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The Efficiency of Medicare

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I. Introduction

The U.S. spends more on health care in per capita terms and as a percent of GDP than any other developed country (OECD, 1998). This can be interpreted in two ways. One is that the elevated spending is symptomatic of failure in the health care system. Money is wasted through administrative overhead, the overuse of fully insured health care, or the provision of expensive tertiary but only marginally useful technology. [1] A different view is that U.S. citizens demand, and get, a higher quality level of health care than anywhere else in the world. It may be expensive, but the technological advances provided in the U.S. have led to dramatic improvements in functioning and life expectancy.[2]

Knowing which story holds true is crucial for any kind of health care reform, and particularly for Medicare reform. Unfortunately, the answer is elusive. While the evidence strongly suggests that technological gains in the treatment of heart attacks and low birthweight infants are substantial (e.g., Cutler et al, 1998; Cutler and Meara, 1999), it is not clear how well these specific paradigms generalize to the entire health care system. Unfortunately, there are few diseases with well-specified initiating events (the index heart attack, the birth) and well-specified outcome criterion (survival), and for these the quality of scientific research tends to be good. Evaluating the treatment of chronic diseases such as congestive heart failure or slow-acting cancer is more difficult, given the difficulties in specifying appropriate treatment protocol for the wide range of patients who are afflicted by these diseases.

Researchers have attempted to exploit "natural randomization" in outcomes data to estimate the marginal effectiveness of specific medical technologies on outcomes such as mortality for people with heart attacks (McClellan et al, 1994) or for infants (Gruber and Currie, 1996). For example, in McClellan et al, the "treatment" group were people experiencing heart attacks who lived near a hospital with a catheterization laboratory, the "control" group those living relatively further away. In this paper, we use the idea of "natural randomization" to evaluate the efficiency of the Medicare program more generally. The macro-level equivalent of living near a catheterization lab is whether the health care

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[1] For a good exposition of this view, see Evans and Stoddart (1994).

[2] For a general exposition of the view that current high spending levels for medical technology will yield benefits that could even lower costs in the future, see Pardes et al (1999). For specific measures of improvements in outcomes following the use of more intensive technology, see Cutler et al (1998), and Cutler and Meara (1999).

system provides a higher-than-average intensity of health care; hospitalization instead of outpatient care, surgery instead of watchful waiting, and 3-month physician appointments instead of 6-month appointments.

There is overwhelming evidence that regions in the United States differ dramatically in terms of their health care resources and utilization (Fisher et al, 1994; Wennberg and Cooper, 1999). Yet one must be cautious about using location as an instrument. Some regions may spend more in Medicare expenditures because their population is sicker, and not because of any differences in the underlying intensity or practice patterns of physicians living in the region.

To avoid these reverse causality issues, we focus on the practice and intensity of health care among elderly people in their *last six months of life*. By definition, these patients are similar across regions in terms of one primary indicator of health status – their six month survival rate. Because there are no well-defined medical guidelines on how aggressively one should treat illnesses such as chronic heart failure, chronic obstructive pulmonary disease, and cancer near death, we suspect that community-level norms or standards of care would be revealed most accurately in how such patients are treated. Obviously, one cannot use treatment patterns in the last six months to make inferences about Medicare efficiency in this group, since they are all dead by the end of the period. Instead, the intensity of care in the last six months is used as our instrument to measure whether regions with higher levels of Medicare expenditures gain benefits in terms of survival or health status. Equivalently, do areas that practice less intensive care realize the same (or better) outcomes?

Measuring, much less defining, intensity is difficult, since there are so many dimensions along which regions can differ; more physician visits, more tests, or simply more "best practice" health care, which may in fact be quite inexpensive (e.g., administering aspirin following heart attacks). We show below that the intensity that seems to matter most for Medicare expenditures is not the use of intensive or "high tech" surgery, but instead appears to be "inframarginal" intensity in the sense of more laboratory tests, physician visits, specialist consults, hospital admissions, and ICU use.

Using data from the *Dartmouth Atlas of Health Care*, we estimate an instrumental variables model of Medicare intensity for a variety of specifications. Briefly, we find little evidence that the greater spending observed in high-intensity regions leads to better health outcomes; in other words, we find "flat of the curve" benefits from the higher expenditures. On the other hand, regional indicators of effective practice – rates of screening for breast cancer, influenza vaccinations, and appropriate treatment of heart attacks – are associated strongly with improved survival, even after controlling for income. Our estimates suggest an efficiency cost of nearly $20 billion annually in the Medicare program.

II. The Nature of the Problem: Per Capita Medicare Expenditures in the United States

We first consider the magnitude and extent of regional differences in Medicare expenditures in the United States. Our basic unit of analysis is the Hospital Referral Region (HRR) of which there are 306 in the United States. The HRR was constructed in the *Dartmouth Atlas of Health Care* as a unit of analysis that reflected the actual hospital migration patterns of Medicare patients for tertiary care. An HRR must include at least one hospital that performs cardiac surgery and neurosurgery. Each zip code in the United States is assigned to an HRR depending on what hospital the majority (or in some cases, the plurality) of Medicare enrollees seek their hospital care, see Wennberg and Cooper (1999) for details. Thus the HRR may cross county or state boundaries, or in some cases follow interstate highways.

The important thing to note about HRRs for this study is that all rates are based upon the zip code of residence and not where the person actually sought care. Thus if an individual lives in Lebanon NH and is admitted to a hospital in Boston, all utilization is assigned to the Lebanon HRR. It is also important to note that most care is delivered locally; 80 percent of the US population lives in HRRs in which over 85 percent of care is delivered by providers within the HRR. In the analysis that follows, all utilization rates have been adjusted for differences across HRRs in the age, sex, and racial composition of the population, and (where necessary) differences in the price level. We restrict our attention to the fee-for-service Medicare population which during the study period accounted for more than 85 percent of the total Medicare population.

Figure 1 uses these data from Wennberg and Cooper (1999) to construct a map showing the distribution of per capita Medicare expenditures across the United States; these are adjusted for differences across regions in the age, sex, race distribution, and for differences in price levels. There are clearly wide variations in the extent of spending, with per capita expenditures ranging from $3,341 in Minneapolis, for example, to $8,414 in Miami. There are clusters of high-expenditure regions, but there is not an obvious pattern; the deep south and some urban areas on the East and West coasts. There are exceptions as well; inexpensive regions in Florida, and low-cost cities on the West Coast (e.g., Portland Oregon) and the East Coast (Richmond, VA, for example).

This pattern of variation is the puzzle that we consider here. If the higher expenditures in some regions actually lead to better health, then the Medicare program may be unfair if by doing so it amplifies existing inequality in health. If the higher expenditures yield nothing in health benefits, then there is tremendous waste in the program; reducing spending in the high expenditure areas can save enough money to preserve the solvency of the Medicare trust fund by a decade (Skinner and Wennberg, 2000), or to provide money for the recently proposed prescription drug benefits without raising taxes or user fees (Wennberg, Fisher, and Skinner, 2000). It could also be the case that people in the high expenditure areas simply prefer this type of health care. The immediate question would then be – why should other regions be subsidizing their preferences?

To consider this question of whether regions that spend more enjoy better health, we provide a simple graph in Figure 2 that shows per-capita Medicare expenditures (age, sex, race, and price-adjusted) on the horizontal axis and survival, which we define as the (1- age-sex-race-adjusted mortality) x 100, on the vertical axis. There is a clear negative correlation between expenditures and survival, which is highly significant. This in itself is not too surprising; spending should be higher in regions with poorer levels of health, so we might expect to observe Mobile, Alabama spending more than Grand Junction, Colorado. In the next section, we consider a simple model that formalizes how we might evaluate the efficiency of Medicare given that Medicare itself is likely to spend more in regions with poorer health.

III. Medicare Expenditures and Outcomes: Theoretical and Measurement Issues

We consider two issues in this section. First we develop a theoretical model of Medicare expenditures and outcomes, and show that the observed negative correlation between Medicare expenditures and survival in Figure 2 is at least in theory consistent with a world in which the Medicare program is behaving optimally. Second, we develop a criterion for determining what one *should* expect in terms of better survival and functioning for the additional Medicare spending.

1. A Theoretical Model of Regional Differences in Medicare Expenditures

Suppose that the value function of the Medicare "social planner" is written

$$V = V(\mathbf{S}(\mathbf{M}), \mathbf{Q}(\mathbf{M}), \mathbf{Y}(1-\vartheta), \mathbf{P}) \qquad (1)$$

where V is the concave value function, the bold-faced **S** denotes the vector of (regional) per capita survival measures for regions i = 1,…k, **M** is the level of per capita Medicare expenditures (and S_i depends only on M_i and not spending in other areas), **Q** the vector measuring quality of life (where Q_i is also dependent on M_i), and $\mathbf{Y}(1-\vartheta)$ the vector of per capita income after the Medicare tax has been paid; we assume that the tax rate ϑ is proportional to income.[3] Finally, the population of each region is given by **P**, this is to allow for larger regions to receive a larger weight in the social welfare function. While the Medicare program is a complex intergenerational transfer mechanism in which younger workers pay most of the taxes ultimately consumed by the elderly, we assume for analytic simplicity that the people paying the taxes in region i are the same ones experiencing the benefits in region i.[4]

Increasing Medicare spending in just one region i is assumed to result in an increase in the overall Medicare tax rate ϑ; $)M_i = \Gamma_j\, P_j/P_i Y_j)\vartheta$. Thus the balanced budget change in the tax rate necessary to fund an extra (per capita) Medicare dollar spent in region i is

$$\frac{dt}{dM_i} = \left[\sum_{j=1}^{k} \frac{P_j}{P_i} Y_j\right]^{-1} \qquad (2)$$

and the first-order conditions for Medicare expenditures across regions is, for each i

$$\frac{dV}{dM_i} = V_{1i}\frac{dS_i}{dM_i} + V_{2i}\frac{dQ_i}{dM_i} - \sum_{j=1}^{k} V_{3j} Y_j \frac{dt}{dM_i} \qquad (3)$$

where V_{1i} is the contribution of an incremental increase of survival in region i to the social welfare function, V_{2i} the contribution of quality of life (conditional on survival), and V_{3i} the impact of after-tax non-medical income on social welfare of the entire country. In the simplest case, where $V_{1i} = P_i$ and $V_{2i} = 0$ for all i, the objective of the welfare function is to maximize the national survival rate conditional on the overall Medicare budget. When V" < 0, the redistributive component also matters for the first-order condition; there is a greater social benefit to raising the survival rates of the sickest regions.

Ignore for the moment the impact of Medicare expenditures on health status or health functioning, so that $dQ_i/dM_i = 0$ for all i. Then the first-order condition can be written

$$\frac{dS_i}{dM_i} - \left[\frac{\sum_{j=1}^{k} V_{3j} Y_j \frac{dt}{dM_i}}{V_{1i}} \right] = 0 \qquad (4)$$

The first term on the LHS measures the marginal productivity of Medicare expenditures on survival in region i. (We ignore for the moment the fact that the incremental M_i can be used to increase a variety of health inputs; for the moment we assume there is just a single dimension of spending.) Suppose that the value function is linear, so there is a uniform social tradeoff between increasing survival by one unit and reducing after-tax income by ∃. Thus ∃ as the conventional cost-effectiveness "hurdle," or how much is society willing to spend to increase survival rates by a given amount. In this special case, ∃ = $P_j V_{3j}/V_{1i}$, ∀ i,j, which allows us to simplify equation (4) to

$$\frac{dS_i}{dM_i} = b^{-1}$$

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[3] The proportionality assumption is not far from the truth; the Medicare payroll tax is proportional with respect to earnings, and is thus somewhat regressive with regard to total income; the Part B premium is regressive, and Part B proportion funded from general tax revenue is progressive. See McClellan and Skinner (1999).
[4] See for example Feenberg and Skinner (2000).

In other words, all regions should devote expenditures up to the point where the marginal gains are equal. This can be shown graphically in Figure 3, with the same dimensions as those shown in Figure 2; expenditures (or intensity) on the horizontal axis and survival on the vertical axis. Combinations of expenditures and survival rates are shown for three regions, A, B, and C, as well as each of their concave health "production function" $F_i(M_i)$. The slopes of each of the straight tangential lines are equal to $\exists$ so that $dS_i/dM_i = \exists$ across regions. Furthermore, this graph replicates the general pattern of spending and survival shown in the empirical data in Figure 2. Accounting for the concavity of the value function V would imply efficiency conditions that would move region A further along its production function, and would likely restrain region C, so that $dS_A/dM_A < dS_C/dM_C$.

Suppose that some of the benefits of the expenditures come in the form of better quality of life, and not just survival. Then the first-order condition becomes

$$\frac{dS_i}{dM_i} - \frac{V_{2i}}{V_{1i}}\frac{dQ_i}{dM_i} - \left[\frac{\sum_{j=1}^{k} V_{3j} Y_j \frac{dt}{dM_i}}{V_{1i}}\right] = 0 \qquad (5)$$

Thus even when the social welfare function is linear, we may not necessarily find that regions with greater spending would experience an increase in survival of $\exists^{-1}$ per dollar spent. For example, it is often argued that angioplasty, a surgical procedure in which a balloon is inserted by catheter into narrowed arteries and then popped so as to improve blood flow, yields greater benefits in quality of life than in survival. As we discuss in more detail below, however, Medicare expenditures are not closely correlated with these types of surgical procedures, but instead appears to be correlated with treatments that lead to a net decrease in quality of life (Wennberg, Fisher, and Skinner, 2000).[5]

2. How Much Should Survival Rates Differ Across Regions?

The theoretical model argued that it is important in assessing efficiency to measure the impact of the marginal dollar of Medicare spending on health outcomes. As a first step, we would like to know how much difference in survival rates should we expect to see under the null hypothesis that incremental Medicare expenditures yield first-order health benefits. In the short term, we would expect to see a short-term jump in survival; spending (say) $100,000 on additional health care expenditures should yield at least one additional "QALY" or quality-adjusted year of life. Over the long term, the differences across regions in survival rates would shrink as those patients saved early on ultimately die, albeit at a later age.

To develop a measure of steady-state differences in mortality rates across regions, we consider lifetables from 1991 available from the Berkeley/Wilmot web database for people age 65 and over. Figure 4 shows the benchmark survival pattern for the US population in 1991 (the leftmost curve); the average mortality rate is 5.2 percent in this population, which is consistent with mortality in the Medicare population. Next, an innovation is introduced that reduces annual mortality rates by 25 percent, leading to the rightward shift in the survival curve (Figure 4). The population-weighted decline in the mortality rates is 1.3 percentage points, down to 3.9 percent. In the steady state, the population is larger by 11 percent as a result. In other words, for every decrease in mortality of 0.1 percent, there is an increase in the number of people alive of 0.93 percent. If we were to assign a "hurdle" rate of $100,000 per life year, then we would expect that every increase of $1,000 in per capita Medicare expenditures should increase survival rates by 0.11 percentage points.

There are two reasons why this measure is too low, and one why it might be too high. As noted above, in the short run spending $1,000 per capita should yield an increase of one full percentage point, as we are simply extending the lifespan of one out of every one-hundred people in the population, and

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[5] To paraphrase Robert Evans, only an economist would consider spending their time in a physician's office a benefit.

the future higher mortality rates have yet to begin. To the extent that these (dollar) differences are short-term in the last decade or so, we would expect to observe much larger effects on survival of Medicare expenditures. Second, the $100,000 hurdle is often given for a year of life in perfect health (e.g., one QALY), and one is rarely extending life years in perfect health; indeed the increased survival may be at the expense of quite poor health functioning.[6] Finally, as noted above if functioning is improved as well as survival, one may require less improvement in survival. However, as we argue in the next section, the incremental Medicare expenditures may not do much to improve quality of life.

IV. Health Care Intensity and Physician Visits in the Last Six Months

In this section, we argue that physician visits in the last six months of life are a good indicator of health care intensity that is unlikely to be tainted with the problem of reverse causation. Figure 5 shows first that there are clear differences in visits per decedent, ranging from 8.5 in Grand Junction, CO to nearly 48 in Miami. Furthermore, there is a close correlation between physician visits in the last six months and overall per capita age-sex-race- and price-adjusted Medicare expenditures, as shown in Figure 5. (We consider the conditional correlation below.)

These physician visits are also highly correlated with other indicators of intensive care among those in the last six months, such as ICU days, the percent dying in an ICU, and the percentage of patients seen by more than 10 separate physicians in their last six months (Wennberg and Cooper, 1999).

What do patients get from the incremental dollars spent in the regions with higher levels of Medicare spending? It is hard to make judgments from the general Medicare population, since we are concerned about unobservable differences across regions. We do provide a heuristic first impression of the source of these variations by reference to the Part B records comprising 2,200 individuals in their last six months of life during 1994-96, drawn equally from the Miami and Minneapolis HRRs. They were chosen randomly for ages 75-90, and their age distribution was similar. Note that these two

[6] One may object ethically to this argument, however.

regions also have similar overall mortality rates, 4.94 percent in Miami and 4.89 percent in Minneapolis. (The standard devation of mortality in the entire sample is 0.36). We compiled selected measures of utilization that either account for a large differences in expenditures on Part B services (e.g., physician visits) or that tells us something about the nature of care being received by people in Miami relative to Minneapolis.

Table 1 lists these selected billing categories in terms of average counts per person in the sample; thus a higher number may reflect more people receiving the treatment or a larger number of treatments per person. The procedures are ranked by their ratio of utilization for Miami relative to Minneapolis. The measures with the most similar utilization rates were for influenza immunization and for nursing home visits. The influenza immunizations are likely for those who are getting shots regularly, but who die suddenly and/or after a short or unexpected illness. The ratio climbs to 2.0 for initial hospital care; these are physician visits precipitated by a hospital admission, and one might expect that such visits would be correlated with the higher rates of hospital days in Miami.

Ratios of about three-to-one are observed for diagnostic testing; head CAT scans, chest x-rays, and echocardiograms of different types.[7] Hemodialysis (ratio of 2.8) is an indicator for ICU admission for people with failing kidneys, while insertion of emergency airways suggests resuscitation of rapidly declining patients (12.4 percent in Miami compared to 2.9 percent in Minneapolis).[8] Upper endoscopy, the insertion of a viewing video tube down the throat, is similarly high in Miami (18.1 percent versus 3.7 percent), as is the insertion of a feeding tube (gastronomy tube placement, 8.3 percent versus 1 percent). Finally, ventilator management, the daily maintenance of a breathing assistance mechanism (typically in the ICU, and highly unpleasant) is almost unbelievably more commonly coded in Miami; an average of one per decedent versus just 2.6 percent in Minneapolis.

Finally, the dollar differences in expenditures near the end of life are explained partly by office outpatient visits (ratio of 2.2), but proportionately more by initial inpatient consults (6.2) and laboratory pathology consults (a ratio of 25-to-one). While these tabulations have been largely impressionary, they do not point to a greater use of discretionary surgery (see Wennberg, Fisher, and Skinner, 2000);

[7] These provide a moving picture of the activities of the heart and heart valves. Doppler echocardiograms provide more accurate measures of blood flow

[8] Of course the insertion could have been done more than once for the same patient.

indeed the use of angioplasty, a surgical procedure that can improve general functioning and comfort, is actually higher in the general Medicare population in Minneapolis than in Miami. Instead, it suggests inframarginal intensity; using the technology for a wider group of patients and more intensively for each patient.

While we have made an *a priori* argument for end-of-life care qualifying as an instrument, we also can make an *a posteriori* argument for our instrument. We include six “low variation” indicators of the general health status in the hospital referral region; these are diseases about which there is little discretion as to whether the individuals are hospitalized, nor is there much discretion over the diagnosis: heart attacks (AMI), stroke (CVA), gastrointestinal bleeding, hip fracture, colon cancer, and lung cancer, all on an age-sex-race-adjusted basis per 1,000 Medicare enrollees. These variables are predictive of overall mortality rates; as shown in Table 3 (Column A), they alone can explain nearly half of all the variation across regions in survival rates (or equivalently, mortality rates).

Column B in Table 3 also considers a more general model of survival that includes average Social Security income for the over 65 population and the percentage of the over 65 population living under the poverty line.[9] We would expect a negative impact of the poverty measure on survival (to the extent lower income people have higher mortality rates) and an ambiguous impact of Social Security income; while higher income may increase survival, higher income – holding the percent in poverty constant – also signals more income inequality, which may itself have deleterious effects on health (e.g., Wilkinson, 1996, Deaton and Paxson, 2000). However, the coefficients are not entirely consistent with priors; the coefficient of the poverty rate on survival is positive, not negative. This anomaly can be explained mechanically by the presence of the low variation conditions which are themselves affected by poverty, but the results is still somewhat surprising.[10]

Consider the predicted measure of survival from Equation B in Table 3 based just on the incidence of the low variation conditions as well as the poverty rate and average Social Security income. This effectively weights the health indicators so as best to predict survival, and thus would seem to

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9 These are derived from zip-code level Census data from 1990 using the CensusCD database, and matched to the HRR.

10 The correlation coefficient between the percent in poverty and the survival rate is –0.33, which is significant at the 0.0001 level.

qualify as a good measure of underlying (measured) health status. The weighted correlation coefficient between predicted survival (or mortality) and physician visits in the last six months of life is just –0.04, with a p-value of 0.48. So it would appear that the instrument is not correlated with measured underlying health status. However, there is some suggestion of a non-linear pattern, as shown in Figure 6. In this graph, the sample is split into 5 equally (weighted) quintiles according to physician visits in the last six months of life. Within each quintile, the distribution of the predicted survival measure is shown; the box is the quartile range (the 25th and 75th percentile), the line in the middle is the median, and the "whiskers" extend 50% of the interquartile range above the box. Any datum above the whiskers is shown as an "outlier."

While there are no strong trends, it does seem clear line that the regions in quintile 1 are somewhat different from the others; they tend to be smaller, in more rural areas, and they tend to have quite healthy populations.[11] To ensure that our results are not being driven by these regions, we consider a model specification below that excludes this first quintile entirely, since the remaining quintiles do appear similar in all respects related to underlying health.

Before moving on to the two-stage regressions, we establish in Column C of Table 3 that after controlling for the health-related variables, physician visits in the last six months are still highly predictive of Medicare expenditures; the regression coefficients (and ones with quintiles entered separately) imply that the overall expenditures associated with the higher physician visits account for nearly $20 billion annually.

V. Measuring the Efficiency of Medicare Expenditures

We next consider the two-stage regression, in which Medicare expenditures are just identified by physician visits in the last six months of life. The implied coefficient is shown in Column D of Table 3. Recall from above that the minimum improvement one would expect to find in a steady-state economy from an extra $1,000 in Medicare expenditures per capita is an improvement of 0.11 percent in survival rates (or an equivalent fall in mortality rates). The estimated impact of Medicare on survival is 0.017, and is not significantly different from zero. However, the upper limit of the 95 percent confidence

[11] We tried including the percent of the HRR that was urban in the survival regression, but it was not significant conditional on the low variation and income variables.

interval is .114, so we can be reasonably confident that the estimate is bound away from our lower bound of 0.11. In other words, we find no evidence that incremental Medicare spending in high-expenditure regions leads to improved survival.

Wennberg and Cooper (1999) developed a measure of "effective" care that measured the frequency of use where appropriate for 11 treatments or screening methods that are generally agreed upon to be effective in medical care. For example, they measured the fraction of women in the Medicare population who were screened for breast cancer (mammography), the percentage of diabetics administered hemoglobin 1ac blood tests and eye exams, and the percentage receiving a pneumonia vaccination. Averaged in with these measures are quality measures for the treatment of heart attacks; the percentage of appropriate patients in each HRR who received aspirin, beta blockers, and ACE inhibitors, for example.[12] Obviously, one would not expect 100 percent compliance for a variety of reasons, but in general the quality indexes were quite low, with a (weighted) mean of 48 percent and a range from 32 to 57 percent. Thus a higher index is likely to indicate better quality care in the sense of better health functioning by detecting and avoiding future disease.

The coefficient on the index of effective care is positive and significant; a 10 percent increase in the index is associated with survival rates that are nearly 0.2 percentage points higher. This could simply reflect the fact that higher income regions demand and get better quality care (and in turn survival is positively related to income), but recall that we have already controlled for both income and poverty levels in the analysis. It could be that the index is measuring a general stance in the region towards effective care of all types, including quite expensive care. However, the correlation between the effectiveness index and per capita Medicare expenditures is –0.26 ($p < .001$), meaning that greater Medicare expenditures in a region do not appear to be buying better quality health care, at least measured along these dimensions (Wennberg, Fisher, and Skinner, 2000).

As a specification check, we estimate the same model using unweighted data; results are shown in Column E of Table 3. Here the coefficient is negative, but not significantly different from zero, and can certainly reject the hypothesis that the true coefficient is equal to 0.11. That the coefficient might

[12] These latter indicators are drawn from the Cooperative Cardiovascular Project, or CCP, a detailed study of more than 200,000 heart attacks in the US.

indeed be negative (i.e., at the margin more expenditures could be worse) has been suggested in a number of recent studies; see for example Fisher et al (2000). Finally, the same model (weighted) that excludes the first quintile of regions with very low levels of physician visits in the last six months again implies no impact of Medicare expenditures on outcomes (not reported, coefficient is 0.23, t-statistic = 0.4).

Discussion

In this paper, we have considered the broad question of the efficiency (or inefficiency) of the Medicare program. In particular, what are we getting for the additional expenditures in "high-cost" regions? Are these regions higher cost simply because there are sicker people living there, and these residents require more health care? Or do the higher expenditures result in increased health inequality; some regions get more health care and benefit as a result? Or are we practicing "flat of the curve" health care where the increased expenditures yield little or nothing in benefits?

We examine this question using overall survival rates and Medicare expenditures across 306 hospital referral regions in the United States. To control for potential endogeneity (that Medicare expenditures are themselves likely to be higher in sicker regions), we use as an instrument the number of physician visits per decedent in their last 6 months of life. We find that this measure is not correlated with alternative measures of health status in the region, so that it does not reflect greater health needs of the community. On the other hand, it is highly correlated with overall Medicare expenditures for the entire population. Briefly, we find no evidence that the higher expenditures improve survival. If true, this would suggest at least $20 billion dollars are wasted annually in providing health care that does nothing to improve health status.

One possibility is that we are simply not controlling for enough relevant confounding variables. While we have deliberately kept this analysis simple, the results, that Medicare spending seems to exert little influence on health outcomes, is found for a variety of different specifications and covariates (Fisher et al, 2000). Also, the outcome variable, which is overall mortality, may also be a blunt instrument for measuring outcomes. Elsewhere, we have shown that the same general result holds among a population of people admitted to the hospital for hip fractures: regional differences in Medicare spending has no apparent influence on outcomes (Chau, Fisher, and Skinner, 2000).

A final possibility is that while survival is not affected, patients may enjoy better health functioning, or they may simply prefer such care. This hypothesis is difficult to address using Medicare claims data, aside from the suggestive tabulations of the greater propensity for “end-game” medical procedures in one high-intensity region, Miami. However, other evidence is at least consistent with the view that greater health care expenditures or intensity does not necessarily improve satisfaction, as in the Texas-New York comparisons of angioplasty (Guadagnoli et al, 1995), and the SUPPORT study of end-of-life care. In the SUPPORT study, seriously ill patients were asked about their preferences regarding dying in the hospital and intensive life-saving care, and efforts were made to ensure that they got what they wanted. However, there was no correlation between expressed preferences and what they actually got; indeed Pritchard et al (1998) found the only predictor of whether patients died in the hospital was the supply of hospital beds in the area.

These “macro” level studies do not provide an easy prescription for how to fix the Medicare program, or how to encourage the greater use of effective care. However, our approach can be better viewed as a report card on the macro-level behavior of the U.S. health care system. The results of this study suggest two things. First, that regions that practice better “quality” care, as measured by the 11 indicators of effective care, appear to show results in terms of higher levels of survival, yet regions that score higher on their effectiveness index do not spend more. Second, the Medicare program generally earns a provisional failing grade, at the least requiring remedial work to determine what we are getting for all that money.

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Table 1: Selected Part B Procedures Per Decedent in Miami and Minneapolis HRRs, 1994-96

(Age 75-90, sample size = 1,100 in each HRR)

Part B Service Code	Miami	Minneapolis	Ratio
Nursing Facility Care (Visit) (99301-99313)	1.883	1.655	1.1
Influenza Immunization (90724)	0.120	0.105	1.1
Initial Hospital Care (99221-99223)	1.360	0.695	2.0
Office Outpatient Visits (99201-99215)	5.250	2.419	2.2
Head Cat Scan (70450,70460,70470)	0.493	0.179	2.8
Hemodialysis (90935, 90937)	0.279	0.101	2.8
Chest X-Ray (71010 - 71035)	7.365	2.437	3.0
Doppler Echo / Echo of Heart (93224-93350)	1.114	0.365	3.0
Electrocardiogram & Report (93000 - 93010)	3.758	1.065	3.5
Insertion of Emergency Airway (31500)	0.124	0.029	4.3
Upper Endoscopy (43235,43239,43255)	0.181	0.037	4.9
Initial Inpatient Consult (99251-99223)	3.225	0.516	6.2
Gastronomy Tube Placement (43246, 43830, 43832)	0.083	0.010	8.3
Laboratory Pathology Consultant (80500-80502)	0.845	0.034	25.1
Continuous Ventilator Management (94657)	1.022	0.026	38.8

Table 2: Summary Statistics (Unweighted)

Dependent Var.	Mean	Standard Deviation	Minimum	Maximum
Medicare Expenditures (in $1,000)	5.00	0.936	3.12	8.86
AMI Rate (per 1000)	19.18	3.09	11.44	29.44
Stroke Rate (per 1000)	22.83	3.19	15.24	32.47
Gastrointestinal Bleeding Rate (per 1000)	15.05	1.83	10.54	20.43
Colon Cancer Rate (per 1000)	4.66	0.59	2.83	6.84
Lung Cancer Rate (per 1000)	1.37	0.33	0.50	2.28
Hip Fracture Rate (per 1000)	15.47	1.62	9.20	19.62
Effectiveness Index	47.08	4.06	32.21	56.74
MD visits in the Last Six Months (per decedent)	22.31	6.47	8.5	47.9
Fraction Living in Poverty	0.128	0.059	0.044	0.320
Average Social Security Income (in $1,000)	7.70	0.66	5.98	9.46
Mortality Rate (percent)	5.29	0.36	4.01	6.22

Table 3: Regression and Instrumental Variables Estimates of the Association of Medicare Spending With Mortality

Dependent Var.	Survival	Survival	Medicare Expend.	Survival (2SLS)	Survival (2SLS), unweighted
	A	B	C	D	E
Medicare Expenditures (in $1,000)				0.017 (0.3)	-0.035 (0.7)
AMI Rate (per 1000)	-.010 (1.5)	-0.013 (1.5)	0.023 (0.9)	-0.016 (1.9)	-0.017 (2.5)
Stroke Rate (per 1000)	-0.037 (4.6)	-0.048 (5.4)	-0.0006 (0.0)	-0.039 (4.3)	-0.038 (5.3)
Gastrointestinal Bleeding Rate (per 1000)	-0.051 (3.4)	-0.050 (3.0)	0.090 (2.2)	-0.049 (2.6)	-0.046 (2.9)
Colon Cancer Rate (per 1000)	-0.011 (0.3)	0.003 (0.1)	-0.162 (1.8)	0.011 (0.3)	0.007 (0.3)
Lung Cancer Rate (per 1000)	0.133 (2.3)	0.128 (1.7)	0.249 (1.6)	0.047 (0.7)	0.021 (0.4)
Hip Fracture Rate (per 1000)	-0.047 (4.2)	-0.049 (3.6)	0.087 (2.5)	-0.052 (3.8)	-0.055 (4.8)
Fraction Living in Poverty		2.889 (3.6)	4.101 (1.9)	3.222 (3.98)	3.605 (4.8)
Average Social Security Income (in $1,000)		0.192 (2.5)	0.008 (0.0)	0.182 (2.5)	0.180 (2.8)
Effectiveness Index				0.020 (4.02)	0.014 (3.1)
MD Visits in the last 6 months			0.064 (6.82)		
Constant	97.12	95.52	1.104	94.49	95.02
R^2	0.45	0.49	0.49	0.52	0.52

Notes: N = 306. Robust standard errors; absolute value of t-statistics in parentheses. All sample sizes weighted by Medicare population unless otherwise noted. Low variation conditions (e.g., AMI, stroke) and effectiveness index are from 1995/96, Medicare expenditures data is for 1996, poverty and Social Security data from 1990 Census.

Figure 1

(Not included in the emailed version – too big)

Figure 2: Per Capita Medicare Expenditures and Mortality Rates in the Medicare Population, 1996

(Note: Medicare expenditures and mortality rates are age-sex-race adjusted, both apply to the fee-for-service population)

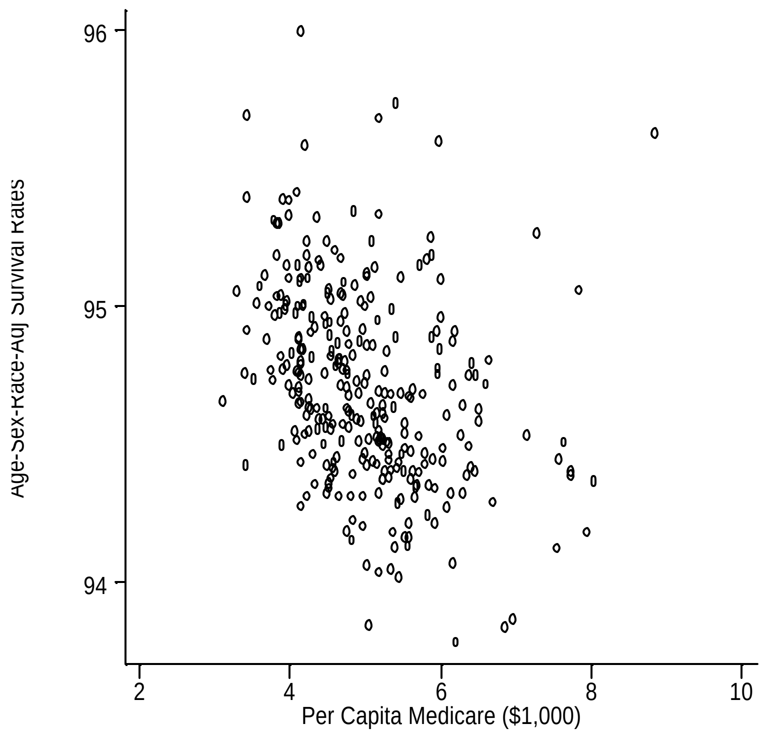
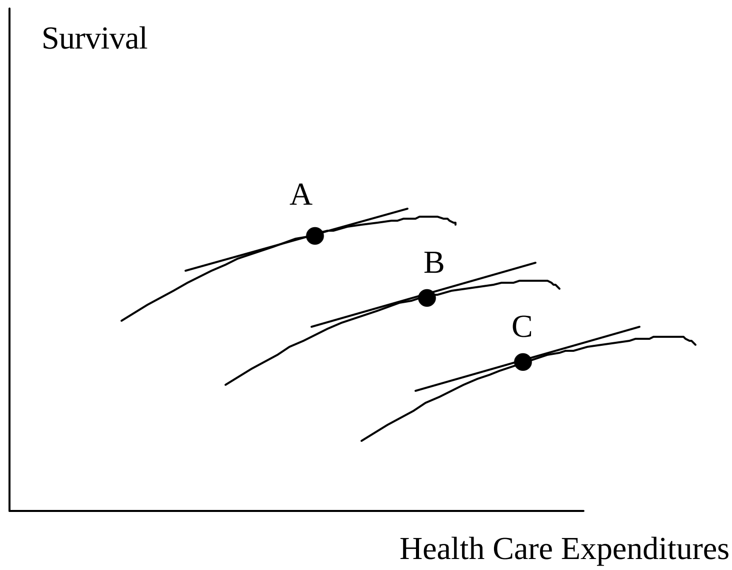


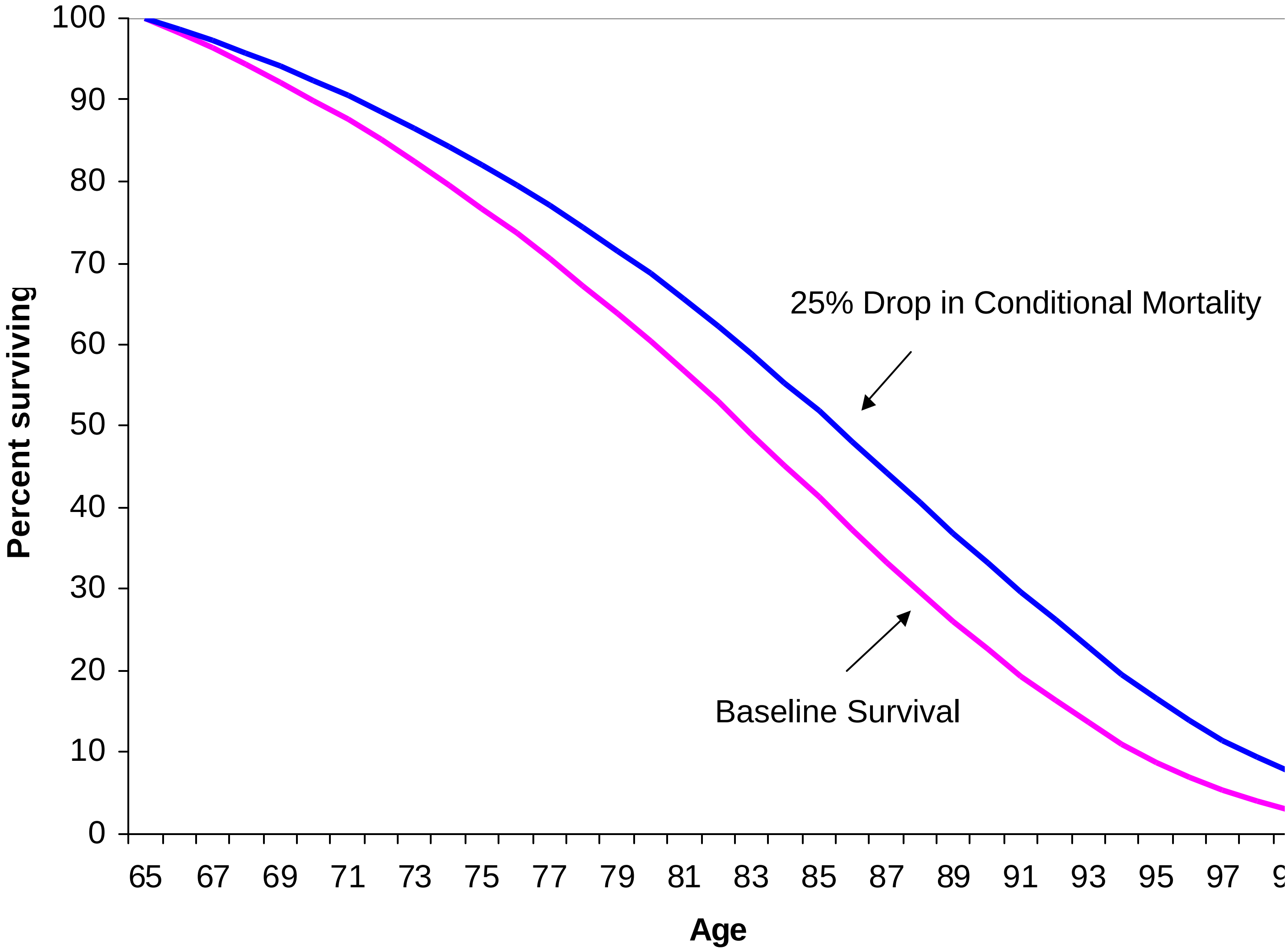
Figure 3: Efficiency in Health Care



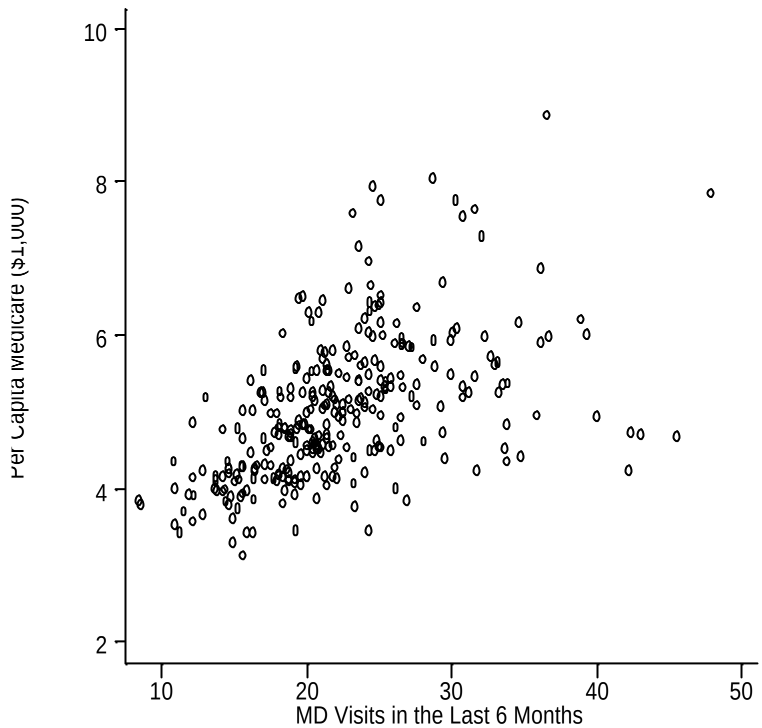
Note: A, B, and C represent regions. At each point, the slope of the health care productivity curve is equal (and shown by the straight line passing through points A, B, and C)

Figure 4: Baseline Survival Curve and Counterfactual Survival Curve After 25% decline in Mortality Rate

Figure 5: Physician Visits in the Last Six Months (Per Decedent)



and Per Capital Medicare Expenditures



10
8
6
4
2
Per Capita Medicare ($1,000)
10
20
30
40
50
MD Visits in the Last 6 Months

Figure 6: Box and Whisker Graph: Predicted Survival Rates by Quintile of Physician Visits in Last Six Months