Public Policy and the Income Distribution

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Chapter 7

The Measurement and Evolution of Health Inequality: Evidence from the U.S. Medicare Population

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The technological revolution in health care has brought both great benefits with respect to survival and general well-being, and substantial increases in costs.[1] Whether these changes have reduced inequality in health care or in health outcomes is not well understood. Earlier research suggested that medical-care innovations, such as the use of antibiotics in the treatment of tuberculosis, reduced health-care disparities by race (McDermott 1978). On the other hand, studies of health-care expenditures by income group found higher income groups accounting for a larger fraction of spending, particularly after accounting for health status.[2] Recent studies also suggest that better-educated patients get access to newer drugs (Lleras-Muney and Lichtenberg 2002), survive longer following the diagnosis of cancer (Glied and Lleras-Muney 2003), and comply better with regimens for the treatment of AIDS (Goldman and Smith 2002).

This chapter returns to the question of whether technological advances and increases in health-care expenditures have been associated with an increase or a decrease of inequality in health or in health care. The group studied is the over-sixty-five population in the United States during the 1990s, which is of interest given their high rates of utilization and very high rates of insurance coverage under the Medicare program. Initially, two conventional measures of inequality are considered: health-care expenditures and health-care outcomes as measured by ten-year survival rates. Using detailed Medicare claims data on a panel of several million people in the

over-sixty-five population in the United States back to 1987, we matched individuals to income deciles on the basis of median income in their zip code of residence. Between 1987 and 2001, we found a dramatic increase in health-care expenditures among the lowest-income groups, accounting for a 78 percent increase ($2,624) in real terms, compared to a 34 percent increase ($1,214) for those in the top-income decile. Using expenditures as a marker for health inequality, one would conclude that inequality has lessened, and if anything the higher (annual) expenditures for lower-income households would help to compensate for earlier years during which insurance coverage and preventive care were minimal.[3]

There are, however, a variety of disadvantages to using expenditures for health care as a measure of access. Expenditures may reflect patient preferences, health status, and access to care, nor is it clear how expenditures on health care translate into health outcomes (for example, Fisher et al. 2003). For example, much of the differential increase in expenditures by income group during this period was accounted for by home health care. One government investigation found that 40 percent of Medicare home health care spending was deemed "inappropriate" (Havemann 1997), suggesting that the actual benefits accruing to patients fell short of the money spent on them.

A different picture emerges in the evolution of outcomes as measured by ten-year survival rates. All income groups experienced a survival gain during the 1990s, but those in higher-income groups did better: life expectancy rose by .2 years in the bottom income decile, compared to .8 years in the top-income decile. But this measure is not immune from criticism either. Individual decisions regarding healthy behavior exert an important influence on health outcomes over the life course, and it is rarely clear whether these choices should be attributed to "preferences," education, or economic status per se (Graham 2002; Contoyannis and Jones 2004; Smith 2003). As well, long and variable lags in outcomes make it difficult to evaluate the impact of current health-care expenditures on changes in current health outcomes, particularly when income itself is endogenous to health status (Case and Deaton 2003).

That the two measures of health inequality are contradictory suggests the need for a different approach. We propose focusing on a more limited set of effective (or high-quality) utilization measures with well-established benefits.[4] These measures include

mammography screening among women aged sixty-five to sixty-nine, eye examinations for diabetics, smoking-cessation advice, aspirin, beta-blockers, and reperfusion in the first twelve hours following a heart attack. The latter three treatments accounted for the vast majority of improvement in thirty-day survival following heart attacks (Heidenreich and McClellan 2001). The advantage of these measures over expenditures is that one need not control for health status; nearly everyone in the appropriate universe should be receiving these treatments. Nor does one need to control for preferences toward health care or for lifestyle differences; every appropriate heart attack patient should be receiving beta-blockers upon admission, regardless of whether they are marathon runners or couch potatoes.[5] The use of these measures is not dependent on genetic or environmental factors that might further confound differences in survival rates across income groups. As well, there is increasing effort to use these measures as components of health-care quality indices, for example, by the National Committee for Quality Assurance (NCQA) at the hospital level or at the state level (for example, Stephen F. Jencks, Edwin D. Huff, and Timothy Cuerdon 2003).

Using the Medicare claims data augmented with the Cooperative Cardiovascular Project (CCP) data for heart-attack patients from 1994 to 1995, we find distinct income gradients with regard to the use of effective care. For mammography, in 1993 examination rates for the top-income decile were 16 percentage points higher than that for the lowest decile, and by 2001 the gap had shrunk only slightly, to 15 percentage points. For the inpatient treatment of heart attacks in 1994/95, where the use of effective care is unlikely to have any incremental impact on patient costs and where noncompliance is minimal, the income gradients are smaller; seven percentage points for beta-blockers and five percentage points for reperfusion therapy within twelve hours, with no significant differences in aspirin or ACE-inhibitor use.[6]

In sum, the dramatic increases in relative Medicare expenditures for low-income neighborhoods during the past several decades have not translated into similar improvements in health outcomes. The apparent lack of relative improvement in effective care among the lowest-income groups makes this puzzle less surprising, but by itself cannot explain the *widening* of survival trends by income group.[7] Still, the use of effective care measures can allow the government to work

toward actually doing something about inequality in health care. Monitoring and rewarding providers and patients to raise rates of effective care close to the 100 percent ideal for all Medicare enrollees would have the additional salutary effect of erasing inequality in the dimension of effective care.

The Measurement of Health and Health-Care Inequality

It is important to distinguish between inequality in health care and inequality in health. There is a long history of measuring inequality in health care by the use of utilization or expenditures measures. Julian LeGrand (1978, 1982) and others found a positive gradient between expenditures and income after controlling for measures of health status in the United Kingdom, even several decades after the establishment of the National Health Insurance. Although there was a lively debate about how best to measure income-based gradients in health care (Wagstaff, van Doorslaer, and Paci 1991; LeGrand 1991), the positive association between expenditures and income has been found in many countries, with just a few exceptions (Wagstaff, van Doorslaer, and Paci 1991). The earlier evidence from the United States pointed toward the same positive association between expenditures and income (Davis and Reynolds 1975; Link, Long, and Settle 1982), although more recent data on Medicare expenditures in the 1990s suggests that lower-income households have begun to account for higher levels of spending (Lee, McClellan, and Skinner 1999; McClellan and Skinner, forthcoming).

Health-care expenditures have been used to construct measures of "full income" that include both money income and government-financed health-care expenditures. This approach was pioneered by Eugene Smolensky and his colleagues at the University of Wisconsin during the 1970s in the study of income distribution (Reynolds and Smolensky 1977; Moon 1977), and was extended to valuing health-care benefits in a money-metric context (Smolensky et al. 1977). More recently, Victor Fuchs (1998a, 2001) has used this approach to document the very large fraction of full income among the elderly in the United States made up of health-care expenditures, most of which is paid for by younger generations. The implicit message in creating full-income measures is the opportunity cost of health-care spending, that a reduction in health-care spending could have a large impact on money income, particularly among low-income groups.

The interest in illness-adjusted expenditures or utilization can be motivated by a concern about access to care, where the null hypothesis of perfect equality is presumably one where high-income and low-income individuals with similar medical ailments would be treated with the same procedures and with the same degree of intensity. But some have questioned whether equal rates of utilization are really the same as equal access, for example if people with high incomes experienced different preferences for care (Mooney et al. 1991; Culyer, van Doorslaer, and Wagstaff 1992). While economists are generally comfortable taking preferences as given, the issue is less clear in the health-care literature. For example, Said A. Ibrahim (2001, 2002) documented more distrust of surgery among black candidates for hip or knee replacement than among whites; they placed greater reliance on alternative (nonsurgical) approaches such as copper bracelets or prayer. Jeffrey N. Katz (2001) has distinguished between preferences "guided by informed decisions" and those "limited by truncated opportunities or historical circumstances." Thus, if low-income households are less likely to seek care because of past adverse encounters with the health-care system, their choices today may be related less to immutable preferences and more to past financial or cultural barriers in access to care.

Another shortcoming of using health expenditures is that higher levels of expenditures may not translate into better health outcomes. James A. Glover (1938) counseled against the overuse of tonsillectomies at a time when the risk of surgical complications was high. He and his colleagues noted that children of anxious high-income parents were more likely to receive the procedure and hence were more likely to be exposed to the risk of operative mortality. More generally, Elliott S. Fisher et al. (2003) have suggested that regions with greater use of health care were no more likely to experience better outcomes or even improved satisfaction of patients and improved access to care. In other words, higher expenditures do not always translate into better health.

In the past decade, there has been an increasing interest in the inequality of health, whether measured as life span, quality-adjusted life years, healthy life years, or self-reported health.[8] Measuring health outcomes avoids the problem of inferring the effectiveness of health-care expenditures on outcomes. It also has the advantage of capturing income-based differences in a variety of factors such as health

behavior, diet, and life-course events that have a larger impact on health outcomes than does the health-care system alone. In sum, the estimated gradient between income and health outcomes tends to be considerably stronger than the estimated gradient between income and health-care utilization.

Inequality in health outcomes can be present even in the absence of inequality in health care. Suppose that the health-care system were perfectly equal and provided instant access to all people in society. Inequality in outcomes could still occur, for a variety of reasons. The first is simply luck, or genetic differences across the population (Gakidou, Murray, and Frenk 2000). However, most summary measures of income-based health inequality remove this source of inequality by averaging over large numbers of individuals. For example, the "concentration index" compares the cumulative distribution of income on the horizontal axis and the cumulative distribution of healthy life years (however measured) on the vertical axis, thereby averaging out variation occurring within income categories.[9]

The second source of life-span inequality arises from potential differences in health behavior such as diet, smoking, exercise, drinking, and other factors associated with income and socioeconomic status. In effect, "Inequalities in health reflect the wider inequalities in society" (LeGrand 1982, 45). For example, Paul Contoyannis and Andrew M. Jones (2004) report that these measures of "healthy living" in 1984 were strong predictors of positive good health in 1991. Of course, this raises the very difficult question again of how one can separate "preferences" for health-related behavior from income per se. Exogenous health-care shocks can also have long-lasting effects on health, for example, as in Douglas Almond's (2003) study of the long-term negative repercussions of being in utero during the 1918 influenza epidemic. Long-term health shocks can also affect both earnings capacity and health, muddying the causal link between income and health outcomes even further (Case and Deaton 2003; Elstad and Krokstad 2003; Graham 2002).

We suggest a more restrictive but theoretically cleaner measure of health-care inequality: the utilization rates of effective care, where effective care is defined as procedures that are efficacious for every appropriate patient. Examples include mammography screening for women aged sixty-five to sixty-nine, and the use of beta-blockers, aspirin, reperfusion therapies, and ACE inhibitors for heart-attack

patients. (ACE inhibitors are angiotensin-converting enzyme-inhibiting vasodilator drugs that were introduced in 1981.) Mammography has been adopted as a measure of preventive care in other studies as well (for example, see Decker, forthcoming); Card, Dobkin, and Maestas 2004).

There are several advantages in using such measures. The first is the existence of a reliable link between utilization and health outcomes. Second, there is no need to control (however imperfectly) for health status, since among appropriate or ideal patients, nearly everyone should receive the treatment. Finally, preferences should generally not play a strong role in the use of such interventions, given that the objective benefits are so much larger than the costs.[10] Trends or levels in several of these effective-care measures will be considered further, but first we will examine the empirical record on the evolution of health-care expenditures and survival by income group.

The Distribution of Medicare Expenditures by Zip Code Income

The Continuous Medicare History Survey (CMHS), a 5 percent sample of Medicare enrollees, is used to consider the secular trends of overall Medicare expenditures by income decile. Because individual income is not available in the Medicare claims data, we instead use median zip code income from the 1990 U.S. Census, which is assigned to each individual in the Medicare denominator file on the basis of their mailing-address zip code. (The results are not sensitive to the use of the 2000 census income data.) There are advantages and disadvantages of using zip code income from the census instead of individual income data from surveys. On the one hand, the neighborhood that a person lives in may better reflect permanent income than self-reported income, which may be infested with measurement error and transitory income and, particularly for the elderly population, may not reflect important components of household wealth. On the other hand, zip code income is subject to "ecological bias," such that poor Medicare enrollees in rich neighborhoods could be treated differently from rich enrollees in poor neighborhoods. One previous study, however, has suggested that zip code income provides a reasonably good characterization of income in health-related research (Geronimus, Bound, and Neidert 1996).

In quantifying health-care expenditures for the population over sixty-five, we express all expenditures in 2001 dollars and estimate age- and sex-specific expenditures in five-year age increments (plus those over eighty-five) for each of ten income deciles. In aggregated data, we use direct adjustment to normalize the per-capita Medicare expenditures to a constant age and sex composition over time by use of the sample frequencies of the ten age and sex categories.[11] Only fee-for-service Medicare enrollees are included in the sample, which means that expenditures made on behalf of enrollees in Medicare managed care plans will not be included.[12] The sample size is sufficiently large (30.8 million person-years) that standard errors are small, and so are not reported.

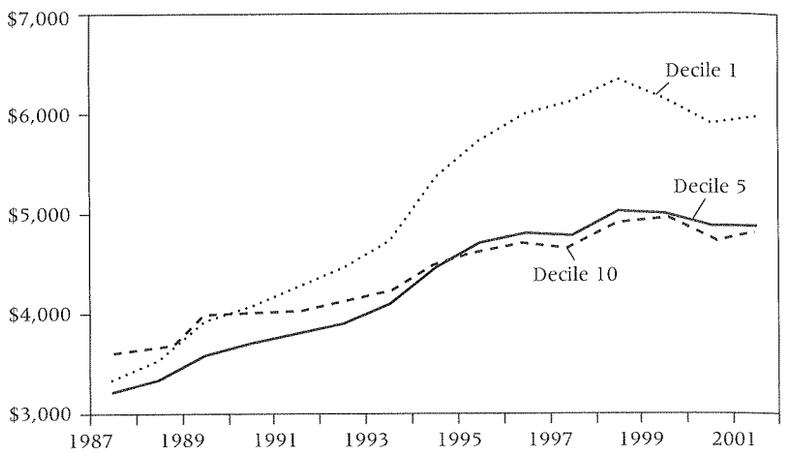
Table 7.1 and figure 7.1 present expenditures for selected income deciles, 1987 to 2001. Not surprisingly, real Medicare expenditures

Table 7.1 Medicare Expenditures by Year and Zip-Code-Income Decile, in 2001 Dollars

	Decile 1	Decile 3	Decile 5	Decile 8	Decile 10
1987	3,346	3,159	3,228	3,478	3,588
1988	3,548	3,309	3,343	3,556	3,656
1989	3,926	3,619	3,590	3,817	3,980
1990	4,068	3,637	3,698	3,904	3,970
1991	4,265	3,852	3,811	4,050	4,022
1992	4,457	4,039	3,914	4,119	4,123
1993	4,740	4,140	4,102	4,199	4,219
1994	5,365	4,553	4,465	4,432	4,464
1995	5,743	4,736	4,702	4,605	4,611
1996	5,998	4,931	4,804	4,596	4,675
1997	6,120	5,073	4,778	4,651	4,666
1998	6,337	5,311	5,031	4,804	4,908
1999	6,153	5,299	5,002	4,719	4,946
2000	5,895	5,068	4,885	4,614	4,725
2001	5,970	5,080	4,873	4,574	4,802
Dollar change, 1987 to 2001	2,624	1,921	1,645	1,096	1,214
Percentage change, 1987 to 2001	78.4	60.8	51.0	31.5	33.8

Source: Authors' calculations using the Continuous Medicare History Survey.
Notes: These estimates of expenditures adjust for age and sex. All expenditures are in real 2001 dollars, adjusted using the GDP deflator.

Figure 7.1 Medicare Annual Expenditures 1987 to 2001, by Income Decile



Source: Authors' calculations using the Continuous Medicare History Survey.
Note: These estimates of expenditures adjust for age and sex.

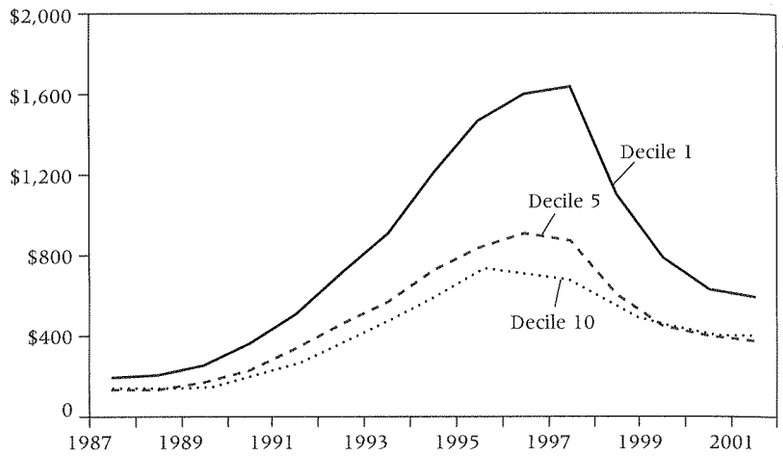
have increased during this period. However, the rates of growth by income group are quite different; the bottom decile experienced a 78 percent increase in real expenditures, in contrast to the top decile, which had just a 34 percent increase.

The advantage of health-care dollar expenditures is that these changes in spending can be compared to changes over the same period of time in median money income, as measured in the Current Population Survey. The real median increase in family income during the period 1987 to 2001 was $2,551.[13] In 1993, the average household size of elderly people living either alone or with a spouse was 1.47,[14] so the per-capita increase in income per elderly person was $1,735 ($2,551 divided by 1.47). Note that the dollar increase in expenditures for the lowest-income decile was $2,624, compared to $1,214 for the highest-income group. Thus, the size of the differential increase (or "twist") in Medicare expenditures was $1,410 ($2,624 minus $1,214), or the amount of money that would have been left "on the table" had Medicare costs for the lowest-income group grown at the same rate as the highest-income group. This differential increase is therefore 81 percent of the total increase in money income for the elderly population during the period 1987 to 2001. It is also larger than the average *level* of per-capita benefits from the Earned Income Tax Credit (EITC) program, estimated to be $1,287 (in 2001 dollars) among the near-poor (Short and Garner 2002). Unlike the EITC, the redistribution occurring in the Medicare program was largely unintended, and the differential benefits to the lowest-income group are still not well understood.[15]

Why the differential growth in expenditures? One reason was the growth in the Disproportionate Share Hospitals (DSH) program, which provided higher reimbursements for hospitals in low-income neighborhoods (see Baicker and Staiger 2004). Another factor was the rapid expansion of home health care during the 1990s. Beginning in the late 1980s, when restrictions on the use of home health care were eased, there were dramatic increases in the use of home health care, particularly in certain regions of the country such as Texas, Florida, and Tennessee (Wennberg and Cooper 1999). Because of the rapid growth in expenditures, and an accompanying increase in scandals, Congress restricted its use sharply in 1997. These expenditures for home health care were concentrated to a large extent in the poorest zip codes of the United States.[16] Figure 7.2 shows average home-health-care spending for the eighty-plus population (the most common users of home health care) by year for deciles 1 (the lowest-income decile), 5, and 10 (the highest-income decile). These are measures of spending per Medicare enrollee age eighty and older, and are not restricted just to users of home health care. There was rapid growth in home-health-care expenditures for all income groups, but the growth for decile 1 was particularly notable, rising to $1,635 per elderly enrollee before dropping after 1997, when the Balanced Budget Act clamped down on unrestricted use.

How much of this spending benefited low-income patients, either through improved survival or improved quality of life? In 1997, a report by the General Accounting Office suggested that 40 percent of all home-health-care costs were "inappropriate" (Havemann 1997). In this case, "inappropriate" meant care resulting from fraud (for example, a physician prescribing tests for sexually transmitted diseases to all of his home-health-care patients in order to get the payments) or care that the patient simply was not eligible to receive. A recent paper by Robin McKnight (2004) did not find adverse health consequences caused by the sharp decline in home-health-care

Figure 7.2 Home Health Care Expenditures for Medicare Enrollees Aged 80 and Over, 1987 to 2001



Source: Authors' calculations using the Continuous Medicare History Survey.
Note: These estimates of expenditures adjust for age (two categories: eighty to eighty-four and eighty-five and older) and sex.

benefits in 1997, although there was a modest consequent increase in out-of-pocket medical expenses. In short, one should be cautious about attributing all dollar increases in Medicare expenditures to the people who nominally "receive" the benefit.[17] Home health care is not the only service provided during the 1990s that may have fraudulently inflated providers' bank accounts, but it was certainly the most visible.[18]

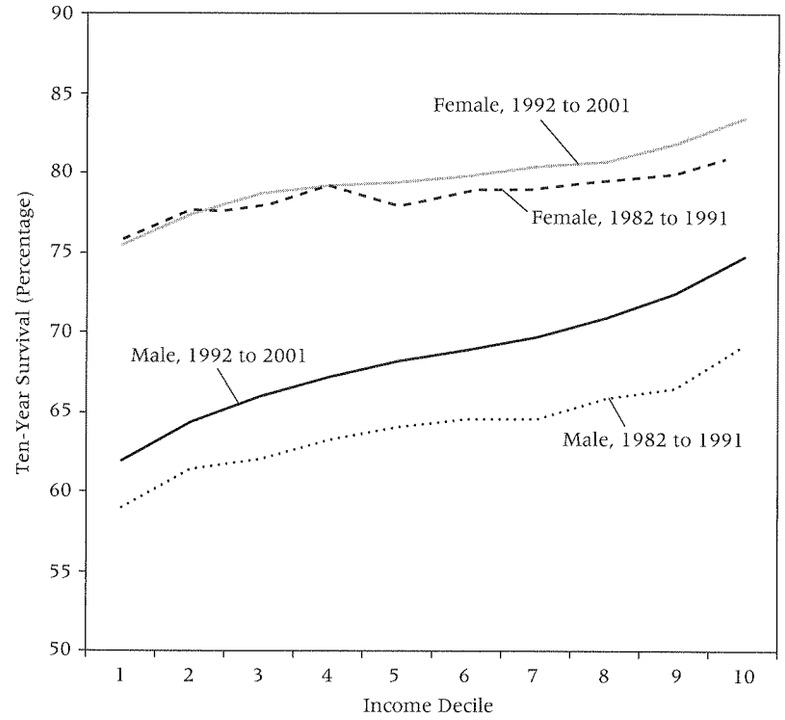
The Distribution of Survival Gains by Income

We next consider overall survival gains in the Medicare population. Here the sample includes not just the fee-for-service population but also the HMO enrollees; this is to avoid potential selection bias caused by healthier individuals' joining managed-care organizations. We consider two different cohorts from the Continuous Medicare History Survey. The first cohort consists of people in 1982 who were either aged sixty-five to sixty-nine or aged seventy-five to seventy-nine. The second cohort consists of people in 1992 who

were in the same age groups, sixty-five to sixty-nine and seventy-five to seventy-nine. For both the 1982 and 1992 cohorts, figure 7.3 shows the ten-year survival rate, in percentage terms, for the younger age groups (aged sixty-five to sixty-nine). There is a clear income gradient for both cohorts; people living in higher-income zip codes were more likely to survive whether in the 1980s or 1990s. In table 7.2 a similar pattern is shown for those aged seventy-five to seventy-nine.

Comparing the 1982 and 1992 cohorts, it is important to note all income groups benefited in the sense of experiencing a higher ten-year survival probability. However, the highest-income groups

Figure 7.3 Ten-Year Survival Rates for Cohorts Aged 65 to 69 from 1982 to 1991 and 1992 to 2001, by Sex



Source: Authors' compilation.

Table 7.2 Ten-Year Survival Probabilities 1982 to 1991 and 1992 to 2001, by Age and Sex

	Aged 65 to 69				Aged 75 to 79			
	Male		Female		Male		Female	
Income Decile	82 to 91	92 to 01	82 to 91	92 to 01	82 to 91	92 to 01	82 to 91	92 to 01
1	59.0	61.9	75.8	75.4	34.6	35.1	51.2	51.8
2	61.5	64.3	77.5	77.4	35.3	36.5	53.3	53.1
3	62.0	66.0	77.8	78.7	35.0	37.6	53.6	54.1
4	63.2	67.2	79.2	79.2	34.8	37.6	53.8	55.0
5	64.1	68.2	77.9	79.4	36.0	39.7	53.9	55.1
6	64.5	68.9	78.8	79.8	36.1	39.8	53.9	54.8
7	64.6	69.7	79.0	80.4	35.4	39.9	53.8	55.7
8	65.8	70.9	79.4	80.7	37.3	41.0	54.1	56.2
9	66.5	72.5	79.8	81.8	38.2	42.9	54.1	56.3
10	69.2	74.8	81.1	83.4	38.7	44.8	54.7	57.1
Sample	188,177	217,272	229,308	263,093	98,053	126,011	152,606	187,554

Source: Authors' calculations using the Continuous Medicare History Survey.

gained the most, both in terms of relative odds ratios, or in terms of absolute gains in expected lifespan.

To quantify these changes in terms of the change in expected survival years, we chain together the two panels of ten-year survival curves for the younger and older cohorts, and estimate the change in expected survival years for a synthetic cohort over a twenty-year period (from sixty-five to sixty-nine to eighty-five to eighty-nine) with fixed weights for men and women based on the fraction of women in the cohort aged sixty-five to sixty-nine (54.8 percent). There was a .2 increase in expected life years in the bottom income decile, a .5 increase in the fifth decile, and a .8 increase in the top-income decile.[19]

Inequality in the Provision of Effective Care

Here we focus on specific measures of effective care, considering first mammography rates (percentage of women who receive mammographies) among women aged sixty-five to sixty-nine in the Medicare population.[20] The advantage of using mammography rates is that we have a time series on rates of screening from 1993 to 2001 and so can measure changes over time in screening rates. A 5 percent sample of part B physician-claims data is used from 1993 to 1997, and a 20 percent sample is used from 1998 to 2001. The later 20 percent sample also includes hospital outpatient data as separate from physician-based claims; these would include women who were screened, for example, in a hospital-based clinic. In theory, excluding such outpatient records for all years could bias our results if low-income women were more likely to receive care in an outpatient setting. In practice, as we show using data from 1998 to 2001, the bias is small or nonexistent.

Table 7.3 reports these mammography screening rates by selected income deciles, but also include (in brackets) the 1998 to 2001 rates that include the outpatient screening data. Although all the rates rose, the relative magnitudes by income group remained largely unchanged (see figure 7.4).

A pronounced income gradient in mammography rates persists throughout the period of analysis. In 1993, the range in screening rates between decile 1 and decile 10 was sixteen percentage points, whereas in 2001 the range had shrunk slightly, to fifteen percentage

Table 7.3 Mammography Rates of Women Aged 65 to 69, by Year and Zip-Code-Income Decile

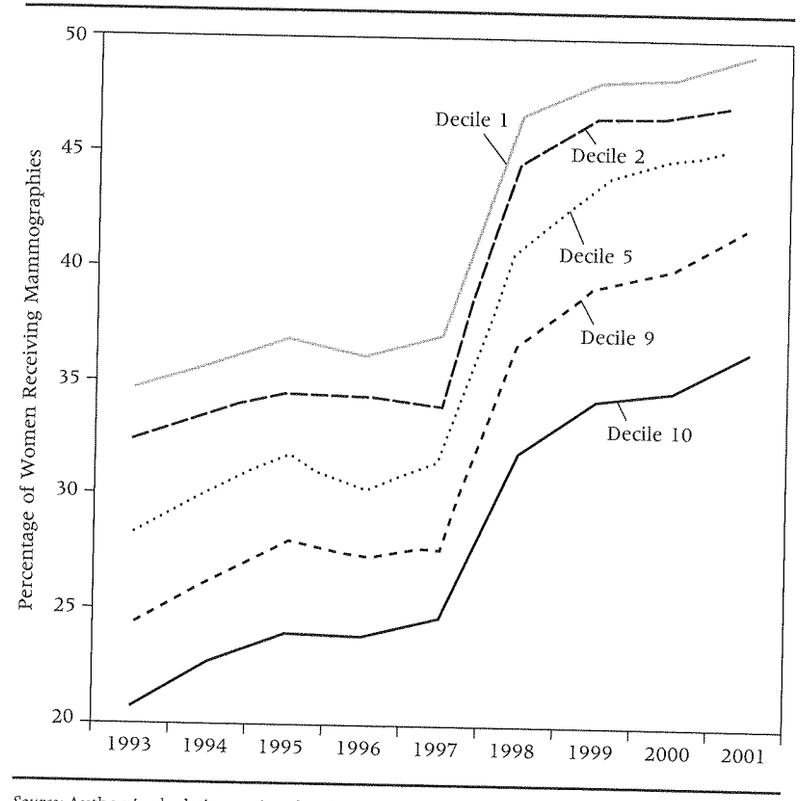
	Decile 1	Decile 3	Decile 5	Decile 8	Decile 10
1993	20.7	25.9	28.2	30.6	34.6
1994	22.8	28.3	30.1	32.2	35.7
1995	24.0	30.1	31.7	33.0	36.8
1996	23.8	29.0	30.0	32.4	36.1
1997	24.7	29.3	31.6	33.3	37.1
1998	32.0	39.5	41.0	43.5	46.7
	[34.8]	[42.0]	[43.9]	[45.7]	[48.5]
1999	34.3	41.9	43.6	45.4	48.1
	[36.8]	[44.2]	[45.8]	[47.5]	[49.8]
2000	34.6	42.6	44.7	45.9	48.3
	[36.9]	[44.8]	[46.6]	[47.8]	[49.9]
2001	36.5	44.0	45.3	47.0	49.4
	[38.5]	[45.9]	[47.0]	[48.5]	[50.7]
Change from 1993 to 2001	15.8	18.1	17.0	16.4	14.8
Change from 1997 to 2001	11.7	14.7	13.7	13.7	12.3

Source: Authors' calculations using the Medicare Part B data.
Note: Numbers in brackets use both the Medicare Part B data and the Medicare outpatient data to estimate the frequency of mammograms.

points. A notable feature of the data is the sharp jump in rates between 1997 and 1998—the consequence of removing the $100 co-insurance payment on January 1, 1998, and allowing reimbursement for annual rather than biannual screening. It is surprising that rates for all income groups appear to have risen by about the same amount, given that low-income households should have been most sensitive to the relaxation of the $100 co-payment.

Similar results for 1998 to 2001 were also found when rates of screening for eye examinations among patients with diabetics were compared (available upon request from the authors). These examinations check for damage to the vascular system caused by high uncontrolled blood-glucose levels. Despite the shorter time period covered, it was possible to establish that there was, again, no evidence of trends in the income-based gradient of diabetes-related eye examinations.

Figure 7.4 Change in Mammography Rates for Females Aged 65 to 69 During 1993 to 2001, by Income Decile



Source: Authors' calculations using the Medicare Part B data.
Note: The 100-dollar co-insurance fee was removed on January 1, 1998.

Of course, some part of the income-based differential could be the consequence of noncompliance—that is, that lower-income patients don't sign up or show up for their screening appointments. We therefore considered physician directives or procedures performed in the first few days following acute myocardial infarction, where the primary goal of the physician is to keep the patient alive, and patient preferences and noncompliance issues should play a small role. The measures of effective care for heart-attack patients are derived from the Cooperative Cardiovascular Project (CCP) survey of more than 160,000 AMI (acute myocardial infarction) patients over the age of

sixty-five in 1994 to 1995. The survey information included detailed clinical data from chart reviews along with information on the patient's treatment. This allowed clinical researchers to determine from the chart data patients who were "ideal" or appropriate for the use of the specific treatment; thus the right rate should be a number near 100 percent, regardless of health status, income, age, or any other characteristic.[21] For this reason, we do not control for covariates or health indices, but consider simple averages by income decile. Table 7.4 presents income-based differences in utilization of effective care and, in the bottom row, the total sample size. Approximate 95 percent confidence intervals are presented at the bottom of the table; these apply to each of the means in the column because the deciles ensure equal sample sizes and the exact binomial confidence intervals are based on the average ratio.

Table 7.4 suggests that in 1994 to 1995, utilization of these measures was remarkably low. For example, the beta-blockers were used

Table 7.4 Rates of Effective Care for Acute Myocardial Infarction in 1994 to 1995, by Income Decile

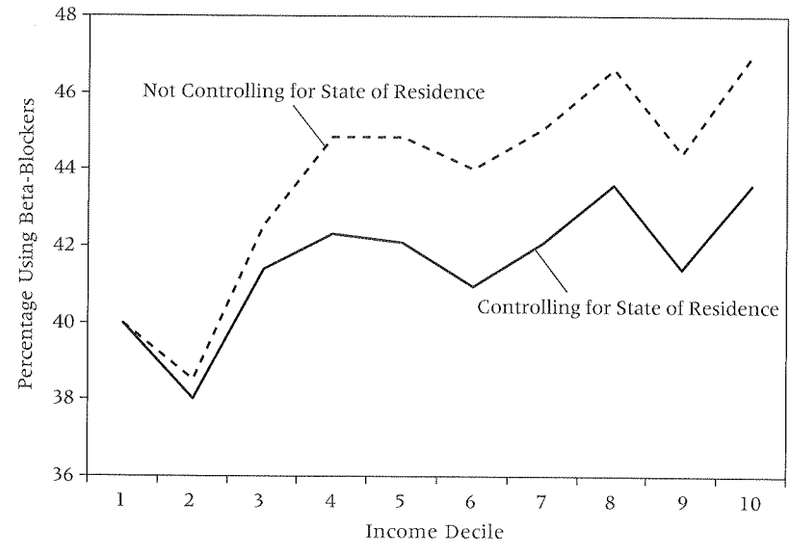
Zip-Code-Income Decile	Beta-Blocker Use at Discharge[a]	Ace Inhibitor at Discharge[b]	Reperfusion Within 12 Hours	Smoking Advice Given[c]
1	40	57	32	33
2	39	57	32	35
3	43	60	33	34
4	45	59	33	35
5	45	59	34	37
6	44	57	35	34
7	45	59	37	34
8	47	59	37	37
9	45	59	36	35
10	47	59	37	35
Approximate 95 percent confidence interval	±1.4	±2.2	±1.7	±2.3
Sample size	50,156	19,286	32,097	17,151

Source: Authors' calculations using the Cooperative Cardiovascular Project (CCP) dataset.
[a]Universe: appropriate (beta-blocker) or eligible (for reperfusion).
[b]Universe: ideal patients.
[c]Universe: smokers.

for less than half of appropriate patients when the target rates should have been closer to 100 percent. Second, rates of use for effective care were modestly elevated among higher-income groups; for example, rates of beta-blockers ranged from 40 percent among the lowest-income decile to 47 percent in the top-income decile. Indeed, for some treatments, such as the use of ACE inhibitors to control hypertension, there were no income-based difference in utilization.

One additional question is whether high-income individuals are more likely to receive higher-quality care because of treatment differences within regions, or because they are more likely to live in regions where overall effective-care rates are higher (Chandra and Skinner 2003). Figure 7.5 shows utilization rates for beta-blockers estimated with and without categorical regional variables. First the previous results were replicated in a logistic-regression with coefficients converted to percentage screening rates. Second, state

Figure 7.5 Income Gradient for the Use of Beta-Blockers Among Ideal Patients, 1994 and 1995



Source: Authors' calculations using the Cooperative Cardiovascular Project data.

dummy variables were then added to the regression, and it was re-estimated, again with odds ratios converted to probabilities, as shown in figure 7.5.

The adjusted probability of beta-blocker use, holding constant the state of residence, shows just a 3.6-percentage-point difference by income group rather than a 7-percentage-point difference. (In this latter regression, only the eighth- and tenth-decile coefficients were significantly different from zero.) That is, half of the income gradient here is the consequence of where patients live and not how patients are treated within regions. The result does not generalize, however. A similar analysis for mammography and diabetes-related eye exams in 1998 to 2001 did not suggest any diminution in the effects of income on utilization rates after controlling for region of residence.[22]

In theory, we would like to know how the income gradient in beta-blocker use evolved over time, but we have just one observation from the survey, in 1994 to 1995. Since the use of beta-blockers for heart-attack patients was rare before the early 1980s, we may safely infer that the observed difference in 1994 to 1995 reflects a somewhat higher growth rate in the use of beta-blockers among the top-income deciles, at least through 1994 to 1995. Since then compliance has improved, but in 2001, median compliance was still less than 70 percent (Jencks, Huff, and Cuerdon 2003). It is possible that rates of compliance have risen more rapidly in low-income regions, but Alabama was low in the use of beta-blockers in 1994 to 1995 and it remained relatively low in 2001.

Conclusions and Discussion

How should one judge whether inequality of health care and of health has improved or worsened during the past several decades? This paper has considered several alternative approaches to measuring inequality using U.S. data from the elderly Medicare population over the age of sixty-five. Medicare expenditures grew much more rapidly among the lowest-income deciles than among higher deciles, but health outcomes improved much less rapidly for this group than for other groups. Beginning at least with Victor Fuchs's comparison of Nevada and Utah, two states with similar health-care expenditures but very different mortality rates (Fuchs 1998b), economists and health-services researchers have long recognized the distinction between inequality in health care as measured by expenditures and inequality in health as measured by survival.

We suggest a different approach to measuring inequality, one that relies on effective care, or measures of health-care quality. The efficacy of these treatments is well proven and benefits most patients (aside from those with contraindications for the treatment), regardless of health status or preferences. An examination of the past decade suggests that there has been little or no relative improvement in the utilization of effective-care measures among lower-income deciles. Thus the discordance between rapidly rising health expenditures of low-income households and rapidly rising longevity of high-income households is not quite so puzzling. Overall expenditures may have risen disproportionately among low-income Medicare recipients, but the use of effective care with a proven impact on health outcomes has not.

It should be cautioned that the magnitudes of the differences in effective care observed in the data would not be expected to have a large impact on overall mortality rates. The predicted impact on heart-attack patients of an increase of seven percentage points in the range of use of beta-blockers (the difference between the rates of use in the highest- and lowest-income deciles) is a decline in mortality of .21 percentage point, or an overall impact on the general population of about .01 percent, since just 5 percent of the Medicare population experience a heart attack in any year.[23] The fact that these measures of effective care account for a small fraction of overall expenditures and a small fraction of the overall variation in health outcomes motivates interest in other measures of quality, for example, the overuse of marginally effective procedures (Fisher et al. 2003).

There are three important limitations of this study. The first is that in using outcome data, we have focused only on survival and not on quality-adjusted or "healthy life years." To capture a fuller measure of health, it would be necessary to include income-based differentials in treatments with proven effectiveness for improving functioning, not just survival per se. Examples include hip or knee replacements for the treatment of osteoarthritis or the use of angioplasty for patients with ischemic heart disease. However, measuring true income-based differences in health status is more difficult, since it would be necessary to adjust for differential health needs such as rates of osteoarthritis of the hip by income group and for preferences—however defined—regarding surgical intervention.[24]

Second, the study is limited to the population over sixty-five. Focusing just on income-based differences in mammography rates

within the Medicare program ignores the fact that Medicare itself contributes to a substantial increase in mammography rates at age sixty-five among those who were previously uncovered by insurance or are in lower educational groups (Decker, forthcoming; Card, Dobkin, and Maestas 2004). Focusing just on inequality within a specific age group ignores changes in inequality across age groups, for example differences between those under age sixty-five, who increasingly lack health insurance, and those over age sixty-five, who are generally covered (Danziger, Haveman, and Smolensky 1977).

Finally, we have not considered the financing side of the Medicare program. During the 1990s payments rose and also became more progressive as general income taxes became a larger source of revenue (McClellan and Skinner, forthcoming). The new prescription drug benefits passed into law in 2003 should also contribute to an increasing degree of redistribution to the extent that future growth in benefits is financed out of general tax revenue. It seems unlikely that this increased future progressivity in the Medicare program should justify the more rapid increases in the longevity of higher-income households, however.

A singular advantage of focusing on equality in effective care (or quality of care) is that there are reasonable approaches to fixing the problem of inequality in health outcomes. Monitoring claims data in real time with the objective of raising rates to ideal levels of near 100 percent among appropriate candidates is one sure way to at least reduce income-based inequality. Of course, inequality in outcomes due to other factors would continue to persist for many years, but at least such differences would not be exacerbated by inequality in health care. Indeed, one could imagine "nondiscrimination" rules like those developed for 401(k) pension plans, whereby hospitals or health-care systems would experience a partial loss in Medicare funding if effective-care measures for their low-income patients fell too far below those for their high-income patients.

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Notes

1. See David Cutler et al. (1998); Cutler and Mark McClellan (2001); Cutler (2004); Jonathan Skinner, Douglas Staiger, and Elliott Fisher (2005).
2. For the older literature, see LeGrand (1978, 1982); LeGrand (1991); Wagstaff, van Doorslaer, and Paci (1991); Karen Davis and Roger Reynolds (1975); Link, Long, and Settle (1982). More recently, see McClellan and Skinner (forthcoming), although see Kanika Kapur et al. (2004); and Jay Battacharya and Darius Lakdawalla (2004). Alex Y. Chen and José Escarce (2004) find a pronounced negative association between income and expenditures, but reverse the association after controlling for a host of covariates measuring well-being and disease burden. Other studies find quite nuanced patterns, for example, Alan M. Gittelsohn, Jane Halpern, and Ricardo L. Sanchez (1991) and Stephen Morris, Matthew Sutton, and Hugh Gravelle (2003).
3. See Decker (forthcoming); J. Michael McWilliams et al. (2003); Card, Dobkin, and Maestas (2004).
4. This terminology follows that in Wennberg, Skinner, and Fisher (2002).
5. In some cases, preferences can still play a role in screening programs, see Walter et al. (2004). The question is then raised as to whether those preferences against effective care reflect past adverse encounters with the health care system.
6. Reperfusion therapy (twelve-hour surgical angioplasty, or "clot busting" thrombolytics) is effective at removing the blockage or clots restricting blood flow to the heart. Aspirin is effective at breaking down platelets that interfere with blood flow, while ACE-inhibitors (angiotensin-converting enzyme-inhibiting drugs) attenuate the body's natural tendency to constrict vascular walls. Finally, beta-blockers reduce the demands of the body on the heart.
7. See also Katherine Baicker and Amitabh Chandra (2004), who have shown this lack of association between Medicare expenditures and effective care measures at the regional level.
8. See Gabriella Berloffa, Agar Brugiavini, and Dino Rizzi (2003); Anne Case and Angus Deaton (2003); Contoyannis and Jones (2004); Jon Ivar Elstad and Steiner Krokstad (2003); E. E. Gakidou, C. J. L. Murray, and J. Frenk (2000); Sherry Glied and Adriana Lleras-Muney (2003); D. P. Goldman and J. P. Smith (2002); Marian E. Gornick et al. (1996); Samuel Preston and Paul Taubman (1994); Eddy van Doorslaer et al. (1997); Wagstaff and van Doorslaer (2004).

9. The measure of inequality is then calculated much like the Gini coefficient; for a general discussion of health inequality decompositions, see Contoyannis and Martin Forster (1999).
10. In practice, Louise C. Walter et al. (2004) have pointed out that preferences could play a legitimate role for some patients who may not want to be screened. These arguments are harder to make in the case of heart attack treatments; it seems unlikely that anyone should prefer not to take aspirin following a heart attack. Alternatively, one may view the benefits as being sufficiently high to justify paternalistic efforts on the part of the government to encourage such practices.
11. Thus the age-sex frequencies are averages from 1987 to 2001. Just the eighty-plus population is considered in quantifying home health care, and for this group there are four age-sex categories: males eighty to eighty-four, males eighty-five or older, females eighty to eighty-four, and females eighty-five or older.
12. Until 1997, managed-care organizations were reimbursed for their Medicare enrollees by a capitated fee based on 95 percent of the lagged value of regional fee-for-service expenditures, so that fee-for-service expenditures within a region would have been a reasonable measure of the managed-care capitation fee. Although the Balanced Budget Act of 1997 severed that close link, it is not expected that the relatively small fraction of Medicare managed-care enrollees would bias these results.
13. See http://www.census.gov/hhes/income/histinc/f11.html.
14. See Frank Hobbs and Bonnie Damon (1996, 6.6). To estimate the average household size, we excluded people sixty-five and older living with other relatives or with unrelated people, and assumed the spouse was also age sixty-five or older.
15. One shortcoming with these changes in Medicare expenditures is that we do not have similar data on Medicaid expenditures. In theory, a decline in Medicaid expenditures among the low-income groups could have been offset by this sharp increase in Medicare expenditures with no net impact on transfers to lower-income neighborhoods. However, Medicaid expenditure data by state and by year for home-health-care expenditures provides little support for this explanation. In 1991, Medicaid programs in New York were spending more on recipients than in Texas ($623 versus $74); by 1997 the spending levels had not changed appreciably ($647 in New York, $146 in Texas). See http://www.cms.hhs.gov/statistics/nhe/state-estimates-resident/medicaid-per-capita50.asp.
16. See Julie Lee, McClellan, and Skinner (1999).
17. This is the basic insight of tax incidence studies: the tax burden does not necessarily fall on the people who pay the tax. Similarly, government benefits do not necessarily flow to the people whose names are on the checks.

18. Another cause for the rapid increase in health-care expenditures during the 1990s was upcoding whereby hospitals switched patients from low-reimbursement to high-reimbursement diagnostic related groups, or DRGs (Silverman and Skinner 2004) and effectively increased the price charged per DRG. Upcoding, which is distinguishable from "bracket creep" by the absence of supporting evidence for the more expensive coding, was curtailed sharply also around 1997 following well-publicized investigations of a large for-profit hospital chain.
19. Recent work has focused on placing a dollar value to increased survival; see Gary S. Becker, Thomas J. Philipson, and Rodrigo R. Soares (2003) or Gabriella Berloffa, Agar Brugiavini, and Dino Rizzi (2003). A different approach to quantifying the changes over time in survival is the concentration index, a variant of a Gini coefficient (Contoyannis and Forster 1999). However, changes in the index were very small, since we were just considering inequality in the over-sixty-five population and not over the entire life-course.
20. The CPT codes are 76090 (unilateral mammography), 76091 (bilateral mammography) and 76092 (screening mammography).
21. See David E. Wennberg and John D. Birkmeyer (1999, chapter 3) for a discussion of this measure.
22. In this case, because the sample sizes were so much larger, we were able to use the 306 hospital referral regions (Wennberg and Cooper 1999) as regional controls instead of states as in the analysis of beta blockers.
23. According to Heidenreich and McClellan (2001), the (thirty-day) marginal impact of beta-blockers on mortality is estimated to be .88 in terms of odds-ratios. Converting this to one-year probabilities suggests that the use of beta-blockers is associated with a reduction in mortality of three percentage points. Between the lowest and highest income group, there is a seven-percentage-point difference in the use of beta-blockers. The implied impact is therefore seven times three, or .21 percent.
24. Chen and Escarce (2004), for example, attempt to control for income-based differences in health status along a wide variety of dimensions.

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Part III

Government Policies and Outcomes