# The Quality of Preventive and Diagnostic Medical Care: Why Do Southern States Underperform?

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Health care expenditures are increasing and are projected to grow at what some perceive as an alarming rate—7.3 percent in 2003 (CMS 2004). As expenditures rise, the focus of the health care industry is turning toward cost containment and ways to slow this growth rate. However, some are concerned that such efforts may lower the quality of medical care (Jencks et al. 2000). This concern over cost containment crowding out quality led the Centers for Medicare and Medicaid Services (CMS) to develop a program to evaluate the quality of medical care received by Medicare beneficiaries.

Jencks et al. (2000) use CMS data on the medical care delivery process for Medicare beneficiaries in each state over the period 1997–99 to evaluate the quality of care.[1] Specifically, the authors analyze quality indicators for preventive services (influenza and pneumococcal immunizations) and diagnostic services (mammograms and screenings for diabetics) to rank states on the basis of the quality of medical care to Medicare beneficiaries. These services are selected because they are associated with high rates of morbidity and mortality improvements and are widely believed to improve outcomes.[2]

Jencks et al. (2000) report distinct geographical differences in the level of preventive and diagnostic services received by Medicare beneficiaries. In general, southern states had lower levels, and thus a lower quality, of services than states in other regions. The reasons behind the state-level differences in the quality of Medicare-beneficiary medical care have not been analyzed. Thus, the goal of this article is to determine which state-level characteristics are associated with the level of diagnostic and preventive medical care. States can then use this information to improve the quality of care. If indeed an ounce of prevention is worth a pound of cure, then improvements in the utilization of preventive and diagnostic services may also slow the growth rate in health care expenditures.

## Quality Indicators

**Preventive care.** Between 1969 and 1996, deaths attributable to influenza averaged 20,000 per year, with approximately 90 percent of these occurring among persons aged sixty-five and older (CDC 2002a). Furthermore, the CDC (2002b) reports that approximately 114,000 people are hospitalized because of influenza each year, with an estimated average inpatient cost of almost $7,000 for those aged sixty-five and older (Meltzer, Cox, and Fukuda 1999). The influenza vaccine has been shown to reduce influenza mortality by approximately 30 percent (Fedson et al. 1993) and hospitalizations by approximately 50 percent (Nichol, Margolis, and Wuorenma 1994). Thus, an improvement in the influenza vaccination rates may lead to a reduction in health care expenditures by lowering hospital expenditures.[3]

For the elderly population, the estimated annual mortality rate for pneumococcal infection exceeds 30 percent (CMS 2002). This rate translates to approximately 3,400 deaths among persons in this age group in 1998 (CDC 2002a). There are an estimated 175,000 hospitalizations for pneumococcal pneumonia every year, with pneumococci accounting for approximately 36 percent of community-acquired pneumonia cases and 50 percent of hospital-acquired pneumonia patients. Herman, Chen, and High (1998) estimate the average cost per day of hospitalization for a patient with pneumococcal pneumonia over the 1983–94 period to be approximately $1,650, with the length of stay averaging eight to ten days for those aged sixty-five and older.[4]

The pneumococcal vaccine is effective in reducing infection by 57 to 75 percent (NNII 2004), and the evidence suggests that cost savings are associated with the use of the vaccine (Herman, Chen, and High 1998; Sisk et al. 1997). In addition, vaccinations are important because antibiotic resistance is increasing, and, thus, the ability to treat pneumococcal infections is becoming more and more difficult (NNII 2004).

**Diagnostic care.** Diabetes is the sixth leading cause of death in the United States; health care expenditures related to the disease were approximately $91.8 billion in 2002 (NDIC 2003). Diabetes is a common condition for adults over age sixty-five, with the CDC (2004a) estimating that more than 18 percent of the elderly population are diabetic. The CMS includes three diabetic indicators—eye exams, lipid profiles, and hemoglobin A1c tests—when assessing state-level differences in the quality of Medicare-beneficiary medical care. These screenings can help prevent blindness as well as cardiovascular, kidney, and nerve disease (NDIC 2003).

The CDC (2004a) reports that improving glycemic control, which is monitored with hemoglobin A1c blood tests, can decrease the probability of patients' developing microvascular diabetic complications (specifically eye, kidney, and nerve disease) by up to 40 percent. In addition, improving control over blood lipids has been shown to dramatically reduce cardiovascular disease among men by 20 to 50 percent (ADA 2005). The incidence of diabetes-related blindness can be reduced by up to 90 percent with regular eye exams and timely treatment. Thus, the use of these three screenings may reduce both complications for diabetics and the growth rate in health care expenditures (CDC 2003).

Breast cancer is the second leading cause of cancer-related deaths among American women, with 40,000 deaths projected and more than 200,000 new diagnoses expected in 2003 (American Cancer Society 2003b). According to the CDC (2004b), mammograms are currently the best method of detecting breast cancer, and early detection leads to a better chance of survival.[5] Furthermore, according to the National Committee for Quality Assurance (2001), the cost of treating breast cancer

Table 1
**Medicare Beneficiary Quality Indicators by Preventive and Diagnostic Care**

| Clinical topic | Quality indicator | Sample size |
|---|---|---|
| **Preventive care** | | |
| Pneumonia | Influenza immunization every year | BRFSS national sample of 134,236 persons aged 65+; state samples range from 1,504 to 4,911. |
| | Pneumococcal immunization at least once ever | |
| **Diagnostic care** | | |
| Breast cancer | Mammogram at least every two years | All Medicare claims |
| Diabetes | Hemoglobin A1c at least every year | |
| | Eye exam at least every year | |
| | Lipid profile at least every two years | |

Source: Jencks et al. (2000)

in the early stage of diagnosis averages $11,000 per patient while diagnosis at the most advanced stage results in average expenditures of $140,000.[6] This finding implies that increasing the percentage of Medicare women who receive regular mammograms, and thereby increasing the rate of early detection, has the benefit of both reducing mortality and slowing the growth rate in health care expenditures.

## Data

The data on the quality indicators for the 1997–99 period were obtained from the CMS.[7] A description of the individual quality indicators by category of care (preventive and diagnostic) and sampling method is shown in Table 1.[8] Given the two

1. By focusing on the process of care rather than outcomes, the CMS will be able to identify weaknesses in the delivery system without the concerns over risk adjustment.
2. Since four large clinical trials performed in the early 1960s found that mammograms led to a decrease in the death rate from breast cancer, mammograms have been recommended yearly or every other year for women over age fifty (Christensen 2002). The Balanced Budget Act of 1997 expanded Medicare coverage to an annual basis for Medicare beneficiaries. However, a recent paper by Gotzsche and Olsen (2001), which noted research flaws in the original studies, has placed some doubt on the true benefit of mammograms.

   Despite this uncertainty of their full benefit, regular mammograms for women over the age of forty are still recommended by the National Cancer Institute, the American Cancer Society, and the American College of Obstetricians and Gynecologists (Christensen 2002).
3. This cost saving is partially offset, however, by the increase in expenditures on the influenza vaccine and the cost of promotions.
4. In addition to pneumonia, the vaccine is also used to prevent pneumococcal bacteremia and pneumococcal meningitis (CDC 2002b).
5. The five-year survival rate drops from 87.9 percent for early-stage diagnosis to 15.2 percent for the most advanced stage of diagnosis (American Cancer Society 2003a).
6. The increasing cost of care with stage of diagnosis is also supported by Taplin et. al (1995).
7. The data series used is Quality of Care–PRO Priorities: National Clinical Topics (Task 1).
8. The data are limited to care received by fee-for-service Medicare patients; thus, the results cannot be generalized to the 15 percent of Medicare beneficiaries enrolled in managed care plans.

Table 2
**State-Level Scores and Regional Means by Category of Care**

| | Category of care (percent) | |
|---|---|---|
| | **Preventive** | **Diagnostic** |
| **Northeast Region** | 55.99 | 65.99 |
| | (4.40) | (3.30) |
| Connecticut | 55.10 | 67.01 |
| Maine | 61.05 | 69.32 |
| Massachusetts | 59.35 | 69.09 |
| New Hampshire | 57.10 | 69.11 |
| New Jersey | 47.30 | 61.34 |
| New York | 51.70 | 61.57 |
| Pennsylvania | 56.45 | 63.58 |
| Rhode Island | 55.35 | 64.44 |
| Vermont | 60.55 | 68.49 |
| **Midwest Region** | 55.02 | 64.37 |
| | (3.12) | (4.30) |
| Illinois | 56.25 | 56.69 |
| Indiana | 50.25 | 60.84 |
| Iowa | 60.60 | 68.40 |
| Kansas | 52.60 | 63.72 |
| Michigan | 54.60 | 63.76 |
| Minnesota | 58.65 | 67.85 |
| Missouri | 57.30 | 62.54 |
| Nebraska | 57.80 | 63.85 |
| North Dakota | 52.80 | 71.99 |
| Ohio | 51.95 | 59.47 |
| South Dakota | 53.10 | 64.78 |
| Wisconsin | 54.35 | 68.51 |
| **South Region** | 53.61 | 59.37 |
| | (4.83) | (4.78) |
| Alabama | 55.05 | 55.81 |
| Arkansas | 50.10 | 53.27 |
| Delaware | 60.60 | 64.96 |
| District of Columbia | 43.30 | 57.97 |
| Florida | 53.90 | 68.00 |
| Georgia | 53.50 | 56.64 |
| Kentucky | 49.90 | 60.28 |
| Louisiana | 45.30 | 55.52 |
| Maryland | 52.20 | 64.00 |
| Mississippi | 53.50 | 49.33 |
| North Carolina | 57.60 | 63.21 |
| Oklahoma | 54.85 | 58.56 |
| South Carolina | 57.95 | 61.75 |
| Tennessee | 57.05 | 56.20 |
| Texas | 56.20 | 62.62 |
| Virginia | 60.65 | 63.62 |
| West Virginia | 49.75 | 57.62 |
| **West Region** | 59.61 | 61.39 |
| | (4.41) | (3.35) |
| Alaska | 48.75 | 56.94 |
| Arizona | 66.15 | 60.29 |
| California | 57.65 | 61.43 |
| Colorado | 63.85 | 61.45 |
| Hawaii | 61.40 | 66.09 |
| Idaho | 58.30 | 63.07 |
| Montana | 59.60 | 62.07 |
| Nevada | 55.00 | 59.81 |
| New Mexico | 61.45 | 56.49 |
| Oregon | 62.85 | 64.37 |
| Utah | 57.30 | 62.85 |
| Washington | 60.95 | 66.65 |
| Wyoming | 61.65 | 56.56 |
| **United States** | 55.89 | 62.73 |
| | (4.79) | (4.74) |

Note: Standard deviations are shown in parentheses.
Source: CMS

sampling methods used by the CMS to collect data, the data are separated into two categories for analysis: preventive and diagnostic care. An aggregated state-level quality indicator score is created for each category. This aggregated score is a weighted average of the individual quality indicators, with the sample size for each individual quality indicator used as the weight. The state-level quality indicator scores, as well as the regional means, are reported in Table 2. The South had the lowest average score for quality of care in both categories, the West outperformed the other regions in terms of preventive care, and the Northeast had the highest diagnostic care score.

Table 3
**Sample Means and Nonlinear Least Squares Regression Results (Dependent Variable: Quality of Care Score)**

| Variable | Sample Mean (standard deviation) (1) | Preventive Coefficient (standard error) (3) | Diagnostic Coefficient (standard error) (4) |
|---|---|---|---|
| **Constant** | | –4.9911* | 0.5724 |
| | | (1.6976) | (1.5319) |
| **Medical system characteristics** | | | |
| Number of physicians/100,000 | 239.45 | –0.0933 | 1.1335* |
| | (0.8626) | (0.5676) | (0.5166) |
| Number of nurses/100,000 | 876.80 | 0.0933 | 0.0924 |
| | (1.8366) | (0.1675) | (0.1526) |
| **Population characteristics** | | | |
| Per capita income | 28,403.9 | 1.1055* | 0.6911 |
| | (4,451.6) | (0.5522) | (0.5046) |
| Per capita income squared | | –0.1846* | –0.1162 |
| | | (0.0910) | (0.0837) |
| Poverty rate | 12.1941 | –0.6775 | –1.9652* |
| | (3.1950) | (1.0166) | (0.9144) |
| Percent over age 65 | 12.7027 | 1.6055 | 2.3130** |
| | (1.9313) | (1.3775) | (1.2664) |
| **Medicare population characteristics** | | | |
| Percent black | 7.8714 | –0.9049* | –1.0019* |
| | (11.0617) | (0.3952) | (0.3573) |
| Percent female | 58.3219 | 5.8272* | –2.3756 |
| | (1.8509) | (2.1866) | (1.9859) |
| **Regional dummy variables** | | | |
| South | 0.3333 | 0.0661 | 0.0196 |
| | (0.4761) | (0.0920) | (0.0849) |
| Midwest | 0.2353 | –0.0524 | 0.0061 |
| | (0.4284) | (0.0754) | (0.0704) |
| West | 0.2549 | 0.3795* | –0.0914 |
| | (0.4401) | (0.1100) | (0.0994) |
| $R^2$ | | 0.5017 | 0.6129 |
| **N** | 51 | | |

Note: * indicates significance at the 5 percent level; ** indicates significance at the 10 percent level.
Source: Author's calculations using data from *Statistical Abstract of the United States: 2000*; U.S. Bureau of the Census; U.S. Bureau of Economic Analysis

The means for the independent state-level variables, which were obtained from several sources, are reported in the first column of Table 3. Data on the number of nonfederal (those not employed by the federal government) physicians and nurses per 100,000 members of the population are from the *Statistical Abstract of the United States: 2000*. The poverty rate for each state is the average over the 1997–99

period and is from the Bureau of the Census. State per capita income data for 2000 are from the Bureau of Economic Analysis. The percentage of each state's population enrolled in the Medicare program is estimated by the percentage of the population over age sixty-five, and state racial and gender distributions are from Bureau of the Census estimates of the population aged sixty-five to eighty-five.[9]

## Empirical Analysis

The values for the dependent variables range from zero to one; thus, a logistic transformation is used to avoid the possibility of predicting values that fall outside this range. The nonlinear least squares estimation technique is used to estimate the parameters of the following regression equation for each separate quality indicator:

$$(1)\quad R_{js} = \frac{e^{X_S' B}}{1 + e^{X_S' B}} + \varepsilon_{js}.$$

$R$ refers to the overall quality-of-care score in the category of interest, $j$ (preventive or diagnostic), for state $s$, and $X$ includes the characteristics of the medical system, the overall population, and the Medicare population within state $s$ that are deemed to be related to the quality of medical care received. The error term, $\varepsilon_{js}$, is assumed to be independent and identically distributed with mean zero and an unknown variance-covariance matrix, $\Sigma$ (Gallant 1987).

State medical system characteristics include the number of physicians and nurses per capita. Increasing the number of physicians should improve the quality of medical care because physicians are ultimately responsible for care; increasing the number of physicians should also improve access to services. In addition, the current U.S. nursing shortage is believed to have adversely affected the quality of patient care (Hopkins 2001); thus, we expect that the coefficient on the number of nurses per capita will also be positive.

For the diagnostic and preventive measures employed in this study, the patient must make the decision to seek out medical care. Thus, adherence to an established quality-of-care standard is a function not only of the care proffered but also of the characteristics of the Medicare beneficiaries. The medical care provider should be able to influence a patient's decision to participate in this type of care, but the patient's characteristics will also influence the level of acceptance. Therefore, the quality of care for these categories is expected to be affected by the characteristics of the Medicare population.

It is well documented that blacks have lower levels of utilization of medical care even after income is taken into account (Mayberry, Mili, and Ofili 2000). Pertinent to this analysis, Gornick et al. (1996) found that blacks had lower levels of utilization of preventive care. The explanations for these racial differences vary from limited access due to discrimination to lower levels of demand due to a distrust of the system (Weddington et al. 1992). Thus, in this study the coefficient on the percentage of a state's Medicare population that is black is expected to be negative.

Evidence in the literature suggests that older females are more likely to obtain preventive services than are older males. Thus, the variable controlling for the percentage of the Medicare population that is female in each state is expected to be positively related to quality (Johnson-Lans and Bellemore 1997).

The quality of medical care may also be influenced by the characteristics of the overall population of a state. For example, states with lower average income, and thus a lower tax base, may not be as willing or able to invest in a higher quality of

care. In addition, states with higher poverty rates may have relatively higher numbers of uninsured or publicly insured. This fact may limit investment in medical care facilities and, in turn, reduce the quality of medical care for Medicare beneficiaries.

Finally, the percentage of a state's population that is aged sixty-five and older is used to proxy for the Medicare-eligible population. States with a large Medicare population may have economies of scale in education and outreach that will lead to higher-quality care. Conversely, medical providers may be reimbursed at a lower rate for Medicare patients than for privately insured patients. Increasing the percentage of patients who are covered by Medicare may lead medical care providers to use cost containment strategies that reduce the quality of patient care. Therefore, the expected sign of this coefficient cannot be determined a priori.

*If indeed an ounce of prevention is worth a pound of cure, then improvements in the utilization of preventive and diagnostic services may slow the growth rate in health care expenditures.*

## Results

The nonlinear least squares estimates of equation 1 are presented in the second and third columns of Table 3. The only coefficient that is statistically significant in both categories is the percentage of the Medicare population that is black. The marginal effect of a 1 percent increase in the percentage of a state's Medicare population that is black is to lower the quality of preventive and diagnostic care by 0.53 and 0.55 percentage points, respectively.[10]

**Preventive care.** In addition to the percentage of the state population that is black, per capita income (and its square), the percent female, and the West region have statistically significant coefficients. A $1,000 increase in per capita income would increase the quality-of-care score by 0.14 percentage points. The significant sign on the percent female is positive, as expected, because women have been shown to be more likely to engage in preventive behavior.

**Diagnostic care.** In addition to the percentage of the Medicare population that is black, the number of physicians, the poverty rate, and the percentage of the population that is eligible for Medicare are associated with the quality of diagnostic care. The coefficient on the number of physicians is positive and statistically significant, suggesting that an increase in the number of physicians by 100 for every 100,000 members of the population leads to a 0.07 percentage point increase in the quality of diagnostic care.

A 1 percent increase in the poverty rate lowers the quality of diagnostic care by 1.31 percentage points while increasing per capita income by $1,000 leads to a 0.11 percentage point increase in the quality of diagnostic care. Finally, increasing the percentage of a state's Medicare population by 1 percent increases diagnostic care by 1.45 percentage points. This finding suggests there may be economies of scale associated with the provision of diagnostic care.

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9. The poverty statistics were obtained from www.census.gov/hhes/poverty/poverty99/pv99state.html (November 21, 2003). Data on state per capita income for 2000 were obtained from www.bea.doc.gov/bea/regional/spi/ (November 21, 2003). "Population Estimates for States by Age, Race, Sex, and Hispanic Origin: July 1, 1999" (ST-99-43) were obtained from www.census.gov/population/estimates/state/sasrh/sasrh99.txt (February 5, 2005).
10. As a result of using the logistic transformation, the coefficients do not represent the true effect of the independent variables. The marginal effects are the average of the marginal effects estimated across the states.

## Conclusion

While all states have room for improvement, this study shows that the quality of preventive and diagnostic medical care was lower, in general, for southern states. The observed state-level differences are attributed, in part, to socioeconomic and demographic characteristics. In particular, the percentage of a state's Medicare population that is black is inversely related to the quality of medical care. However, we are unable to determine whether racial disparities in utilization of these services are solely the results of blacks' utilizing lower levels of services or whether utilization levels were lower for all Medicare beneficiaries in states that have proportionally larger black populations.

Access to individual-level data within states would allow researchers to make these determinations and provide a direction for future work. Most importantly, understanding the causes behind racial disparities in the quality of medical care will enable the CMS to promote the goal of delivering the highest quality of care to all Medicare beneficiaries and slow the growth rate in health care expenditures (Etchason et al. 2001).

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