Whom Does Medicare Benefit

Jay Bhattacharya, Stanford University
Darius Lakdawalla, RAND
Michael Schoenbaum, RAND

Preliminary and Incomplete
Please Do Not Cite.

April 18, 2002

A. Introduction

Medicare is one of the most significant public entitlement programs in the United States, and certainly the most important program in health. In 1998, Medicare benefit payments alone accounted for 13% of the Federal budget and 2.5% of GDP (US Department of Health and Human Services, 1999). The sheer size of Medicare makes it important for us to understand and quantify its value. In particular, we need to know whether Medicare actually benefits anyone, and if so whom.

The "pay-as-you-go" financing structure of Medicare results in significant intergenerational transfers. Smaller generations on net pay for larger generations. Continual improvements in the quality of medical care imply a second kind of intergenerational transfer. Every generation pays for the level of medical technology available when it is young, but receives the benefits of the technology available when it is old. Given the rapid pace of technological change in health care, it is likely that younger generations on net pay for older generations, at least in the recent history of the Medicare program. Figure 1 makes this point by plotting actual growth in real per capita benefits, along with the growth that would have occurred if benefits had grown by 3% annually or 4% annually. From 1967 to 1997, per capita benefits grew at an annualized rate around 4%, but if it were not for a substantial deceleration during the mid-80s, this rate would have been much higher. Even a four percent growth rate, however, exceeds the 3% real rate of interest. As long as the economy can sustain rapid Medicare benefit growth and the growth in taxation that it implies, this virtually guarantees that every cohort—from a lifetime perspective—will end up benefiting from Medicare, because it pays in much less than it gets out. In effect, its rapidly growing benefit structure turns Medicare into an intergenerational Ponzi scheme, at least until Medicare tax growth outstrips the ability of the economy to absorb it.

However, whether Medicare has actually benefited particular groups in a cohort depends also on how it redistributes money *within* generations. Medicare may have improved the lot of the average person in today's elderly cohorts, but not necessarily the average poor person or the average rich person. The direction of intra-cohort transfers is not straightforward to predict. On the one hand, Medicare provides the same level of insurance to all elderly people, even though richer people pay more Medicare taxes. This would seem to distribute money from the advantaged to the disadvantaged. On the other hand, however, disadvantaged groups tend to die at younger ages and have fewer years to collect Medicare benefits. Similarly, disadvantaged people tend to use fewer medical services, even when fully insured. Economic theory alone cannot tell us how Medicare redistributes resources within generations. An empirical investigation is needed.

To address this need, this paper attempts to construct the rate of return on Medicare for various groups in the population. We will focus in particular on how rates of return vary with permanent income and education. This allows us to determine whether Medicare benefits the average person, the average disadvantaged person, or the average advantaged person. Implicitly, we will view Medicare taxes as investments in future health benefits. Whether or not Medicare is beneficial depends on the internal rate of return on these investments. We find that the internal rate of return is significantly higher for the less educated. Indeed, the

internal rate of return is less than the real rate of interest for the most educated groups, but well above it for the least educated. As a result, less educated individuals would willingly choose to invest in Medicare, while more educated individuals would not. This is true in spite of the fact that less educated people do not live as long.

B. A Framework for Estimating Medicare's Rate of Return

The goal of this paper is to determine whether or not Medicare benefits different education groups in the population. Before we are able to do that, however, we must grapple with two conceptual issues. First, the benefits of Medicare have to be determined relative to some other insurance arrangement, about which we need to be explicit. Second, a cost-benefit analysis of Medicare raises important questions about family structure that need to be resolved.

Conceptually, we would like to compare Medicare to the market for old-age medical insurance that today's elderly medical cohorts would be facing, in the absence of Medicare. Unfortunately, it is impossible to know what such a market would look like. In lieu of this ideal comparison, there are at least three feasible options. First, we could assume that there would be no privately provided medical insurance for the elderly in the absence of Medicare. This comparison seems inadequate, because a market for insurance existed before Medicare (McClellan and Skinner, 1997), and it is hard to imagine that it would not have evolved to a higher state in the absence of Medicare. This leaves us with two choices. We could compare Medicare to the spot market for insurance to which the elderly had access in 1966. Alternatively, we could evaluate the benefits of Medicare relative to a competitive market for lifetime insurance coverage. The latter strategy compares Medicare to an insurance market that is as highly evolved as possible.

Realistically, the market for old-age medical insurance would fall in between these two extreme alternatives. We choose to compare Medicare to a well functioning market for two reasons. First, this approach is conservative, in that it understates the benefits of Medicare, particularly for the poor. McClellan and Skinner (1997) find that the imperfections of the 1966 market fell most heavily on the poor. Our comparison is thus a rather strict test for Medicare to pass. Second, this comparison eliminates a vexing source of error. It is uncertain exactly how the insurance market looked before Medicare. On the other hand, we can be certain about what a perfectly functioning market would look like.

Some simple arithmetic with a standard overlapping generations model reveals why we can afford to be conservative. Suppose cohorts live for two periods: during the first period, they work and pay Medicare taxes, and during the second they receive Medicare benefits. Define τ_t and B_t as time t Medicare taxes paid and time t Medicare benefits received, respectively, and define n_t as the size of the cohort that is working at time t. Assuming that Medicare is a strictly pay-as-you-go system, we would have the balanced budget constraint:

$$n_t \tau_t = B_t n_{t-1} \tag{1}$$

The rate of return earned on Medicare by the time $t-1$ cohort is:

$$1+r_{t-1}=\frac{B_t}{\tau_{t-1}}=(1+\beta_{t-1})(1+\pi_{t-1}), \tag{2}$$

where β_{t-1} represents the rate of growth in benefits from time $t-1$ to time t, and π_{t-1} represents the rate of growth in population over the same period. Taking logarithms yields the approximation:

$$r_{t-1}\approx\beta_{t-1}+\pi_{t-1} \tag{3}$$

Individuals will earn an excess return on Medicare if growth in per capita benefits plus population growth exceeds the real rate of interest. From 1966 to 2000, the rate of growth in the 18-65 year-old population was approximately 1.4% annually,[1] while the rate of growth in real per capita Medicare benefits was about 4 percent annually. This roughly corresponds to a 5.4 percent annual return on Medicare, which far exceeds any reasonable estimate of the real rate of return, usually thought to be around three percent.

Given a perfectly functioning market for lifetime medical insurance, each person would be charged an actuarially fair price for insurance. A risk-neutral firm would be willing to sell an insurance policy for which the expected value of lifetime premia equaled the expected value of benefits paid. Cast in the language of capital investment, the internal rate of return on the insurance policy should be equal to the real risk-free rate of interest, for every group in the population.

Computing the internal rate of return on Medicare is conceptually straightforward. For a given group in the population, we add up the expected net present value of Medicare claims lodged, subtract the expected net present value of Medicare taxes paid, and calculate the real rate of interest that would equate these two quantities. Define τ_{it} as the average Medicare tax paid by group i at age $t\geq 18$, define B_{it} as the average Medicare benefit received by group i at age $t\geq 65$,[2] and define S_{it} as the probability that an 18 year-old in group i survives to age t.[3] The internal rate of return is the scalar r that solves the following equation:

$$\sum_{t\geq 18} S_{it}\frac{(B_{it}-\tau_{it})}{(1+r)^{t-18}}=0 \tag{4}$$

This equation has a unique and positive solution, since $B_{it}=0$ for all t less than 65. Calculating the internal rate of return on Medicare requires us to estimate three

---

[1] According to Census Bureau figures, there were about 164 million 18-64 year-olds in 1997, and 114 million in 1970. This implies an annual rate of growth of 1.4%.

[2] We do not consider the relatively small number of people who become eligible for Medicare disability insurance at ages younger than 65.

[3] We calculate the rate of return at a group level rather than an individual level, because there is no single data set that contains a lifetime benefit and tax history for a set of individuals.

time-series: a series of survival probabilities, S_{it}; a series for the real Medicare benefits received by group i at age t, B_{it}; and a series for the real Medicare taxes paid by group i at age t. Using these data series, our goal will be to estimate the internal rate of return on Medicare for the cohort born between 1931 and 1941. The different groups i represent different education and sex groupings. We will compute the internal rate of return by sex for four different education groups: high school dropouts, high school graduates, college attendees, and college graduates.

We have addressed the question of a comparison insurance market, but we now need to specify our assumptions for family structure. To understand the importance of family structure, consider the case of a non-working spouse who never pays Medicare payroll taxes. In spite of this, he or she will be eligible for Medicare benefits, but it would be misleading to state that these benefits come for free. Implicitly, a non-working spouse shares tax payments within the household. To distribute these tax payments, as well as Medicare benefits, we assume that families are formed at the time of marriage, and are dissolved if and only if one spouse dies. For example, a husband who dies does not gain any utility from Medicare benefits his widow receives after death, nor does he suffer any costs from taxes she pays. Similarly, any taxes paid or benefits received before marriage reside only with the individual. In addition, divorce or separation does not "dissolve" the family in our framework. We assume that ex-spouses continue to share costs and benefits after divorce, whether it is through explicit transfers like alimony, or implicit transfers from a division of wealth at the time of divorce. From our perspective, the major difference between a divorced couple and a married couple is that the divorced couple has a formalized sharing rule that is harder to change, *not* that the divorced couple does not share resources.

B.1 Estimating Survival Probabilities

Our first task is to estimate the probability that an 18 year-old in group i survives to age $t > 18$. Standard life tables tend not to report survival probabilities by education group. Therefore, we start with standard Social Security Administration life-tables and adjust them to reflect mortality differences across education groups. In particular, using microdata from the National Mortality Followback Surveys of 1986 and 1993, we calculate the ratio of the group-specific death rate to the total death rate. Applying this ratio to the overall life-table then allows us to compute group-specific survival probabilities.

Since we are calculating the rate of return for a specific birth cohort, the natural thing to do would be to construct a cohort life table. Unfortunately, we know of no source for cohort-specific death rates by education group. As a result, we will construct a 1990 period life table for each sex and education group. The 1990 US Vital Statistics period life table gives us a series $\overline{S_t}$, the average probability of survival to age t. Using data from the 1993 National Mortality Followback Survey (NMFS), we then estimate $\frac{S_{it}}{\overline{S_t}}$ for several age groups. The NMFS contains individual-level data on a sample of decedents from 1992. It is designed to be nationally representative, while oversampling young decedents. Based on

interviews with next-of-kin, the NMFS collects demographic information about each decedent, including age, sex, race, education, smoking status, and cause of death. Using the weights provided in the NMFS, we are able to estimate the total number of deaths nationwide within each age group, and within each age-education category. To translate the total number of deaths into death rates, we use the National Health Interview Survey to estimate the 1992 population nationwide in each age-education category. Since mortality rates and gradients tend to differ significantly across race and Hispanic status, and since samples would be too small to conduct analyses for minority populations, we restrict our analysis here and elsewhere to the non-Hispanic white population. The results of these calculations are shown in Table 1. With only a few exceptions, death rates decline uniformly with education group, within an age category. Among very old women, we observe a slight increase in mortality rates between high school dropouts and high school graduates. Among 45-54 year-old women and 55-64 year-old men, we observe mortality rates that are higher for college attendees than high school graduates. Apart from these isolated cases, mortality rates fall with education.

To see the impact of these mortality differentials on the expected value of Medicare benefits, it is helpful to examine survival curves for different education groups. As discussed above, we construct these by applying our estimated mortality ratios to US Vital Statistics 1990 period life tables for white males and white females.[4] These survival curves are graphed in Figures 2 and 3. For both men and women, 18 year-old high school dropouts are less likely to reach age 65 than college graduates (or those who will end up as college graduates). However, the difference is twice as large for men than for women. High School dropout males are twenty percentage points less likely to survive to age 65, while females are only about ten percentage points less likely. This is one of the reasons why, from an individual perspective, Medicare is a much better deal for low-skill women than for low-skill men.

B.2 Estimating Lifetime Medicare Taxes Paid

We now need to estimate τ_{it}, Medicare taxes paid by group i at time t, using data on actual Medicare tax rates, and earnings data from the Health and Retirement Survey (HRS). Since we are evaluating the Part A hospital insurance component of Medicare, we restrict ourselves to Medicare payroll taxes, which are the sole source of funds for Part A coverage. These tax rates, along with the Medicare earnings cap, are shown in Table 2. The table demonstrates a few important features of the Medicare taxation system. First, for much of its history, Medicare taxes were not collected on all earnings, but only on earnings up to a maximum amount. This changed in 1994, when Congress removed the cap on taxable earnings. Prior to this year, the real value of the Medicare cap roughly doubled, from 1966 to 1993. Second, self-employment earnings and wage earnings have not always been taxed at the same rate. The worker and firm each pays half the tax on wage earnings. However, through 1983, self-employed people paid at the tax rate faced by the worker alone, which amounts to half the total Medicare tax paid. Prior to this year,

---

[4] Unlike all the other data we will use, the Vital Statistics period life tables are not available for non-Hispanic whites alone.

therefore, self-employed individuals faced a lower total tax rate than workers. During the years with a Medicare earnings cap, if a worker had earnings both from wage work and self-employment, her wage taxes were calculated first, and then her self-employment tax. For example, suppose a worker in 1967 had $6000 in wage income, and $4000 in self-employment income. Taxes would have been collected on all her wage income, but only the first $600 of her self-employment income. Her total tax would have been: (1.0%)*$6000+(0.5%)*$600=$63.

Based on these tax rates, we can estimate taxes paid using earnings data from the HRS. The HRS is a longitudinal study of individuals born between 1931 and 1941, who have survived until 1992. The first wave of the HRS was conducted in 1991. The fifth wave collected data for 1999. It can be linked to quarterly Social Security Administration earnings records that go back to 1951. This linked file contains earnings records for 9537 HRS respondents present in Wave 1. Between the linked file and the HRS main files, we have quarterly earnings histories from 1951 through 1999. The linked Social Security file contains data on Social Security covered earnings, or the amount of earnings subjected to Social Security payroll taxes. However, from 1966 to 1992, the Medicare earnings maximum was the same as the Social Security earnings maximum. There are two problems to be surmounted in the use of these data. The first involves the treatment of spouses, while the second involves the calculation of self-employment income.

The HRS data simplifies the task of computing annual taxes paid by couples, since a reasonable number of married couples in the HRS cohort are both present in the HRS data and the linked Social Security earnings data. For these people, we have complete data on the couple's income. The remaining respondents include the never married, widow(er)s, divorce(e)s, and married people whose spouse is simply not present in the linked earnings file. For these people, we must impute spousal earnings.

Table 3 provides a useful description of the data. There are 13,478 respondents in Wave 1 of the HRS. 3941 of these are not present in the linked Earnings History file. We drop these observations. If selection into the Earnings History file is random, this introduces no bias.[5] Another 6668 people (or 3334 couples) are present with their spouses or partners in the Earnings History file. For each of these people, we are able to calculate earnings for the couple. Of the remaining 2869 people, 264 were never married; as such, individual income is equal to family income, and we drop the 68 respondents for whom marital status is unknown. This leaves 2537 people for whom family income must be imputed.

Consider first the 1051 married or partnered respondents in this group. We impute spousal earnings by looking at similar respondents and calculating the earnings of their spouses. Specifically, we compute the real average spousal earnings profile of all similarly aged and educated HRS respondents (of the same sex). The average earnings profile is then assigned to each respondent whose spouse is not present in the data. As discussed above, the 1029 divorced or separated respondents are treated as if they were married; average spousal earnings are imputed for them

---

[5] Haider and Solon (2000) show that, conditional on having a Social Security Number, selection into the SSA file is indeed random.

according to the same procedure. Even if the individual has been divorced more than once, our strategy will not be affected, as long as his spouses have been similarly educated.

This leaves only the 457 widowed respondents. The difficulty with these respondents is estimating the year of their spouse's death, which is not reported in the data. The best we can do is to make use of the HRS variable for "length of longest marriage." For those who are currently married in wave one of the HRS, we compute the year they would have been married, assuming that their current marriage is their longest marriage. This yields the most recent year in which they could have been first married. We then compute the average year within the four education groups we are considering, racial category (white, black, or other), and age in 1991. This yields our estimate of year of marriage for widow(er)s. Using the variable for length of longest marriage, we then compute the year in which each widow's spouse would have died. This date is used to truncate the average real spousal earnings profile estimated above, and this finally yields the earnings that the deceased spouse would have contributed to the partnership. As a result of the data limitations we face, this is a highly imperfect strategy, but it is important to stress that it affects less than 5% of our sample. Even if we were to mismeasure income by 50% for these respondents, it would have less than a 3% impact on our estimates of average income.

The HRS earnings history data do not distinguish between self-employment income and wage earnings, even though Medicare taxed these two types of income at different rates from 1966 to 1983. To decompose the HRS income measures into self-employment income and wage income, we use data from the 1966-83 Current Population Surveys (CPS). The CPS asks respondents about wage income, self-employment income, age, sex, educational attainment, and race. From the CPS, we estimate—for every survey year, 5-year age group, education group, sex, and race—the average proportion of total income subject to Medicare tax that was derived from self-employment. We restrict these calculations to CPS respondents that reported some income during the year. These proportions are then used to impute self-employment income and wage income for the 1966-83 period. In practice, these imputations had very little effect on our estimated rates of return from Medicare. Even ignoring this issue—and treating all 1966-83 income as wage income—yields virtually the same rates of return. Nonetheless, for the sake of consistency, we estimate self-employment income. Table 4 displays these estimated proportions for the age ranges occupied by the HRS cohort in 1966 and 1982. Self-employment income is relatively insignificant for women throughout these age ranges. It is, however, somewhat important for men between the ages of 35 and 55, and particularly for the least and most educated men. The men in the middle of the education distribution seem more likely to be involved in wage labor.

All these calculations result in an age-profile of real Medicare income (i.e., income subject to Medicare taxes) for families. The family profiles, by the male's education group, are shown in Figure 4. What is most striking about the figure is the extent to which the removal of the Medicare earnings cap affected the redistributive consequences of Medicare. In 1991, the cap was raised by a factor of 2. At this time, the HRS cohort was between ages 50 and 60. From these ages onward, the inequality in Medicare covered earnings shoots up dramatically. Indeed, prior to

this change, there was relatively little difference in Medicare taxes paid. At age 45, for example, college graduates had only about $7800 (in 1997 dollars) more in Medicare income than high school dropouts. At late 1980s tax rates, this amounted to a mere $225 in extra Medicare taxes annually. However, these increases in the cap happened relatively late in the cohort's life-cycle and ended up having little impact on relative rates of return.[6]

Using these estimated income profiles, we can calculate age-profiles of Medicare taxes paid. Throughout the entire life-cycle, high school dropouts pay considerably less tax than other educational groups, although differences among the top three education groups do not appear until after age 41. The implications of this figure can be seen most clearly in Table 5, which shows the real net present value of Medicare taxes paid on a family basis, by education group and sex. This calculation accounts for differential mortality across education groups, and incorporates a discount factor given in the left-hand column. Notice first that the net present value of taxes paid is lower for women than for men, because of the time the average adult woman spends unmarried, and thus paying taxes at a lower rate than the average adult man. At a three percent real interest rate, the average college-educated man can expect to pay about 88% more taxes than the average high school dropout man. The differential among women is similar, at about 94%. As we will see, these differentials far outweigh the more limited differences in the utilization of Medicare, even when we adjust for the probability of survival.

B.3 Estimating Lifetime Medicare Benefits

The data for this exercise come from the Medicare Current Beneficiary Survey (MCBS) Cost and Use Files, produced by the Health Care Financing Administration (HCFA). The MCBS, available from 1992 to 1998, is a rotating panel data set, every year of which is a weighted sample of the Medicare population. Since all individuals over age 65 are on Medicare, it can also be used as a nationally representative sample of individuals over 65. The MCBS samples all individuals, both institutionalized and non-institutionalized. The oldest-old (over 85 years of age) are oversampled. The MCBS collects age, sex, marital status, race, education, and many other covariates.

Most significantly, HCFA creates variables from administrative records that allow us to measure the total expenditures paid out by Medicare on behalf of the respondent in the survey year. The vast majority of Medicare beneficiaries are enrolled in a "fee-for-service" arrangement, under which Medicare reimburses health care providers directly for expenses incurred. The MCBS contains data on these fee-for-service payments, broken down by type of service. This allows us to construct Medicare Part A expenditures for these fee-for-service patients. Included in this measure are all expenses incurred as a result of: inpatient or long-term care treatment, hospice treatment, and home health care treatment, most of which is

---

[6] Even if the cap had not been lifted and had instead grown at the rate of inflation, this would have raised the internal rate of return on Medicare for college graduates in the HRS cohort by just three-tenths of a percentage point, according to our calculations.

covered by Part A. About ten to fifteen percent of beneficiaries, however, are enrolled in Medicare HMOs. These are private HMOs that contract with Medicare to provide medical care in exchange for a flat, per capita fee. The MCBS reports the amount of money that Medicare paid to an HMO on behalf of each respondent, but this payment includes both Part A and Part B services. To decompose the per capita fee, we assume that HMO patients within an age, sex, and education category spend the same proportion of resources on Part A services as fee-for-service patients in the same category. Roughly two-thirds of Medicare expenditures go to Part A services. Using this procedure, we can calculate for every MCBS respondent annual Part A expenditures.

We treat the MCBS as a set of seven repeated cross-sections of the Medicare population and express all the expenditure variables in terms of 1997 dollars. We deflate expenditures using the medical care CPI. The measurement of medical care prices is a difficult issue. In all likelihood, the medical care CPI overstates price inflation in medical care, for two basic reasons. First, it is difficult to measure improvements in quality, and as a result some of these get measured incorrectly as "price inflation." Second, consumers will tend to substitute away from goods with higher relative prices more quickly than the measuring agency can pick this up. Our deflated medical care benefits will likely understate real benefits. This represents another respect in which we are being conservative in estimating the returns to Medicare. Of course, in practice, the choice of inflation factor for a 7-year period will not have very big effects. We found that doubling or halving the annual rate of inflation had very little impact on our estimated rates of return.

Table 6 displays average annual real Medicare benefits by age group, sex, and education category. These are expressed for individuals, rather than families. In general, benefits fall with education, because it is correlated with better health status and fewer health problems. However, much of this period-by-period gradient exists because poorly educated groups are sicker and die earlier. From a lifetime perspective, therefore, this gradient is virtually offset. This becomes clearer once we account for mortality and calculate the expected net present value of individual benefits from the perspective of an 18 year-old. Table 7 displays these expected net present values. At a three percent real rate of interest, a college graduate male can expect 5% more in Medicare benefits than a high school dropout, even though on a period-by-period basis he can expect less. College graduate females receive 5% less benefits than high school dropouts—a much smaller difference than exists in the period-by-period calculation—and in fact college attendee females receive more in net present value terms than high school dropouts. While the differences narrow from a lifetime perspective, it is nonetheless clear that these differences in benefits pale in comparison to the differences in taxes paid. These numbers alone reveal that Medicare is in fact progressive.

While these calculations reveal striking differences between the benefit gradient and the tax gradient in education, they must be adjusted in two ways before we can compare them directly to our tax calculations. First, the benefit calculations are based on a cross-section of people, while our tax data are based on a cohort's tax history. Since it is reasonable to assume that real Medicare benefits will grow over the life of the cohort, this is an important difference. Second, the benefit data are

calculated for individuals. They must be adjusted in accordance with the family structure we assumed in our computation of tax liabilities.

For the sake of comparison, we recalculate the expected net present value of Medicare benefits assuming different annual real rates of benefit growth. For example, if we assume that benefits grow at X%, we recalculate the annual benefit figures in Table 6 as $Benefits_{it} * (1+\frac{X}{100})^{t-65}$. In other words, the benefits for 70 year-olds are assumed to have been growing for 5 years, and so on. The logic behind this framework is that the HRS cohort is entering Medicare eligibility during the MCBS period. Therefore, it is roughly accurate to regard the MCBS as recording average benefits that will be received at the time of entry, and to inflate benefits accordingly. We will explore the impact of real benefit growth that ranges from zero to five percent annually. Table 8 illustrates the net present value of Medicare benefits that result if we apply our maximum five percent annual real rate of growth to the MCBS data. Under this scenario, college graduates benefit disproportionately, because college graduates are more likely to survive to enjoy the fruits of the high growth rate. Even so, college graduates end up with just about a ten to twenty percent premium relative to high school dropouts, at a three percent real rate of interest. This remains far below the difference in taxes paid.

Finally, we need to convert the individual-level Medicare benefits to family-based benefits consistent with our measures of taxes. Once again, we assume that families are formed at marriage and dissolved only at the death of one spouse. To compute the average family Medicare benefit for, say, X year-old college-educated males, we use the proportion of this population that has a living spouse or ex-spouse, along with the distribution of spousal education for 65 year-old college-educated males in the HRS. The average Medicare family benefit is then equal to the individual's benefit plus the average spousal benefit. The latter term is taken to be the probability of having a living spouse within the age-sex-education cell, multiplied by the weighted average of Medicare benefits for X year-old females, where the weights are given by the distribution of spousal education observed for 65 year-old college-educated males in the HRS. A comparison of Tables 9 and 6 reveal the effects of calculating benefits on a family basis. At the younger ages, average spousal benefits represent about two-thirds of the individual benefits, but at older ages, this falls to about one-half.

B.4 The Internal Rate of Return on Medicare

We now have in hand an age-tax profile and an age-benefits profile at the family level. Using these profiles, it is straightforward to solve for the internal rate of return by sex and education group, as a function of the real annual rate of growth in Medicare benefits. The results of these calculations are shown in Table 10. Assuming that the risk-free real rate of return is 3%, Medicare will benefit all education groups so long as benefits grow at a real rate of 2% annually. This seems, if anything a conservative assumption. As a result, it seems that Medicare is providing excess returns to the cohort born between 1931 and 1941. Moreover, the estimated rates of return are quite similar to the "back of the envelope" calculations presented earlier. Under the assumption of 4% benefit growth—the historical rate—the real rate of return to Medicare is estimated to have been 5.2% since its inception.

This is almost exactly what we estimate the overall rate of return to be at a 4% rate of benefit growth.

The high rates of return are not the result of the 1966 enactment of Medicare, which provided this cohort with ten years of earnings that were not subject to Medicare taxation. Even if we assume that Medicare was enacted in 1951, with the same tax rates and nominal earnings cap that prevailed in 1966, estimated internal rates of return change by less than a tenth of a percentage point. The bulk of this cohort's earnings was subject to Medicare taxation. Their excess rates of return are thus not a reflection of a "free lunch" effect.

It is also clear that Medicare transfers resources within generations from the rich to the poor. The extent of its progressivity depends on the real rate of benefit growth. Faster benefit growth benefits the educated disproportionately, as the table makes clear. However, even at high rates of growth, Medicare remains progressive. The fundamental reason for this was made clear earlier: while educated people derive slightly more benefit from Medicare, their incremental benefit is extremely small relative to the additional taxes they end up paying over their lifetimes.

Finally, according to our calculations, the removal of the earnings cap—even though it happened late in their earnings lifetimes—had a significant impact on this cohort. In particular, there is little reason to believe that Medicare will be any more progressive for future cohorts as a result of the repealed cap. For the HRS cohort, the cap was removed when it was near the peak of its age-earnings profile. We re-estimated the internal rate of return on Medicare assuming that there had never been a Medicare earnings cap. We found that the internal rate of return fell by about a tenth of a percentage point for college graduates, by 0.05 percentage points for college attendees, and was unchanged for the other groups. This is a very small increase in the progressivity of Medicare.

B.5 A Robustness Check

Due to limitations in the HRS data, we made two important assumptions. First, the family income for people with unobserved spouses can be proxied by the family income of people with observed spouses. Second, individual-level data on Medicare benefits can be translated into family-level benefits. By using data from the 1964-1998 Current Population Surveys (CPS), we are able to relax these assumptions. Since the CPS is a household survey a much lower proportion of the sample has an unobserved spouse. Moreover, the CPS allows us to calculate tax liabilities at the individual level, rather than the family level. This obviates the need to calculate family-level Medicare benefits. Unlike the HRS, the CPS contains data on marital status at every point in time. Since we know with certainty whether or not individuals are married, we can apportion total family taxes into a component borne by the husband and a component borne by the wife. In particular, we assume that husbands and wives share the tax burden equally. The one important drawback of the CPS—and the reason it was not used in the primary analysis—is that its data on

wages are self-reported and likely to be of lower quality than the administrative data in the HRS.[7]

From the 1964 through 1998 CPS data, we select every household in which at least one person belongs to the HRS cohort. Within each household, we match each individual to his/her spouse if present and calculate the total Medicare payroll taxes paid by the couple. The tax burden of each couple is then split in half and assigned to each partner. If the spouse is absent—either through divorce or separation—we impute spousal wage income within single-year age, sex, and education cells.[8] In the CPS, well under ten percent of the total observations on spousal income are imputed; the rate of imputation is about twenty percent in the HRS.

Table 11 displays the results of this procedure. It is not possible to compare these numbers directly with the family taxes paid in Table 2, but it is possible to make some rough comparisons. Approximately, average family income should be about twice as high as individual income. Even if the data were perfect, this would not hold exactly, because not everyone is married, and because spouses are not always identically educated. Nonetheless, this simple rule of thumb seems to work reasonably well.

The best way to judge the similarity of these data is to compare the estimated internal rates of return. Table 12 demonstrates that rates of return are about one quarter to one half a percentage point higher using the CPS. This seems to be because earnings profiles in the CPS are slightly lower than in the HRS administrative data. This could be the result of self-reporting bias, or of mistakes in the administrative data. Regardless, this difference does not affect the qualitative results of interest. We continue to find that Medicare benefits all education groups in the HRS cohort, but that it particularly benefits the least educated.

C. Conclusion

Today's elderly cohorts benefited enormously from Medicare. On average, they received a real rate of return that was about two full percentage points higher than the real rate of interest. This was due in large part to the rapid growth of per capita Medicare benefits since its inception. More surprisingly, however, was the result that the poor benefited disproportionately from Medicare. Even though they die at younger ages and have fewer years to enjoy Medicare benefits, the rate of return is much higher for the least educated groups in the population.

Our results differ from previous work in this area by McClellan and Skinner (1997). McClellan and Skinner calculated the value of Medicare across income deciles. A simple computation, that treats benefits as equally valuable across education

---

[7] This is not to imply that administrative data are perfect, but they are likely to be better than self-reported data, because individuals and the government have incentives to correct mistakes.

[8] For example, if there is a 40 year-old, white high school graduate male (married, divorced, or separated) with an unobserved spouse, we assign to him the spousal income observed for other 40 year-old, white high school graduate males.

groups, shows that the rich benefit disproportionately from Medicare. Accounting for the insurance value of Medicare—under the assumption that the insurance market for elderly health would have remained incomplete without Medicare—improves the situation for the poor, but only to the extent that Medicare is very weakly progressive, if at all. Our results are much stronger in favor of the conclusion that Medicare benefits the poor.

The key difference between McClellan and Skinner's analysis and ours is that they found Medicare benefits to be somewhat positively correlated with socioeconomic status, while we found the opposite. Their numbers were based on measures of Medicare claims at the zip code level; these were converted to measures of claims by income status by using the average income level within each zip code. Our calculations, on the other hand, used actual person-level Medicare benefits. It is possible that the area-based measures of Medicare benefits overstate the income-Medicare relationship. If richer areas have better medical facilities, people who expect to use more medical services will have incentives to move to such areas, regardless of their income. Similarly, people who have less need for these facilities will have incentives to move out. As a result, the positive relationship between Medicare claims and income could be an artifact of their geographic data. Further investigation, however, is needed to resolve this discrepancy.

References

Haider, Steven, and Gary Solon (2000). "Non-Response Bias in the HRS Social Security Files." Working Paper DRU-2254-NIA, RAND. Santa Monica, CA: RAND.

McClellan, Mark, and Jonathan Skinner (1997). "The Incidence of Medicare." Working Paper 6013, National Bureau of Economic Research. Cambridge, MA: NBER.

US Department of Health and Human Services (1999). *HCFA Statistics, 1999.* Washington, DC: Health Care Financing Administration.

Table 1: Yearly deaths per 1,000 people for the non-Hispanic White Population, 1985-92.

	Age Group	Less than High School	Graduate of High School	Attended College	Graduate of College	Overall
Males	18-24	1.78	1.73	0.75	0.43	1.29
	25-34	3.33	1.73	1.33	0.66	1.53
	35-44	4.22	2.96	2.42	1.20	2.40
	45-54	9.82	4.94	6.44	2.62	5.31
	55-64	18.40	13.60	12.48	7.31	13.20
	65-74	36.56	33.42	27.05	17.87	30.72
	75+	104.30	96.37	75.96	72.41	94.54
Females	18-24	0.60	0.50	0.33	0.19	0.42
	25-34	1.39	0.58	0.42	0.33	0.55
	35-44	1.43	1.40	0.84	0.96	1.17
	45-54	5.00	3.06	1.80	1.54	2.76
	55-64	11.32	7.52	8.26	5.35	8.21
	65-74	18.33	19.38	15.20	11.72	17.46
	75+	78.64	83.89	74.00	51.59	76.78

Note: Death rates are averages of 1985 and 1992 rates, estimated from the 1986 and 1993 National Mortality Followback Surveys, respectively.

Table 2: History of Medicare Taxation Since Inception.

Year	Medicare Tax Rates		Earnings Maximum	
	Wage Earner	Self-Employed	Nominal	Real ($1997)
1966	0.7%	0.4%	$6,600	$32,694
1967	1.0%	0.5%	$6,600	$31,716
1968	1.2%	0.6%	$7,800	$35,974
1969	1.2%	0.6%	$7,800	$34,112
1970	1.2%	0.6%	$7,800	$32,265
1971	1.2%	0.6%	$7,800	$30,911
1972	1.2%	0.6%	$9,000	$34,557
1973	2.0%	1.0%	$10,800	$39,040
1974	1.8%	0.9%	$13,200	$42,974
1975	1.8%	0.9%	$14,100	$42,064
1976	1.8%	0.9%	$15,300	$43,157
1977	1.8%	0.9%	$16,500	$43,701
1978	2.0%	1.0%	$17,700	$43,571
1979	2.1%	1.1%	$22,900	$50,626
1980	2.1%	1.1%	$25,900	$50,448
1981	2.6%	1.3%	$29,700	$52,441
1982	2.6%	1.3%	$32,400	$53,888
1983	2.6%	1.3%	$35,700	$57,529
1984	2.6%	2.6%	$37,800	$58,392
1985	2.7%	2.7%	$39,600	$59,069
1986	2.9%	2.9%	$42,000	$61,505
1987	2.9%	2.9%	$43,800	$61,883
1988	2.9%	2.9%	$45,000	$61,052
1989	2.9%	2.9%	$48,000	$62,129
1990	2.9%	2.9%	$51,300	$62,997
1991	2.9%	2.9%	$125,000	$147,302
1992	2.9%	2.9%	$130,000	$148,717
1993	2.9%	2.9%	$135,000	$149,948
1994	2.9%	2.9%	none	
1995	2.9%	2.9%	none	
1996	2.9%	2.9%	none	
1997	2.9%	2.9%	none	
1998	2.9%	2.9%	none	
1999	2.9%	2.9%	none	
2000	2.9%	2.9%	none	
2001	2.9%	2.9%	none	
2002	2.9%	2.9%	none	

Source: Social Security Administration web site.
Note: Half of the tax on wage earnings is paid by the worker, and half is paid by the firm.

Table 3: Availability of Data in the HRS Earnings History File.

Marital Status in 1991	Presence in Earnings History File: Respondent and Spouse Present	Respondent Only Present	Respondent Not Present	Total
Married, Spouse Present	6427	975	2435	9837
Married, Spouse Absent	12	22	23	57
Partnered	229	54	102	385
Separated	0	222	88	310
Divorced	0	807	270	1077
Widowed	0	457	163	620
Never Married	0	264	98	362
Unknown	0	68	762	830
Total	6668	2869	3941	13478

Table 4: Average Percentage of Medicare Income from Self-Employment among whites in the HRS Birth Cohort.

		Males				Females			
	Age Group	Less than HS	HS Graduate	Coll Attendee	Coll Grad	Less than HS	HS Graduate	Coll Attendee	Coll Grad
1966	25-29	3.4%	3.9%	4.6%	4.4%	2.2%	2.7%	3.2%	2.7%
	30-34	5.2%	4.9%	6.7%	8.6%	3.0%	3.9%	6.9%	2.5%
	35-39	8.5%	10.5%	12.5%	14.8%	5.5%	3.9%	5.6%	6.4%
1982	40-44	10.8%	9.0%	13.3%	11.6%	4.6%	5.8%	6.2%	6.4%
	45-49	13.0%	11.8%	10.2%	12.0%	6.6%	4.8%	6.3%	6.5%
	50-54	12.4%	9.8%	8.8%	10.0%	6.9%	5.9%	7.0%	4.8%

Table 5: Net Present Value of Real Medicare Taxes Paid on a Family Basis.

Real Interest Rate	Male				Female			
	Less than HS	HS Grad	Coll Attendee	Coll Grad	Less than HS	HS Grad	Coll Attendee	Coll Grad
0%	$21,452	$28,872	$33,375	$44,752	$16,552	$24,340	$29,863	$35,593
1%	$15,797	$21,087	$24,096	$31,823	$12,270	$17,963	$21,770	$25,498
2%	$11,761	$15,581	$17,607	$22,893	$9,194	$13,399	$16,051	$18,478
3%	$8,850	$11,644	$13,020	$16,661	$6,962	$10,101	$11,967	$13,546
4%	$6,730	$8,799	$9,741	$12,268	$5,325	$7,693	$9,021	$10,044
5%	$5,170	$6,722	$7,372	$9,138	$4,113	$5,917	$6,872	$7,531

Note: All figures are in real 1997 dollars.

Table 6: Real Annual Individual Medicare Part A Expenditures, by Age, Sex, and Education.

	Males				Females			
Age Group	HS Dropout	HS Grad	Coll Attendee	Coll Grad	HS Dropout	HS Grad	Coll Attendee	Coll Grad
65-69	$2,918	$1,719	$1,988	$1,457	$2,633	$1,645	$1,314	$901
70-74	$3,347	$2,944	$2,775	$2,651	$2,657	$2,345	$2,419	$1,363
75-79	$3,428	$3,471	$3,955	$3,208	$3,642	$2,944	$3,357	$2,644
80-84	$4,449	$4,689	$3,918	$3,811	$4,111	$4,246	$3,774	$2,796
85+	$5,149	$5,609	$5,802	$3,903	$5,202	$4,829	$3,881	$4,102

Note: All figures are stated in terms of constant 1997 dollars.

Table 7: Expected Real Net Present Value of Individual Medicare Part A Benefits (No Real Benefit Growth).

Real Interest Rate	Male				Female			
	Less than HS	HS Grad	Coll Attendee	Coll Grad	Less than HS	HS Grad	Coll Attendee	Coll Grad
0%	$44,102	$46,066	$49,967	$49,613	$40,246	$42,148	$43,057	$40,899
1%	$24,973	$25,587	$27,747	$27,374	$22,338	$23,115	$23,574	$22,053
2%	$14,293	$14,369	$15,583	$15,273	$12,545	$12,826	$13,055	$12,031
3%	$8,264	$8,155	$8,848	$8,613	$7,126	$7,198	$7,309	$6,640
4%	$4,825	$4,675	$5,076	$4,908	$4,093	$4,084	$4,136	$3,705
5%	$2,844	$2,707	$2,942	$2,825	$2,375	$2,342	$2,365	$2,091

Note: All figures are in real 1997 dollars, from the point of view of an 18 year-old.

Table 8: Expected Real Net Present Value of Individual Medicare Part A Benefits (5% Benefit Growth).

Real Interest Rate	Male				Female			
	Less than HS	HS Grad	Coll Attendee	Coll Grad	Less than HS	HS Grad	Coll Attendee	Coll Grad
0%	$78,443	$89,919	$98,248	$100,213	$79,816	$88,153	$90,394	$92,603
1%	$43,205	$48,621	$52,999	$53,801	$42,951	$46,968	$48,149	$48,583
2%	$24,076	$26,595	$28,935	$29,223	$23,400	$25,325	$25,949	$25,787
3%	$13,570	$14,712	$15,983	$16,055	$12,903	$13,816	$14,146	$13,846
4%	$7,732	$8,228	$8,930	$8,919	$7,199	$7,624	$7,799	$7,519
5%	$4,452	$4,650	$5,044	$5,008	$4,063	$4,255	$4,347	$4,129

Note: All figures are in real 1997 dollars, from the point of view of an 18 year-old.

Table 9: Real Annual Family Medicare Part A Expenditures, by Age, Sex, and Education.

	Males				Females			
Age Group	HS Dropout	HS Grad	Coll Attendee	Coll Grad	HS Dropout	HS Grad	Coll Attendee	Coll Grad
65-69	$4,746	$3,244	$3,372	$2,581	$4,159	$3,129	$2,731	$2,086
70-74	$5,395	$4,990	$4,786	$4,332	$4,336	$4,125	$4,238	$3,195
75-79	$5,859	$6,010	$6,607	$5,763	$5,007	$4,523	$5,260	$4,446
80-84	$7,281	$7,684	$6,795	$6,590	$5,182	$5,508	$5,009	$3,968
85+	$7,838	$8,345	$8,539	$6,786	$5,757	$5,634	$4,630	$4,851

Note: All figures are stated in terms of constant 1997 dollars.

Table 10: Internal Rate of Return on Medicare by Sex, Education Group, and Medicare Benefit Growth Rate.

Medicare Benefit Growth	Males					Females				
	HS Dropout	HS Grad	Coll Attendee	Coll Grad	Overall	HS Dropout	HS Grad	Coll Attendee	Coll Grad	Overall
0%	4.6%	3.6%	3.4%	2.4%	3.7%	4.6%	3.4%	2.9%	2.2%	3.6%
1%	4.9%	4.0%	3.8%	2.9%	4.1%	4.9%	3.8%	3.3%	2.7%	4.0%
2%	5.3%	4.4%	4.2%	3.3%	4.4%	5.5%	4.5%	4.1%	3.7%	4.4%
3%	5.6%	4.8%	4.6%	3.8%	4.8%	5.6%	4.5%	4.1%	3.6%	4.7%
4%	5.9%	5.1%	5.0%	4.3%	5.2%	5.9%	4.9%	4.5%	4.0%	5.1%
5%	6.3%	5.5%	5.4%	4.7%	5.6%	6.2%	5.2%	4.9%	4.5%	5.5%

Table 11: Net Present Value of Medicare Payroll Taxes for White Population, on an Individual Basis.

Real Interest Rate	Male				Female			
	Less than HS	HS Grad	Coll Attendee	Coll Grad	Less than HS	HS Grad	Coll Attendee	Coll Grad
0%	$9,890	$14,812	$17,558	$23,707	$8,636	$13,854	$17,226	$22,360
1%	$7,399	$10,999	$12,983	$17,209	$6,494	$10,315	$12,713	$16,352
2%	$5,599	$8,259	$9,708	$12,638	$4,937	$7,764	$9,487	$12,095
3%	$4,284	$6,270	$7,341	$9,390	$3,794	$5,906	$7,159	$9,048
4%	$3,314	$4,812	$5,612	$7,057	$2,946	$4,539	$5,460	$6,844
5%	$2,590	$3,732	$4,336	$5,364	$2,311	$3,524	$4,209	$5,235

Note: All figures are in real 1997 dollars. Calculations are based on data from the 1966-98 CPS.

Table 12: Internal Rate of Return on Medicare for White Population, at the Individual Level.

Medicare Benefit Growth	Males				Females			
	HS Dropout	HS Grad	Coll Attendee	Coll Grad	HS Dropout	HS Grad	Coll Attendee	Coll Grad
0%	5.3%	3.9%	3.7%	2.7%	5.1%	3.7%	3.1%	2.0%
1%	5.6%	4.3%	4.0%	3.1%	5.4%	4.0%	3.5%	2.4%
2%	5.9%	4.6%	4.4%	3.5%	5.7%	4.4%	3.9%	2.9%
3%	6.2%	5.0%	4.7%	3.9%	6.1%	4.8%	4.3%	3.4%
4%	6.5%	5.3%	5.1%	4.4%	6.4%	5.2%	4.7%	3.8%
5%	6.8%	5.7%	5.5%	4.8%	6.7%	5.6%	5.1%	4.3%

Figure 1: Growth in Real Per Capita Medicare Benefits

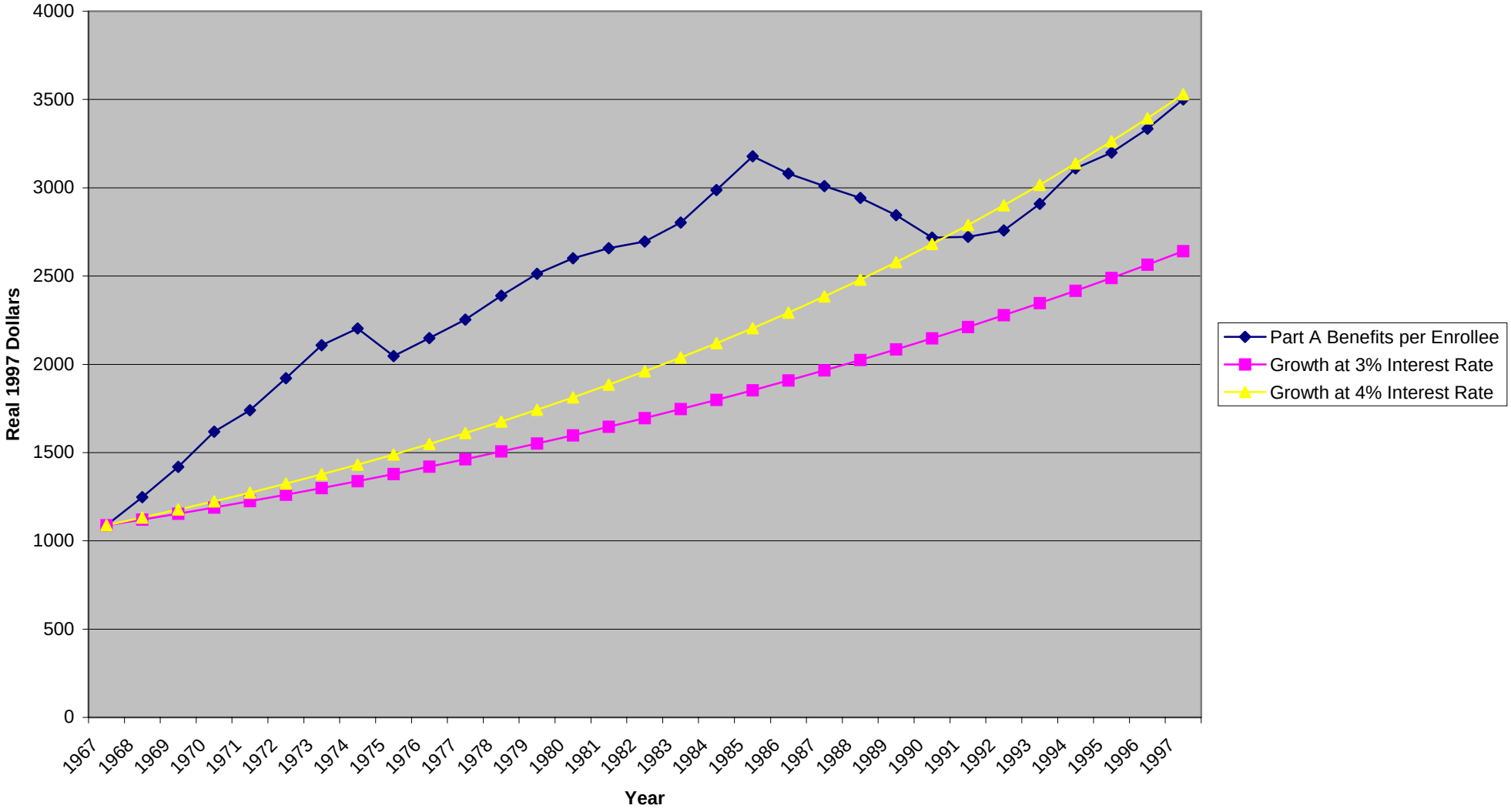

Figure 2: Male Survival Curves by Education Group.

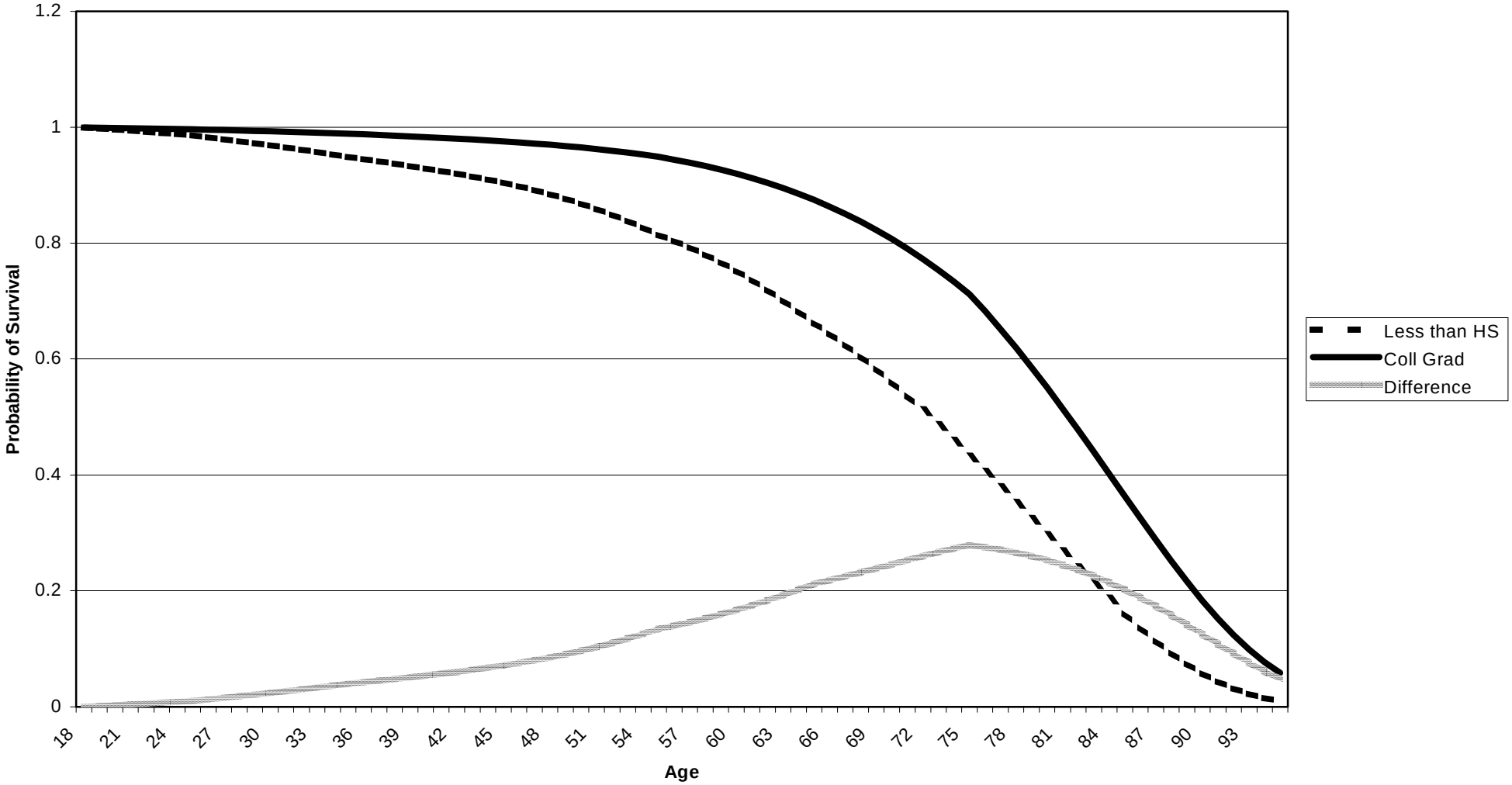

Figure 3: Female Survival Curves by Education

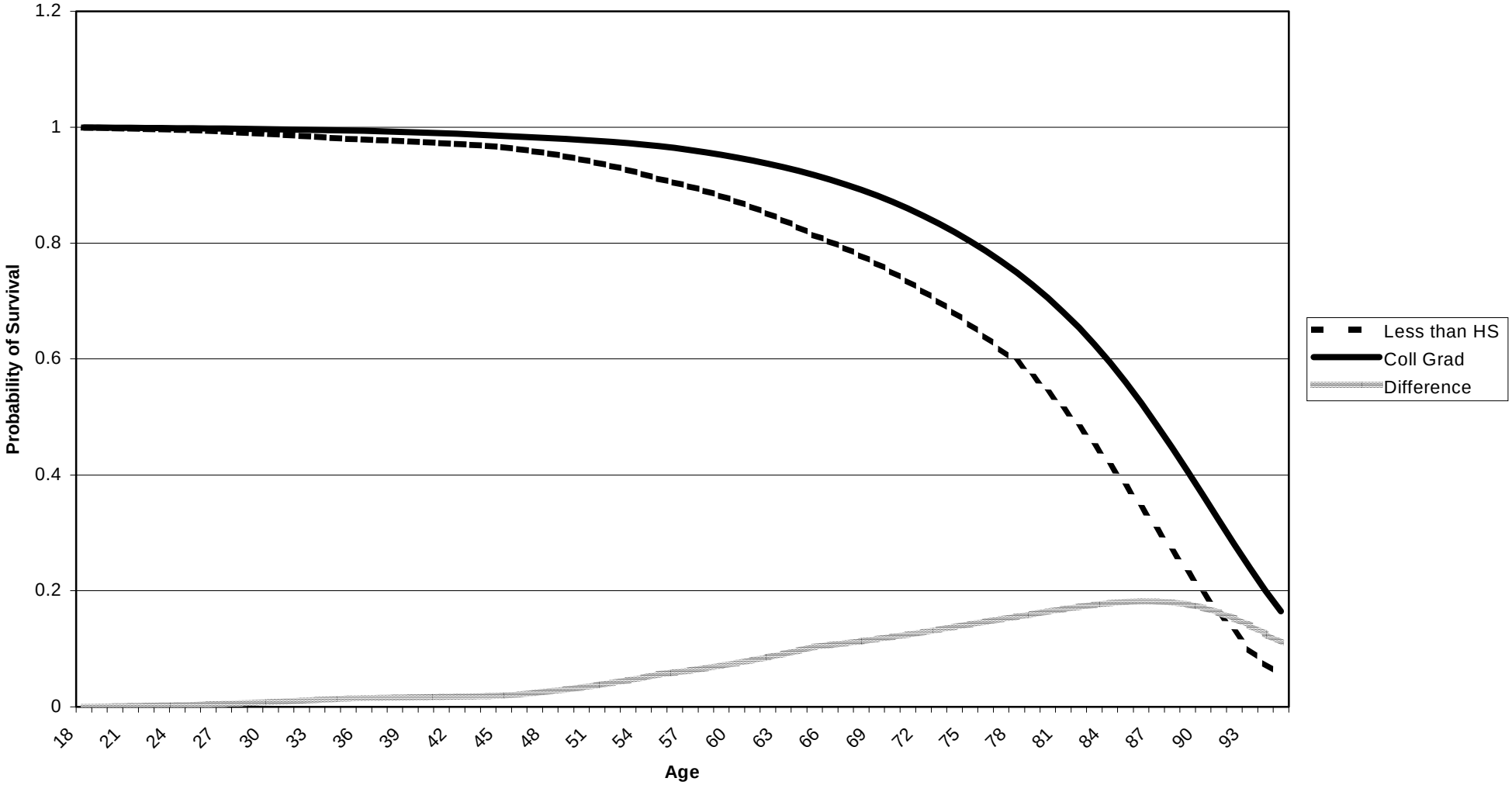

Figure 4: Age-Profile of Real Medicare Income for Couples, by Male's Education Group.

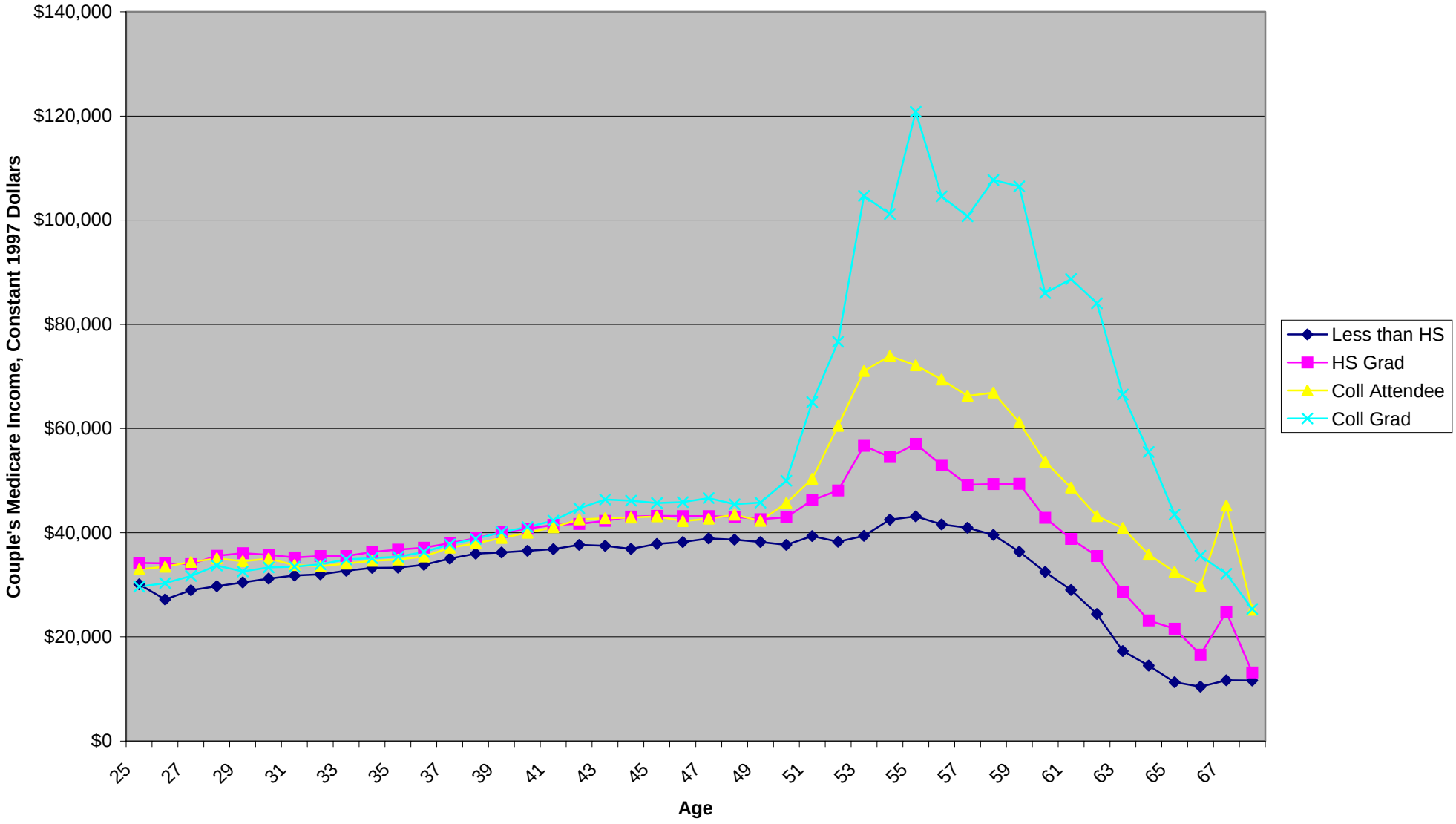

Figure 5: Age-Profile of Real Medicare Taxes Paid by White Men, on a Family Basis.