medicare's case-mix-constant payment rates for SNFs. All payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index. Changes in payment rates are calculated at the level of the hospital service area, and statistics are weighted by the number of fee-for-service beneficiaries in each area in 1997.

associated with a statistically significant increase in SNF volume and that decreases in payment rates are associated with decreases in volume (see the left panel of Table 3). Among all SNFs, a change of 1 percent in the SNF payment rate is associated with a change in SNF volume of 0.13 percent. Compared with the volume-response coefficient for freestanding SNFs, the coefficient for hospital-based SNFs is found to be larger (0.26), which implies that hospital-based SNFs are more responsive than freestanding SNFs to changes in payment rates. Among hospital-based SNFs, both those facing increases in payment rates and those facing decreases in payment rates exhibited similar responses, with volume in both cases changing in the same direction as the change in payment rate.[33] Among freestanding SNFs, the coefficients on increases and decreases in payment rates are not

individually statistically significant, but they are jointly statistically significant, and both point estimates are similar to the overall volume response.

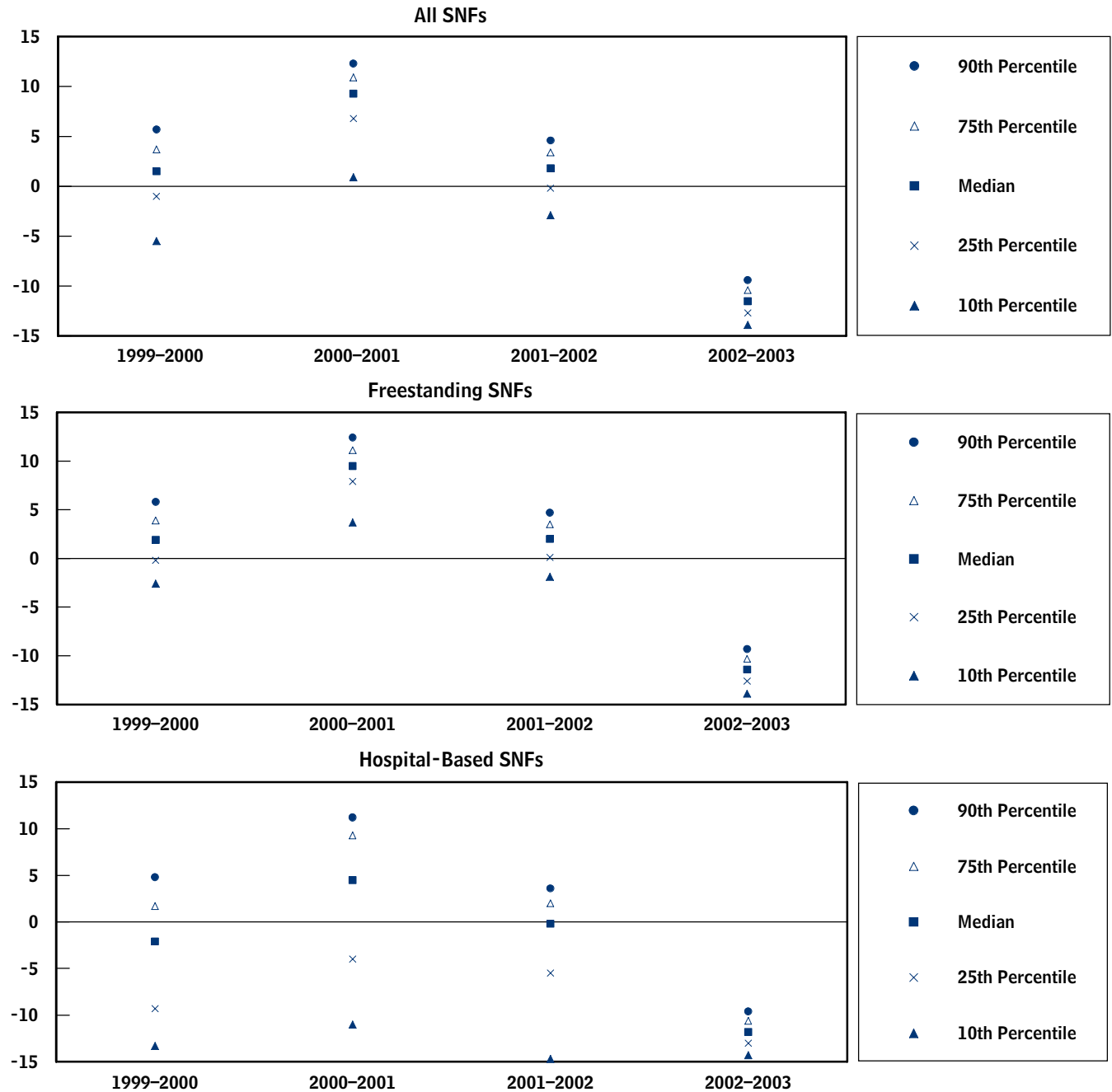**Key Results for the Provider-Level Analysis**
The results of the provider-level analysis provide further evidence of the existence of a statistically significant volume response (see the right panel of Table 3). In the analysis including all SNFs, the coefficient on the change in the payment rate is 0.23, which implies that a change of 1 percent in the SNF payment rate would lead to a change in volume of 0.23 percent in the same direction as the change in the payment rate. In the provider-level analysis, the volume response is found to be statistically significant only among freestanding SNFs. When increases and decreases in payment rates are analyzed separately, increases in payment rates are found to result in increases in volume among both freestanding and hospital-based SNFs, but decreases in payment rates are not associated with statistically significant changes in volume.

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33. Among hospital-based SNFs, the magnitude of the volume response is larger among SNFs facing increases in payment rates than among those facing decreases (0.43 versus 0.20), but the difference is only weakly statistically significant (the *p*-value is less than 0.10).

Figure 2.

Year-to-Year Changes in Medicare's Payment Rates, 1999 to 2003, Based on CBO's Provider-Level Analysis

(Arc percentage change)

All SNFs

Freestanding SNFs

Hospital-Based SNFs

Legend:
- ● 90th Percentile
- △ 75th Percentile
- ■ Median
- ✕ 25th Percentile
- ▲ 10th Percentile

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility.

This figure presents statistics on the distribution of the arc percentage changes in Medicare's case-mix-constant payment rates for SNFs. All payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index. Changes in payment rates are calculated at the level of the SNF, and statistics are weighted by the average payments each SNF receives for Medicare-covered services. The number of SNFs included in this analysis is about 14,000 in each year.

Table 3.

Estimated Volume Responses Among SNFs to Changes of 1 Percent in Medicare's Payment Rates

(Percent)

	Geographic-Level Analysis	Provider-Level Analysis
All SNFs	0.13 ***	0.23 ***
Freestanding	0.08 **	0.22 ***
Hospital-based	0.26 ***	0.08
Freestanding SNFs		
Increase in payment rate	0.06	0.30 ***
Decrease in payment rate	0.10	0.10
Hospital-based SNFs		
Increase in payment rate	0.43 ***	0.39 ***
Decrease in payment rate	0.20 ***	-0.06

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility; ** = p-value < 0.05; *** = p-value < 0.01.

This table presents the key coefficients for a set of regression models. In each regression model, the dependent variable is the arc percentage change in the volume of Medicare-covered SNF services. In the geographic-level analysis, the volume of SNF services is measured by the number of Medicare-covered SNF days per beneficiary. In the provider-level analysis, the volume of SNF services is measured by the number of Medicare-covered SNF days provided by each facility. The statistics presented in this table are the coefficients on the arc percentage change in Medicare's real payment rate for SNFs. A higher volume-response coefficient implies a more responsive SNF. For the geographic-level analysis, beneficiaries are grouped into hospital service areas on the basis of their zip code of residence, and regressions are weighted by the number of fee-for-service beneficiaries in each area in 1997. For the provider-level analysis, regressions are weighted by the average payments each SNF receives for Medicare-covered services.

Discussion of the Results

Both the geographic-level analysis and the provider-level analysis indicate that the volume of Medicare-covered SNF services varies positively with the payment rate, that the magnitude of the response is fairly modest, and that the response occurs both among freestanding and hospital-based SNFs. Although the provider-level analysis suggests that SNF volume responds only to increases in payment rates, the geographic-level analysis suggests that SNFs respond, in a roughly symmetrical fashion, to both increases and decreases in payment rates.

One possible explanation for that finding is that increases in volume in response to higher payment rates might occur over a relatively short time frame, whereas decreases in volume in response to lower payment rates might occur over a longer time frame. The geographic-level analysis is suited to detecting long-run responses to changes in payment rates (because it measures the four-year response from 1997 to 2001), whereas the provider-level analysis is better suited to detecting short-run responses (because it measures annual responses from 1999 to 2003).

The difference between the overall volume response estimated in the geographic-level analysis (0.13) and the response estimated in the provider-level analysis (0.23) is not statistically significant, although it deserves some comment. The difference between those two estimates could reflect different time periods,[34] different levels of measurement error in the two types of analyses, or a bias in one or both of the analyses.[35]

The difference in estimated volume responses could also reflect a certain type of volume spillover effect. Suppose that there are two SNFs in the same geographic area and that one SNF receives a payment increase and the other does not. Based on the provider-level analysis, the SNF that receives the increase in payment rate is predicted to increase its volume relative to the SNF that receives no change in payment rate. One possible spillover effect of one SNF taking steps to increase its volume

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34. By examining the 1997–2001 period, the geographic-level analysis largely estimated the response of SNFs to Medicare's transition from a cost-based system to a prospective payment system. In contrast, the provider-level analysis, by focusing on the 1999–2003 period, estimated the response of SNFs to Medicare's payment changes under the PPS.

35. Measurement error in an independent variable will result in a bias toward zero in the estimated coefficient on that variable in a regression analysis. The discrepancy between the estimated volume responses could be explained by the greater degree of error in the measurement of changes in payment rates in the geographic-level analysis versus the provider-level analysis.

could be to draw some volume away from other SNFs in the same area. The change in volume as measured in the geographic-level analysis would reflect the combination of both the main effect (an increase in volume at the SNF that received a payment increase) and the volume spillover effect (a decrease in volume at the SNF that received no change in payment rate). That type of spillover effect could explain the finding of a larger volume response in the provider-level analysis than in the geographic-level analysis.

The results of this research indicate that the volume of SNF services varies positively with changes in Medicare's payment rate. However, the total effect on Medicare's SNF spending of a change in Medicare's payment rate would also include the impact on the "intensity" of services. Intensity, as it is generally defined, is a measure of the average complexity and costliness of medical services. In the SNF setting, changes in intensity would result from changes over time in the shares of residents assigned to different case-mix categories. (Each case-mix category is assigned a separate payment rate.)

One potential topic for future research is the possible existence of spillover effects from changes in payment rates for SNFs on the volume of services provided in other types of health care facilities. Other topics of interest include volume responses in institutional settings besides SNFs, such as hospitals and home health agencies. Volume responses, particularly in the hospital setting, are directly relevant to projections of the impact on Medicare's spending of changes in payment rates.

Appendix:
Detailed Regression Results

This appendix presents detailed regression results (see Tables A-1 and A-2) from the Congressional Budget Office's geographic-level analysis and provider-level analysis of how the volume of Medicare-covered skilled nursing facility (SNF) services adjusts in response to changes in Medicare's SNF payment rates. In both sets of analyses, the dependent variable is the arc percentage change in the volume of Medicare-covered SNF days, and the key independent variable is the case-mix-constant arc percentage change in Medicare's real (inflation-adjusted) payment rate for SNFs. For the geographic-level analysis, the unit of the analysis is the hospital service area (N = 3,436), and changes in volume and payment rates are measured from 1997 to 2001. For the provider-level analysis, the unit of analysis is the SNF, and changes in volume and payment rates are measured for each year-pair from 1999 through 2003 (1999–2000, 2000–2001, and so on).

Table A-1.

Detailed Regression Results from CBO's Geographic-Level Analysis

Variable	SNF Days per Beneficiary for All SNFs	SNF Days per Beneficiary for Freestanding SNFs		SNF Days per Beneficiary for Hospital-Based SNFs	
		First Regression	Second Regression	First Regression	Second Regression
Arc Percentage Change in Medicare's Payment Rate for SNFs[a]	0.130*** (0.029)				
Arc percentage change in Medicare's payment rate for freestanding SNFs		0.079** (0.036)			
Arc percentage change in Medicare's payment rate for freestanding SNFs x "increase" indicator[b]			0.065 (0.052)		
Arc percentage change in Medicare's payment rate for freestanding SNFs x "decrease" indicator[b]			0.098 (0.062)		
Arc percentage change in Medicare's payment rate for hospital-based SNFs				0.256*** (0.040)	
Arc percentage change in Medicare's payment rate for hospital-based SNFs x "increase" indicator[b]					0.429*** (0.107)
Arc percentage change in Medicare's payment rate for hospital-based SNFs x "decrease" indicator[b]					0.197*** (0.053)
Rural Indicator[c]	0.020* (0.011)	0.015 (0.013)	0.015 (0.013)	0.080*** (0.027)	0.074*** (0.027)
Large Urban Indicator[c]	-0.023** (0.009)	-0.003 (0.011)	-0.003 (0.011)	-0.052** (0.024)	-0.053** (0.024)
Arc Percentage Change from 1997 to 2001 in Hospital Wages[d]	-0.032 (0.046)	-0.038 (0.055)	-0.038 (0.055)	0.028 (0.120)	0.035 (0.120)

Continued

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Table A-1.

Continued

Variable	SNF Days per Beneficiary for All SNFs	SNF Days per Beneficiary for Freestanding SNFs		SNF Days per Beneficiary for Hospital-Based SNFs	
		First Regression	Second Regression	First Regression	Second Regression
Arc Percentage Change from 1997 to 2001 in Real (CPI-inflated) Income per Capita[e]	-0.322*** (0.074)	-0.371*** (0.089)	-0.372*** (0.089)	0.015 (0.194)	0.005 (0.194)
Estimated Difference Between Coefficients on "Increases" and "Decreases"			-0.033 (0.088)		0.232* (0.133)
F-statistic on Exclusion of Both "Increases" and "Decreases" in Payment Rates			4.99**		36.24***
Number of Observations	3,435	3,424	3,424	3,396	3,396
R-squared	0.326	0.244	0.244	0.250	0.251

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility; * = p-value < 0.10; ** = p-value < 0.05; *** = p-value < 0.01; CPI = the consumer price index for all urban consumers.

Standard errors are shown in parentheses. All regressions are weighted by the number of fee-for-service beneficiaries in each hospital service area (HSA) in 1997. State indicator variables are included in each regression (coefficient estimates are not shown).

a. All payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index.

b. For each HSA, an "increase" indicator and a "decrease" indicator are defined separately for freestanding and hospital-based SNFs depending on whether the arc percentage change in Medicare's input price-inflated payment rate for that type of SNF is positive or negative. The sign of the reported coefficients, however, reflects the effect of an increase in the payment rate.

c. The "small urban" reference category is omitted.

d. Hospital wages are measured by aggregating salaries and hours for all hospitals in each HSA. For HSAs that do not contain a hospital, hospital wages are measured by aggregating all hospitals in the hospital referral region in which the HSA is located. Hospital referral regions are aggregations of HSAs that represent regional health care markets.

e. County-level income per capita is measured using the 2004 Area Resource File. The county-level income measures are aggregated to the HSA level using as weights the fraction of all Medicare beneficiaries living in each HSA who lived in the county in 1997.

Table A-2.

Detailed Regression Results from CBO's Provider-Level Analysis

Variable	SNF Days per Facility for All SNFs	SNF Days per Facility for Freestanding SNFs		SNF Days per Facility for Hospital-Based SNFs	
		First Regression	Second Regression	First Regression	Second Regression
Arc Percentage Change in Medicare's Payment Rate[a]	0.227*** (0.030)	0.219*** (0.040)		0.079 (0.052)	
Arc percentage change in Medicare's payment rate x "increase" indicator[b]			0.302*** (0.060)		0.392*** (0.132)
Arc percentage change in Medicare's payment rate x "decrease" indicator[b]			0.104 (0.073)		-0.058 (0.074)
Rural Indicator[c]	0 (0.004)	-0.004 (0.004)	-0.004 (0.004)	0.015 (0.009)	0.013 (0.009)
Large Urban Indicator[c]	0.003 (0.003)	0.005* (0.003)	0.005* (0.003)	-0.012 (0.008)	-0.012 (0.008)
Arc Percentage Change from 1997 to 2001 in Hospital Wages[d]	0.021 (0.018)	0.031 (0.020)	0.031 (0.020)	-0.035 (0.053)	-0.033 (0.053)
Arc Percentage Change from 1997 to 2001 in Real (CPI-inflated) Income per Capita[e]	-0.182*** (0.055)	-0.105* (0.060)	-0.105* (0.060)	-0.568*** (0.149)	-0.559*** (0.149)
Year-Pair Indicator					
1999-2000[f]	-0.048*** (0.005)	-0.044*** (0.006)	-0.033*** (0.009)	-0.037*** (0.010)	-0.031*** (0.010)
2000-2001[f]	-0.002 (0.007)	-0.004 (0.009)	0.001 (0.009)	0.050*** (0.012)	0.046*** (0.012)
2001-2002[f]	0.002 (0.005)	0.006 (0.006)	0.017** (0.008)	0 (0.010)	0.007 (0.011)
Hospital-Based Indicator[g]	-0.104*** (0.004)				
Nonprofit Indicator[h]	-0.003 (0.006)	0.015* (0.008)	0.015* (0.008)	-0.019** (0.010)	-0.018* (0.010)
For-Profit Indicator[h]	-0.006 (0.006)	0.007 (0.008)	0.007 (0.008)	-0.008 (0.013)	-0.008 (0.013)

Continued

Table A-2.

Continued

Variable	SNF Days per Facility for All SNFs	SNF Days per Facility for Freestanding SNFs		SNF Days per Facility for Hospital-Based SNFs	
		First Regression	Second Regression	First Regression	Second Regression
Estimated Difference Between Coefficient on "Increases" and "Decreases"			0.198* (0.105)		0.451***(0.175)
F-statistic on Exclusion of Changes in Payment Rates for "Increases" and "Decreases"			24.16***		7.27***
Number of Observations	52,265	46,016	46,016	6,249	6,249
R-squared	0.050	0.036	0.036	0.049	0.050

Source: Congressional Budget Office analysis of Medicare administrative data.

Notes: SNF = skilled nursing facility; * = p-value < 0.10; ** = p-value < 0.05; *** = p-value < 0.01; CPI = the consumer price index for all urban consumers.

Standard errors are shown in parentheses. All regressions are weighted by each SNF's average Medicare expenditures. State indicator variables and indicator variables for the top 10 national chains are included in each regression (coefficient estimates are not shown).

a. All payment rates are inflated to the fourth quarter of 2003 using the national SNF market basket index.

b. Each SNF is defined as receiving an ''increase'' or a ''decrease'' separately for each year-pair depending on whether the arc percentage change in Medicare's input price-inflated payment rate for that SNF is positive or negative. The sign of the reported coefficients, however, reflects the effect of an increase in the payment rate.

c. The ''small urban'' reference category is omitted.

d. Hospital wages are measured by aggregating salaries and hours for all hospitals in each county. For counties that do not contain a hospital, corresponding state average hospital wages are used.

e. County-level income per capita is measured using the 2004 Area Resource File.

f. The ''2002–2003 year-pair'' reference category is omitted.

g. The ''freestanding'' reference category is omitted.

h. The ''government-owned'' reference category is omitted.

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