

Working Paper Series
Congressional Budget Office
Washington, DC

Changes in Medicare Spending per Beneficiary by Age

Xiaotong Niu
Congressional Budget Office
xiaotong.niu@cbo.gov

Melinda Buntin
Vanderbilt University
melinda.buntin@vanderbilt.edu

Joyce Manchester
Vermont Legislative Joint Fiscal Office
jmanchester@leg.state.vt.us

November 2015

Working Paper 2015-08

To enhance the transparency of CBO's work and to encourage external review of it, CBO's working paper series includes both papers that provide technical descriptions of official CBO analyses and papers that represent original, independent research by CBO analysts. Papers in this series are available at <http://go.usa.gov/ULE>. The information in this paper is preliminary and is being circulated to stimulate discussion and critical comment as developmental work for analysis for the Congress.

The authors thank Tom Bradley and Jamease Kowalczyk of CBO for writing Box 1 and for their comments on the rest of the paper. The authors also thank Jessica Banthin, Linda Bilheimer, Philip Ellis, Holly Harvey, Geena Kim, Jeffrey Kling, Paul Masi, Eamon Molloy, Lyle Nelson, Robert Sunshine, and Julie Topoleski, all of CBO, as well as James Baumgardner and Paul Jacobs, both formerly of CBO, for helpful comments and suggestions; Christopher Zogby of CBO for technical assistance; Bo Peery of CBO and Timothy Taylor of the *Journal of Economic Perspectives* for editorial assistance; and Jeanine Rees for preparing the paper for publication. In addition, the authors thank Liming Cai, Aaron Catlin, Micah Hartman, David Lassman, and Anne Martin of the Centers for Medicare and Medicaid Services; Ellen Meara of Dartmouth College; and Louise Sheiner of the Brookings Institution for comments and suggestions.

Abstract

The aging of the population exerts upward pressure on federal spending for health care, especially Medicare, as both the number and average age of elderly beneficiaries increase. Total Medicare expenditures may also be affected by changes in relative per-beneficiary spending for beneficiaries of different ages as the population ages. In this paper, we use the Master Beneficiary Summary File to estimate spending per beneficiary for the elderly population (people between ages 65 and 105) enrolled in the traditional fee-for-service (FFS) Medicare program between 1999 and 2012. Over that period, the age for which Medicare spending per beneficiary was highest increased from 89 to 97. In addition, spending per beneficiary grew faster for older beneficiaries than for younger ones in the second half of the period.

Over the entire period, the average annual growth rate of Medicare spending per beneficiary for people ages 65 to 74 was about half of that for those ages 85 to 94. Faster decline in the use of acute inpatient hospital care among younger beneficiaries than among older beneficiaries contributed to the slower growth of spending per beneficiary for the 65- to 74-year-old age group. More rapid growth in spending on care provided in skilled nursing facilities and hospice care—services that are more widely used by older beneficiaries—than in spending on other Medicare services contributed to the faster growth in spending per beneficiary among the older groups; that growth also accounted for the increase in the age for which Medicare spending per beneficiary was highest. Neither increases in life expectancy nor changes in the composition of beneficiaries who were enrolled in the Medicare FFS program can account for those changes in Medicare spending per beneficiary by age.

Contents

I. Introduction	1
II. Data	3
II.1. Data Set Construction.....	3
II.2. Summary Statistics	6
III. Shift in the Profile of Medicare Spending by Age	7
III.1. Effects of Spending on SNF and Hospice Care	8
III.2. Effects of Increasing Life Expectancy	12
III.3. Effects of Increased Enrollment in MA Plans	14
IV. Growth in Medicare Spending by Age	14
V. Discussion and Conclusion	16
V.1. Comparison With Previous Studies	18
V.2. Limitations of This Study.....	19
V.3. Implications for the Distribution and Projections of Medicare Spending.....	20
Box 1: Effects on CBO’s Medicare Baseline of the Changing Age Distribution of the Elderly Population	22
Appendix A. The Effects of Increases in Life Expectancy	23
Appendix B. The Effects of Selective Enrollment in Medicare Advantage	30
References.....	41

Tables

Table 1. Census Population Estimates and Number of Beneficiaries in the Master Beneficiary Summary File, by Age, 2010	4
Table 2. Fee-For-Service Medicare Spending per Beneficiary, by Service Type, 1999 to 2012.....	8
Table 3. Fee-For-Service Medicare Spending per Beneficiary, by Age Group, and the Shares of That Spending That Went to Different Service Types, 1999, 2005, and 2012	9

Figures

Figure 1. Percentage of Beneficiaries in the Master Beneficiary Summary File With Reported Medicare Spending or Enrolled in Part B, 1999, 2005, and 2012	5
Figure 2. Number of Fee-For-Service Medicare Beneficiaries in the Data Set, by Age, 1999, 2005, and 2012	7
Figure 3. Real Fee-For-Service Medicare Spending per Beneficiary, by Age, With and Without Care Provided in Skilled Nursing Facilities and Hospice Care, 1999, 2005, and 2012.....	10
Figure 4. Average Annual Growth Rates of Spending on Care Provided in Skilled Nursing Facilities, Hospice Care, and Other Medicare Services, 1999 to 2012	11
Figure 5. The Age for Which Medicare Spending per Beneficiary Was Highest in Each Year, With and Without Care Provided in Skilled Nursing Facilities and Hospice Care, 1999 to 2012.....	12
Figure 6. Cumulative Growth in the Likelihood of Beneficiaries Having Any Reported Spending on Hospice Care and in Per-User Spending on Hospice Care, 1999 to 2012	13
Figure 7. Annual Growth in Medicare Spending per Beneficiary, 1999 to 2012	15
Figure 8. Cumulative Growth in the Likelihood of Beneficiaries Having Any Reported Spending on Acute Inpatient Care and in Per-User Spending on Acute Inpatient Care, 1999 to 2012.....	17
Figure 9. Share of Total Fee-For-Service Medicare Spending, by Age, 1999, 2005, and 2012	21
Figure A-1. Medicare Spending per Beneficiary, by Time Until Death, 2002	24
Figure A-2. Real Medicare Spending per Beneficiary, by Age and by Time Until Death, 2010	25
Figure A-3. Effects of Increases in Life Expectancy on Medicare Spending per Beneficiary, 1999 to 2009	27
Figure A-4. The Age for Which Medicare Spending per Beneficiary Was Highest in Each Year, With and Without Adjustment for Increases in Life Expectancy, and With and Without Care Provided in Skilled Nursing Facilities and Hospice Care, 1999 to 2012.....	28
Figure A-5. Annual Growth Rate of Medicare Spending per Beneficiary, Adjusted to Remove the Effects of Increases in Life Expectancy, 2000 to 2010.....	29
Figure B-1. Share of Medicare Beneficiaries Enrolled in the Fee-For-Service Plan, 1999 to 2012.....	31
Figure B-2. Share of Medicare Beneficiaries Enrolled in the Fee-For-Service Plan, by Age, 1999, 2004, 2008, and 2012.....	33
Figure B-3. Share of New 65-Year-Old Medicare Beneficiaries Enrolled in the Fee-For-Service Plan, 2000 to 2012	34
Figure B-4. Rates of Switching Between the Fee-For-Service Plan and a Medicare Advantage Plan, by Age Group, 1999 to 2012.....	35
Figure B-5. Comparison of Spending for Beneficiaries Who Switched Between the Two Types of Medicare Plans With Spending for Those Who Remained Continuously Enrolled in the Fee-For-Service Plan.....	37

I. Introduction

Despite the recent slowdown in the growth of federal spending on Medicare, such spending is projected to consume an increasing share of gross domestic product (GDP) in the future. After rising from 1.9 percent of GDP in 2000 to 2.9 percent of GDP in 2014, net Medicare expenditures under current law are projected to rise to 3.6 percent of GDP by 2025 and increase further in subsequent years (CBO 2015a; CBO 2015b). Such growth over the long term probably cannot be sustained without reducing other federal spending, raising tax revenues above their historical levels relative to GDP, or adopting a combination of those approaches.

As members of the baby-boom generation (the cohort born between 1946 and 1964) reach age 65 and become eligible for Medicare coverage, the effects of the aging of the population on future Medicare spending has become a key policy concern, because of both the rising number of elderly beneficiaries and changes in the age distribution of beneficiaries.¹ It is well documented that health care spending declines with age following childhood but rises again at older ages (Yamamoto 2013). Thus, the increases in both the number and average age of Medicare beneficiaries are expected to lead to higher aggregate Medicare spending (see Box 1). Aggregate spending is also sensitive to changes in the profile of Medicare spending per beneficiary by age—that is, to how average Medicare spending for beneficiaries of a given age changes in relation to average spending for beneficiaries of other ages over time. This paper provides estimates of how Medicare spending per beneficiary for beneficiaries of different ages and for different types of services has changed in recent years.

The interaction of changes in life expectancy and morbidity rates could affect relative Medicare spending per beneficiary for different ages.² The direction and magnitude of that effect depend on the relative magnitudes of change for those two measures, and empirical studies have reached very different conclusions depending on the sample of Medicare beneficiaries or on the morbidity measure used (Crimmins and Beltrán-Sánchez 2011; Cutler, Ghosh, and Landrum 2013).

If the average age of onset of chronic and disabling conditions rises more rapidly than life expectancy, future generations will spend fewer of their later years with chronic diseases, disabilities, or functional limitations (Fries, Bruce, and Chakravarty 2011). Such improvements in health in the later years of life could lower spending for older Medicare beneficiaries in relation to younger ones (Freedman, Martin, and Schoeni 2002; Seeman et al. 2010). Conversely, life expectancy could increase without changing the number of years the average elderly person lives with morbid conditions (Gruenberg [1977] 2005). Because health care spending tends to be high in the last years of life (Riley and Lubitz 2010), increases in life expectancy could simply boost the average age at which those more expensive years begin, thus lowering spending for

¹ Although people with disabilities as defined by the Social Security's Disability Insurance program can qualify for Medicare coverage before age 65, we are concerned only with beneficiaries age 65 or older in this analysis.

² Morbidity refers to an unhealthy or diseased state; morbidity rate refers to the prevalence of morbidity within a population.

younger beneficiaries in relation to those who are older.³ The magnitude of the resulting changes in the age profile of Medicare spending per beneficiary is an empirical question.

Simulations of lifetime health care spending or projections of future expenditures usually assume a stable cross-sectional relationship between age and health care spending over time (Alemayehu and Warner 2004; Cutler and Sheiner 2000; Keehan et al. 2004; Steuerle and Quakenbush 2015). If the profile of spending by age changes over time, however, the assumption of a constant relationship would lead to inaccurate projections of overall Medicare spending and of the distribution of that spending by age cohort.⁴ A few studies have directly estimated changes in the distribution of health care spending—including Medicare spending—by age (Cutler and Meara 1998, 2001; Lassman et al. 2014; Lubitz et al. 2001; Meara, White, and Cutler 2004), but only recently have researchers begun to examine the issue using more comprehensive data with detailed analysis by age. One recent study presented spending by age after applying a smoothing filter to adjust for insufficient sample sizes at older ages (Yamamoto 2013). Although the filter captures the general trend, it might ignore deviations from the trend that could provide additional insights into changes in spending patterns. A study by Neuman, Cubanski, and Damico (2015) that is closely related to ours examines how Medicare fee-for-service (FFS) spending per beneficiary by age changed over time using a 5 percent sample of Medicare claims. The authors point out that the age for which such spending was highest rose from 92 in 2000 to 96 in 2011. Furthermore, they conclude that spending on care provided in skilled nursing facilities (SNFs) and hospice services was an important driver of the increase in relative spending for older beneficiaries in 2011.

The analysis presented here takes the findings from those studies several steps further. Using a data set that contains information about all Medicare FFS beneficiaries enrolled between 1999 and 2012, we examined how per-beneficiary Medicare spending on Parts A and B varied by age and by type of service, as well as how those patterns changed over the analysis period. The Medicare FFS program continues to devote an increasing share of total expenditures to older beneficiaries, reflecting the higher growth of spending per beneficiary for older beneficiaries than for younger ones. Our analysis shows that the age of the beneficiaries with the highest Medicare spending per beneficiary has increased and that, starting in 2004, the growth rate of Medicare spending per beneficiary was higher for older beneficiaries than for younger beneficiaries.

³ In addition to the incidence and duration of acute and chronic health conditions, the link between changes in life expectancy and health care costs also depends on the intensity of treatments applied to health conditions that are prevalent at various ages. An increase in the intensity of treatments could lead to increases in either the prevalence of treated conditions or the cost per treated condition. Thorpe (2013) found that among Medicare beneficiaries, an increase in the prevalence of treated conditions accounted for most of the growth in health care spending in recent years. In contrast, Roehrig and Rousseau (2001) attributed most of that growth to an increase in cost per treated condition.

⁴ Keehan et al. (2004) acknowledge that the use of a constant profile of spending by age could potentially underestimate the effects of aging on future health care spending. They found that, by themselves, changes in the age composition of the population could explain very little of the growth in per capita health care spending between 1987 and 1999.

Increases in life expectancy alone cannot account for those changes. Despite significant changes in the Medicare Advantage (MA) enrollment patterns over time, changes in FFS enrollment and characteristics of FFS enrollees have had only a limited effect on the age profile of spending per beneficiary. Rapid growth in spending on SNF and hospice care and the increasing concentration of the use of hospice care among the very old account for almost the entire increase in the age for which Medicare spending per beneficiary was highest. The faster decline in the rate of use of acute inpatient care among the younger beneficiaries also contributed to the difference in growth rates between older and younger age groups.

II. Data

For this analysis, we used data from the Master Beneficiary Summary File (MBSF) for the years 1999 to 2012. The MBSF is a denominator file compiled by the Centers for Medicare and Medicaid Services (CMS) that includes anyone who is enrolled in Medicare at any point in the year.

II.1. Data Set Construction

We adjusted the MBSF data to better match the age distribution of the Census Bureau's population estimates. Because nearly all of the U.S. population age 65 and over enrolls in Medicare, the number of elderly in the MBSF should be close to the population estimates from alternative sources like the Census Bureau. For the population age 95 and over, however, the 2010 census number differs considerably from the 2010 MBSF estimate (see columns 1 through 3 of Table 1). This divergence arises because the MBSF probably includes some deceased Medicare beneficiaries: Death dates are not always reported to CMS or the Social Security Administration in a timely manner (ResDAC 2012). The inclusion of deceased beneficiaries means that the number of very old beneficiaries reported in the MBSF is greater than in the census.

As a result of those errors in recording deaths, a sharp drop occurs around age 95 in the share of beneficiaries in the MBSF who paid premiums for Part B coverage or for whom Medicare spending was reported (see Figure 1). Thus, we followed the example of previous studies and excluded from the MBSF all individuals over the age of 95 who neither paid a premium to enroll in Part B of Medicare nor had any reported Medicare spending in a given year (ResDAC 2012; Kestenbaum and Ferguson 2006). After those individuals are removed, the number of very old beneficiaries in the MBSF for 2010 is more consistent with the Census Bureau's population estimates (see columns 4 and 5 of Table 1). The data set used in the following analysis includes all beneficiaries under age 95 as well as those between ages 95 and 105 who had Part B coverage or had Medicare spending reported for them in a given year.

Even after those adjustments, the number of people age 95 or older in the restricted MBSF data set used in this paper is still significantly greater than in the Census Bureau's estimates. In 2010, the number of people between ages 95 and 99 recorded in the MBSF is almost 30 percent larger than in the Census Bureau's estimates, and the number of people age 100 or older is about 80 percent larger. Additional adjustments to the data set based on other administrative data sets, which are beyond the scope of this study, would be needed to fully account for the discrepancies

Table 1.
Census Population Estimates and Number of Beneficiaries in the Master Beneficiary
Summary File, by Age, 2010

Age	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Census Population	Full MBSF Data Set		Restricted MBSF Data Set		Final Data Set	
		Beneficiaries	Difference From Census (Percent)	Beneficiaries	Difference From Census (Percent)	Beneficiaries	Difference From Census (Percent)
65-69	12,435,263	12,442,624	0.1	11,015,076	-11.4	12,442,624	0.1
70-74	9,278,166	9,458,275	1.9	8,949,470	-3.5	9,458,275	1.9
75-79	7,317,795	7,447,091	1.8	7,209,454	-1.5	7,447,091	1.8
80-84	5,743,327	5,964,544	3.9	5,829,639	1.5	5,964,544	3.9
85-89	3,620,459	3,951,390	9.1	3,873,126	7.0	3,951,390	9.1
90-94	1,448,366	1,736,482	19.9	1,705,733	17.8	1,736,482	19.9
95-99	371,244	486,049	30.9	473,847	27.6	482,676	30.0
100+	53,364	216,213	305.2	95,988	79.9	97,813	83.3
100-104		77,650		71,061		72,358	
105-109		22,889		8,621		8,796	
110+		115,674		16,306		16,659	

Note: The population estimates are from the Census Bureau (<http://go.usa.gov/38pGC>). The full MBSF data set includes all observations in the MBSF for 2010. The restricted MBSF data set includes beneficiaries for whom spending was reported or who had Part B coverage in 2010. The final data set reflects the adjustment to smooth out the inconsistency between ages 94 and 95.

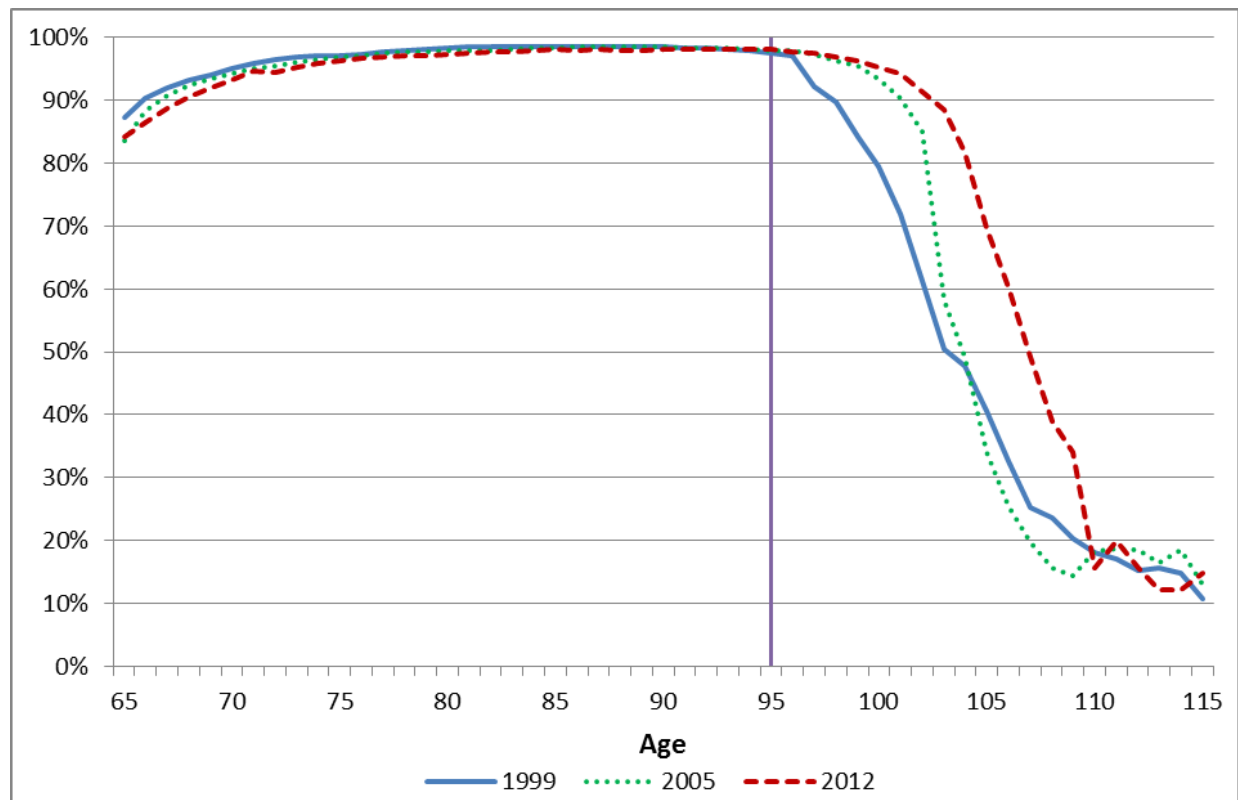
between the restricted MBSF data set and the Census Bureau's estimates (Kestenbaum and Ferguson 2006).⁵

The data set for each year consists of only those Medicare beneficiaries who were not enrolled in a Medicare Advantage plan at any point in that year. Most MA plans receive capitation payments (adjusted for the individual risk factors of each enrollee) from CMS, so CMS does not know how much an MA plan spends on any particular beneficiary.⁶ To obtain a data set that included only those beneficiaries with complete Medicare claims records, the data set for each year was restricted to exclude those who were enrolled in an MA plan at any point during the year. (We analyze the effects of changes in FFS enrollment patterns on our results in Appendix B.) In 1999,

⁵ Previous studies have found that the Census Bureau's population estimates overstate the number of very old people. For example, starting with a sample of Medicare Part B enrollees in the Social Security Administration's records, Kestenbaum and Ferguson (2006) adjusted the number of centenarians to obtain a sample that was consistent with other administrative data sources over time; the estimated number of centenarians in 2010 based on their adjustments is less than the number in the Census Bureau's estimate for that year. Given the issues with the Census Bureau's estimates, instead of aligning our data set to them, we include them only as a reference point in our discussion of adjustments.

⁶ For some MA plans—those administered by cost-based managed care organizations (MCOs)—CMS does have some information about spending for specific beneficiaries. For those MCOs, however, CMS processes only certain types of claims (for example, hospital, SNF, and outpatient claims) and certain types of carrier claims (claims for some types of transfusions, for example). Very few enrollees in MA plans have claims data recorded in the MBSF. In July 2007, 19.1 percent of all Medicare beneficiaries were enrolled in an MA plan; only 1 percent of those enrollees had claims data in the MBSF (ResDAC 2011).

Figure 1.
Percentage of Beneficiaries in the Master Beneficiary Summary File With Reported Medicare Spending or Enrolled in Part B, 1999, 2005, and 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999, 2005, and 2012. The vertical line is drawn at age 95.

the first year covered in this analysis, about 80 percent of Medicare beneficiaries were not enrolled in an MA plan in any month during the year. That share had risen to 85 percent by 2004, when it began to decline, falling to just over 70 percent by 2012, the last year covered in our analysis.

In the final step of data set construction, we further adjusted the number of beneficiaries age 95 or older upward to account for the discontinuity in the selection between ages 94 and 95. We inferred that all 94-year old FFS beneficiaries in the MBSF files were alive, whereas we inferred that only those 95-year-olds who paid premiums for Part B coverage or for whom spending was reported in the MBSF were alive. To ensure consistency in the data set construction at all ages, we included additional beneficiaries between ages 95 and 105 for whom no spending was recorded during the year such that the percentage of beneficiaries with Part B coverage or reported Medicare spending for each age between 95 and 105 was the same as the percentage of 94-year-olds who met those qualifications. The percentage was estimated separately for men and women in each year; the average value over the analysis period was greater than 96 percent for men and about 98 percent for women. To obtain the final count of beneficiaries, we thus added the number of FFS beneficiaries between ages 95 and 105 in the restricted data set divided by those percentages to the number of FFS beneficiaries between ages 65 and 94 (see columns 6 and

7 in Table 1). That final adjustment led to an increase in the number of FFS beneficiaries in the data set and to a slightly lower estimate of Medicare spending per beneficiary for ages 95 to 105, but it had only a small effect on the estimates presented in this paper.

In order to compare data on spending per beneficiary for Medicare Parts A and B from several years, we adjusted such spending to 2009 dollars using the price index for personal consumption expenditures (PCE price index).⁷ We also aggregated the spending into nine service types: inpatient hospital, SNF, hospice, home health, physician, outpatient hospital, durable medical equipment (DME), Part B drug, and other. “Inpatient hospital” includes acute inpatient and other inpatient services. “Physician” includes evaluation and management, anesthesiology, imaging services, other procedures, and other office services. “Other” includes dialysis, services provided at ambulatory surgical centers, tests, and other carrier claims.

For this analysis, we calculated average spending and use for specific ages as well as for age groups (65–74, 75–84, 85–94, and 95–105). Because our data set contains 100 percent of Medicare beneficiaries between ages 65 and 105 enrolled in FFS (with the adjustments noted above), we do not report measures of statistical significance: All means and changes are population measures based on data for all FFS Medicare beneficiaries. We analyzed the distribution of Medicare spending per beneficiary by age and by service type for the years 1999 to 2012.

II.2. Summary Statistics

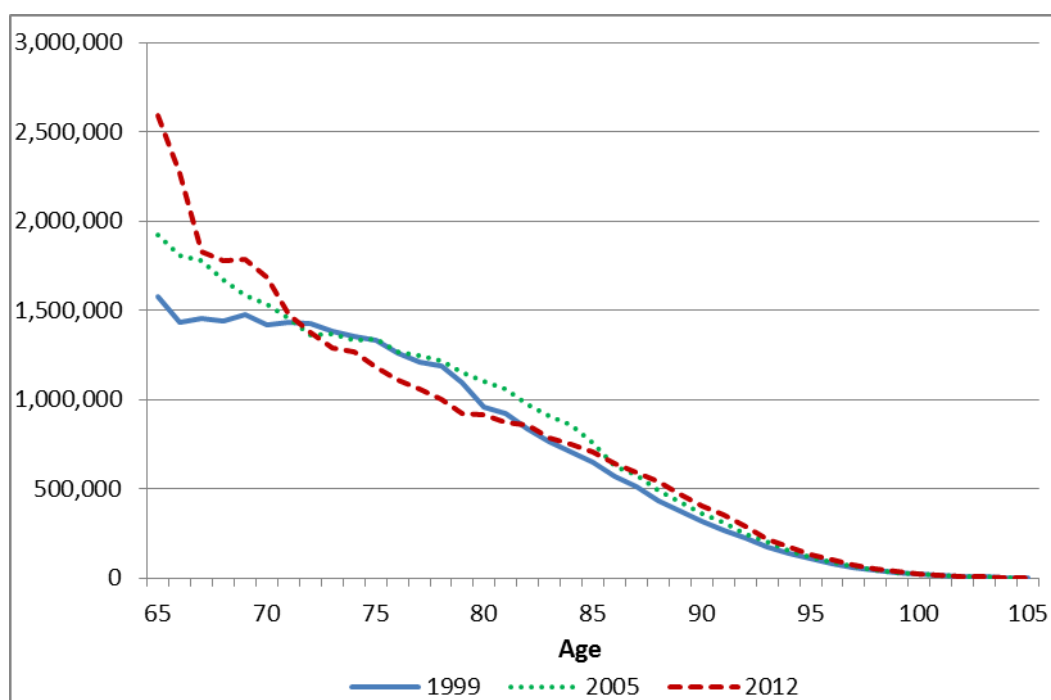
From 1999 to 2012, the most direct effect of aging on Medicare spending was an increase in the number of older beneficiaries, especially those age 85 or older (see Figure 2). But in more recent years, as members of the baby-boom generation have started to turn 65 and enroll in Medicare, the most notable development due to aging has been the surge of new younger beneficiaries.

The other significant change in Medicare spending over the 1999–2012 period was in the relative spending for different types of services (see Table 2). In 1999, almost half of total Medicare spending for FFS beneficiaries went to inpatient hospital care, but that share declined over the period while the shares of total spending that went to outpatient hospital care, hospice care, SNF care, and home health care increased.⁸ In each year of the period, the shares of Medicare spending for older beneficiaries that went to hospice care and post-acute care (including SNF care and home health care) were greater than the shares of spending for younger beneficiaries that went to those services; by contrast, the shares of older beneficiaries’ spending that went to

⁷ The MBSF provides annual Medicare spending for the following 17 types of services for each FFS beneficiary: acute inpatient, other inpatient, evaluation and management, anesthesiology, imaging services, other procedures, other office services, outpatient hospital, SNF, hospice, home health, durable medical equipment, Part B drug, dialysis, ambulatory surgical centers, tests, and other carrier claims.

⁸ The breakdown of total FFS Medicare spending by service type is slightly different from that reported in CBO’s baseline budget projections. The MBSF includes only payments for claims processed and paid by the Medicare program, whereas CBO’s baseline includes not only claim payments but also payments made directly to providers.

Figure 2.
Number of Fee-For-Service Medicare Beneficiaries in the Data Set, by Age, 1999, 2005, and 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999, 2005, and 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year.

inpatient hospital care, outpatient hospital care, and physician services was smaller than the shares of younger beneficiaries' spending that went to those services (see Table 3).⁹

III. Shift in the Profile of Medicare Spending by Age

In each year during the 1999–2012 period, Medicare spending per beneficiary was lowest for the youngest beneficiaries and increased with age, but it did so at a decreasing rate, peaking at a certain age—between the late 80s and late 90s for the years in the period; for beneficiaries who

⁹ Our data set includes beneficiaries with Part A or Part B coverage, and our outcome variable is the total spending on Parts A and B. Beneficiaries with only Part A or Part B coverage have very different spending patterns from those of people with both types of coverage. The following estimates are based on the enrollment information as of July 1 in each year from CMS's annual *Medicare and Medicaid Statistical Supplement* for the years 2001 to 2013 (<http://go.usa.gov/3BsUj>). The number of elderly FFS beneficiaries with only Part B coverage is small, generally constituting only about 1 percent of all beneficiaries. A significant percentage of elderly FFS beneficiaries had only Part A coverage, and that percentage increased over the period, from 5.5 percent in 1999 to about 11 percent in 2012. The percentage of beneficiaries between ages 65 and 74 who had only Part A coverage was higher—7.5 percent in 1999 and about 16 percent in 2012. Despite those changes in coverage over the period, our main conclusions hold even if we restrict the analysis to beneficiaries with both Parts A and B coverage.

Table 2.
Fee-For-Service Medicare Spending per Beneficiary, by Service Type, 1999 to 2012
Percent

Year	(1) Average Spending on All Services (2009 dollars)	(2) Inpatient Hospital	(3) Skilled Nursing Facility	(4) Hospice	(5) Home Health	(6) Physician	(7) Outpatient Hospital	(8) Durable Medical Equipment	(9) Part B Drug	(10) Other
1999	5,920	49.0	6.5	1.4	5.1	19.4	8.7	2.6	2.3	5.0
2000	6,005	47.7	6.8	1.5	4.5	20.3	8.8	2.3	3.0	5.2
2001	6,460	45.8	7.3	1.7	4.7	20.4	9.2	2.4	3.4	5.1
2002	6,731	45.1	7.4	2.0	4.8	19.5	9.7	2.5	3.8	5.2
2003	6,971	43.9	7.1	2.3	4.7	19.5	10.1	2.7	4.4	5.3
2004	7,347	42.5	7.5	2.5	4.8	19.7	10.8	2.5	4.3	5.4
2005	7,629	41.8	7.8	2.8	5.0	19.6	11.2	2.5	3.8	5.4
2006	7,777	40.7	8.2	3.1	5.3	19.1	11.4	2.5	4.0	5.6
2007	7,807	39.7	8.6	3.3	5.8	18.7	11.8	2.5	4.0	5.6
2008	7,941	39.1	9.1	3.4	6.1	18.3	12.2	2.5	3.7	5.6
2009	8,292	38.2	9.2	3.4	6.4	18.2	12.9	2.2	3.6	5.7
2010	8,319	37.4	9.4	3.5	6.4	18.4	13.3	2.2	3.6	5.7
2011	8,173	36.3	10.1	3.6	5.9	18.5	13.9	2.1	3.7	5.7
2012	7,907	36.1	9.1	3.9	5.7	18.5	14.9	2.1	3.8	5.8

Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. Fee-for-service Medicare spending includes spending on Parts A and B. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. All spending amounts were adjusted to 2009 dollars using the price index for personal consumption expenditures. The category “Physician” includes evaluation and management, anesthesiology, imaging series, other procedures, and other office services. “Other” includes dialysis, visits to ambulatory surgical centers, tests, and other carrier claims.

were older than that age with the highest spending, average Medicare spending declined steadily with age through 105, the maximum age in our data set (see Figure 3a). Per-beneficiary Medicare spending for 80-year-olds was consistently more than 50 percent higher than per-beneficiary spending for 70-year-olds, but per-beneficiary spending for 90-year-olds was less than 50 percent greater than such spending for 80-year-olds. (The seemingly large difference in Medicare spending per beneficiary between ages 65 and 66 is an artifact of Medicare eligibility rules. Because Medicare spending is aggregated for each calendar year and Medicare eligibility is determined based on birth date, most 65-year-old beneficiaries are enrolled for only part of the calendar year.)

From 1999 to 2012, the age profile of real (inflation-adjusted) Medicare spending shifted upwards, indicating an increase in per beneficiary spending for all ages, and to the right, indicating that the increase was greatest for older beneficiaries. The age with the highest spending increased by nearly a decade over the period—from 89 to 97 (see Figure 3a).

III.1. Effects of Spending on SNF and Hospice Care

Changes in spending on SNF and hospice care led to the rightward shift in the age profile of spending per beneficiary. Per-beneficiary spending on SNF and hospice care grew faster than

Table 3.
Fee-For-Service Medicare Spending per Beneficiary, by Age Group, and the Shares of That Spending That Went to Different Service Types, 1999, 2005, and 2012
Percent

Year	Age	(1) Average Spending on All Services (2009 dollars)	(2) Inpatient Hospital	(3) Skilled Nursing Facility	(4) Hospice	(5) Home Health	(6) Physician	(7) Outpatient Hospital	(8) Durable Medical Equipment	(9) Part B Drug	(10) Other
1999	65-74	4,484	49.6	3.0	0.9	3.3	21.2	10.9	2.8	2.9	5.3
	75-84	6,979	49.3	6.5	1.3	5.3	19.5	8.3	2.5	2.3	4.9
	85-94	8,397	47.3	12.7	2.3	7.8	16.0	5.7	2.2	1.4	4.6
	95-105	7,907	44.6	16.7	4.2	9.4	13.0	4.3	2.2	0.7	4.8
2005	65-74	5,616	42.1	3.6	1.2	3.4	22.1	13.7	2.9	4.8	6.1
	75-84	9,067	42.5	7.7	2.4	5.2	19.7	10.8	2.5	3.8	5.4
	85-94	11,089	40.1	14.8	5.7	7.5	15.4	7.9	2.0	2.2	4.6
	95-105	11,150	35.3	18.7	13.3	8.7	11.1	6.0	1.8	1.0	4.0
2012	65-74	5,601	36.9	4.9	1.4	3.9	21.0	18.2	2.5	4.5	6.8
	75-84	9,690	36.8	9.1	3.1	5.8	18.7	14.7	2.0	3.9	5.8
	85-94	12,588	34.6	15.6	7.9	8.4	14.6	10.3	1.4	2.7	4.5
	95-105	13,634	29.6	18.2	18.6	9.3	10.7	7.4	1.2	1.6	3.5

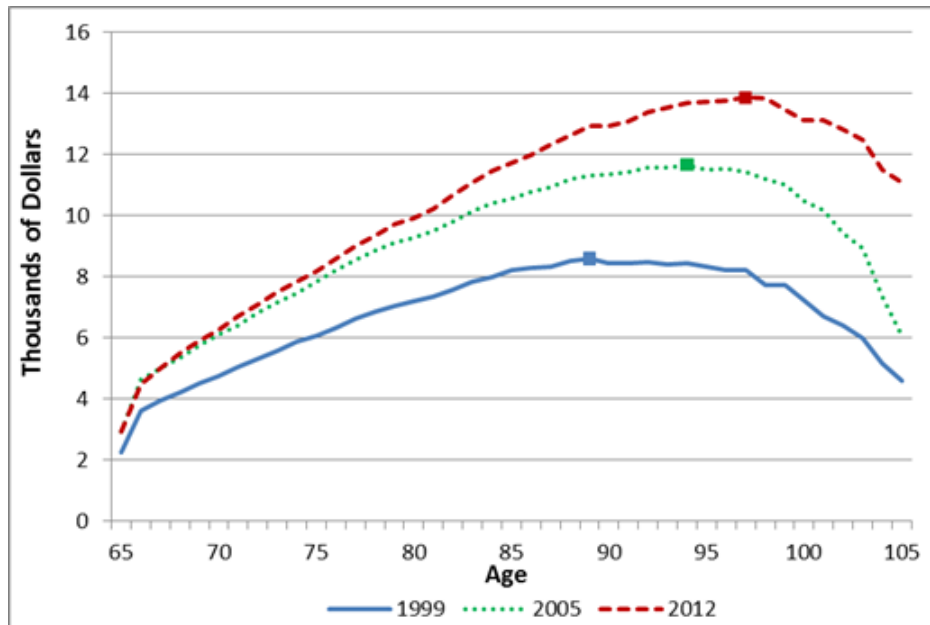
Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999, 2005, and 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. All spending amounts were adjusted to 2009 dollars using the price index for personal consumption expenditures. The category “Physician” includes evaluation and management, anesthesiology, imaging series, other procedures, and other office services. “Other” includes dialysis, visits to ambulatory surgical centers, tests, and other carrier claims.

spending for all other Medicare services combined for every age group in the elderly population over our analysis period (see Figure 4). Because the older age groups spent more on SNF care and on hospice care initially (see Table 3), that growth had a bigger impact on the overall growth of spending among beneficiaries at older ages.

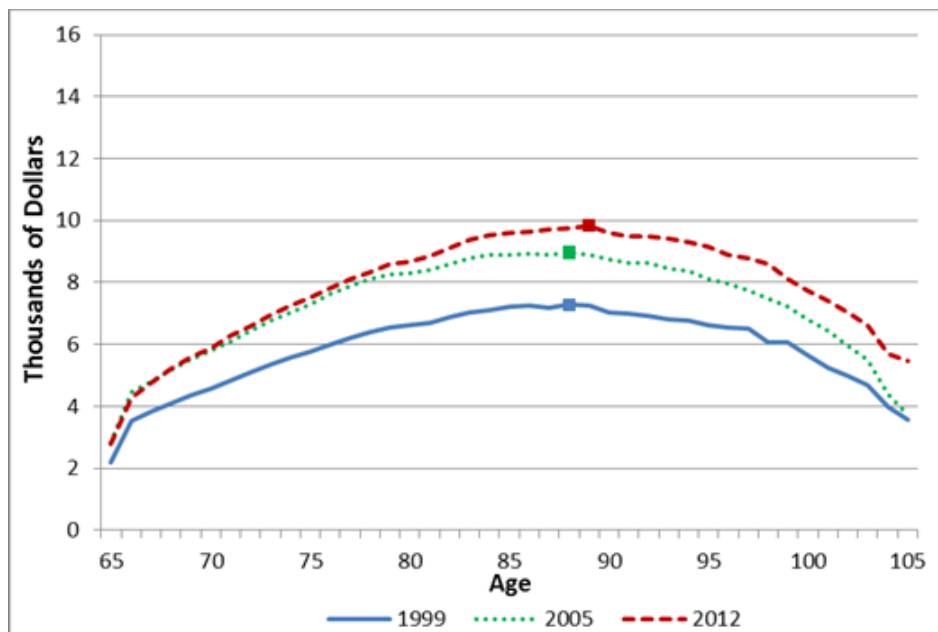
However, the faster overall growth rates of per-beneficiary spending on SNF and hospice care relative to other services were insufficient to account for the entire increase in the age with the highest spending, especially for the period before 2005 (compare the dashed and solid lines in Figure 5). The more rapid growth in spending for hospice care at older ages was also an important driver of that shift. That phenomenon, in combination with higher spending on hospice care at the start of the period, resulted in much higher spending for hospice care among older beneficiaries by the end of the period and further contributed to the rightward shift in the profile of Medicare spending by age. If the growth rates of per capita spending on SNF and hospice care for all ages were the same as the rate for the 65- to 74-year-old age group, the age with the highest spending would still have risen, but not by as much as it actually rose (see Figure 5). Therefore, faster growth in spending on SNF and hospice care, along with faster growth in spending on hospice care at older ages, explained the rightward shift in the profile of Medicare spending by age.

Figure 3.
Real Fee-For-Service Medicare Spending per Beneficiary, by Age, With and Without Care
Provided in Skilled Nursing Facilities and Hospice Care, 1999, 2005, and 2012

(a) Spending per beneficiary for all Parts A and B services

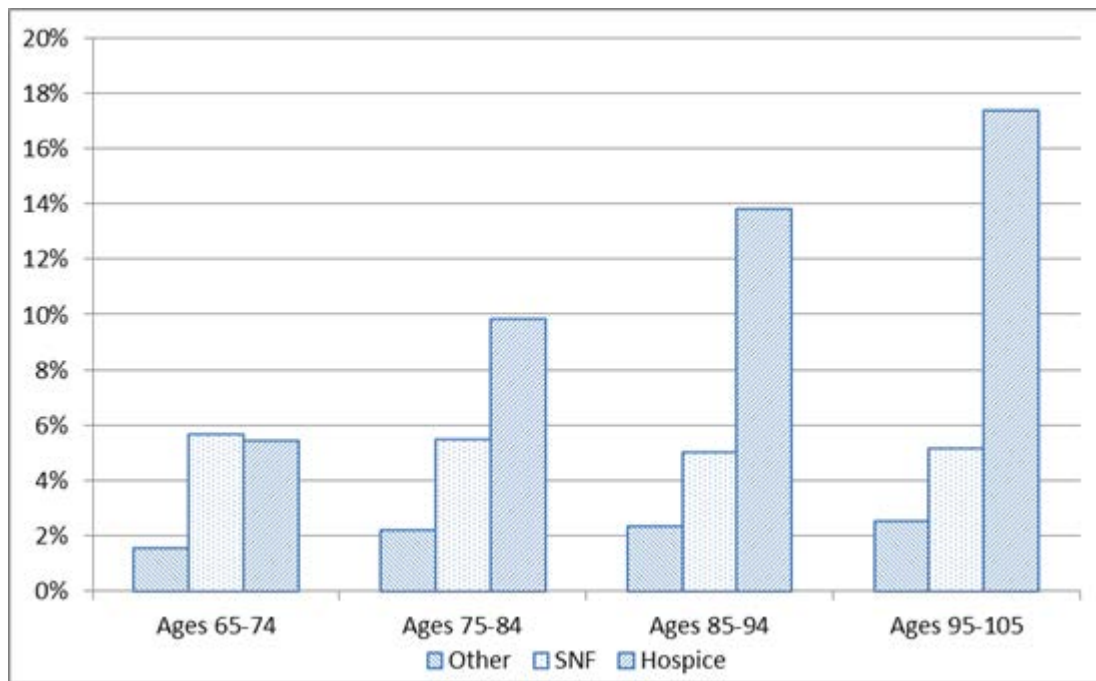


(b) Spending per beneficiary excluding SNF and hospice care



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999, 2005, and 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. Each marker indicates the peak of each age profile. The spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

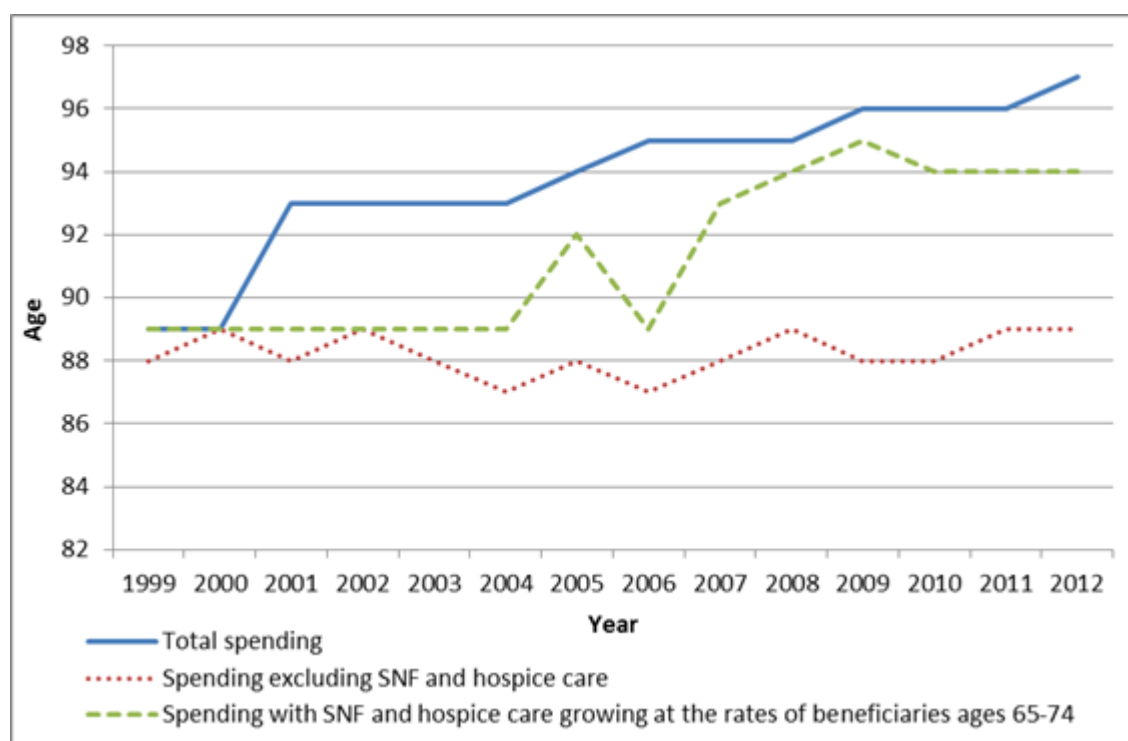
Figure 4.
Average Annual Growth Rates of Spending on Care Provided in Skilled Nursing Facilities, Hospice Care, and Other Medicare Services, 1999 to 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. For each of the four age groups, we estimated the average rate of spending growth on skilled-nursing-facility care, hospice care, and other services. “Other” services include inpatient hospital, home health, physician, outpatient hospital, durable medical equipment, Part B drug, dialysis, visits to ambulatory surgical centers, tests, and other carrier claims. Spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

The growth rates of per-beneficiary spending on hospice care are progressively larger for older groups (see Figure 4), primarily because use of those services is growing more quickly among older beneficiaries than younger ones. Medicare spending per beneficiary is calculated on the basis of two factors: the likelihood of use (the proportion of beneficiaries with such spending) and spending per user (the average amount spent on those Medicare beneficiaries who use the services). The likelihood of use of hospice care for all age groups increased significantly over the 1999–2012 period, but the magnitude of the increase was greater for older age groups: It nearly doubled for the 75- to 84-year-old age group, and it tripled for the 85- to 94-year-old age group (see Figure 6a). All age groups also saw a striking increase in the annual cost of hospice care, with real spending on hospice care per user rising by more than 50 percent between 1999 and 2012 for all age groups. Unlike the differences in the growth rates of the likelihood of use, however, the differences in the increase in spending per user among the age groups were not very pronounced. The differential growth rates in the likelihood of use of hospice care among age groups contributed to the shift in the age profile of Medicare spending.

Figure 5.
The Age for Which Medicare Spending per Beneficiary Was Highest in Each Year, With and Without Care Provided in Skilled Nursing Facilities and Hospice Care, 1999 to 2012



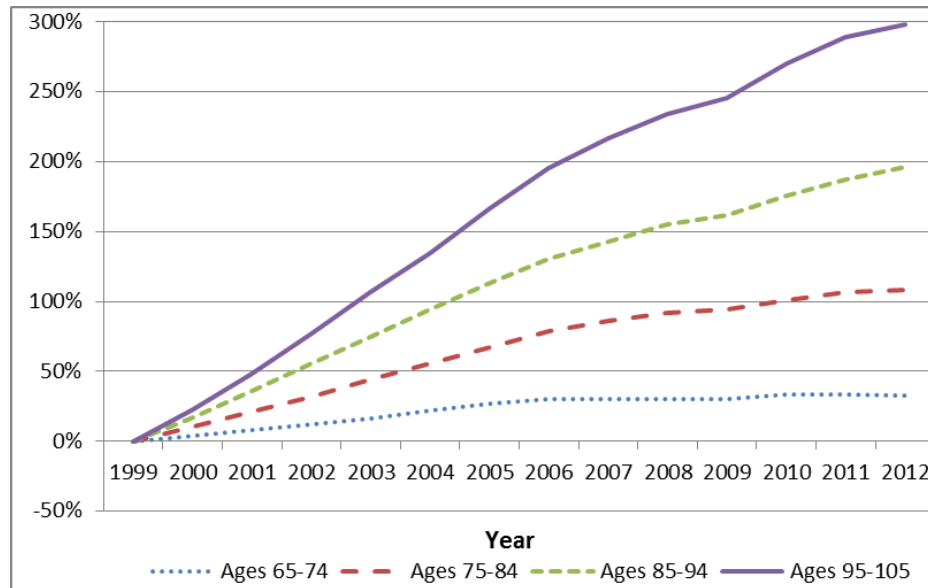
Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. Three different age profiles of spending age are presented: The solid line is the age profile of spending on all Parts A and B services; the dotted line is the age profile of spending on all Parts A and B services except care provided in skilled nursing facilities and hospice care; and the dashed line is the age profile of total spending on Parts A and B with spending on SNF care and on hospice care for all ages between 65 and 105 adjusted to grow at the rate of the 65–74 age group in each year. Spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

III.2. Effects of Increasing Life Expectancy

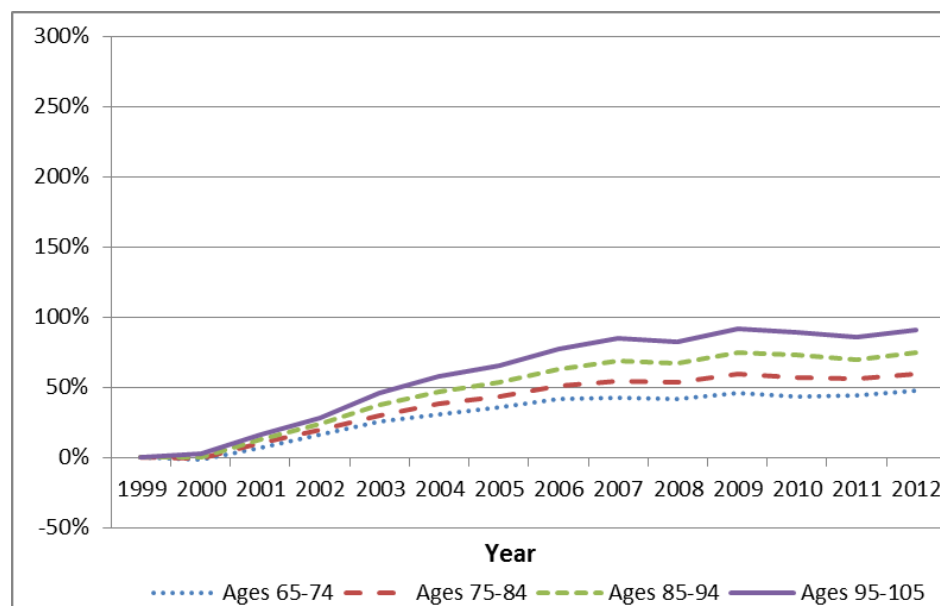
The increase in life expectancy has been significant in recent decades, but that increase alone cannot explain the shift in the age for which spending per beneficiary was highest. Because Medicare spending tends to increase in the last year of life, increases in life expectancy or reductions in age-specific mortality rates could affect the age profile of Medicare spending per beneficiary. We identify the effects of the rising life expectancy using changes in the composition of FFS beneficiaries with respect to the number of years until death. We group beneficiaries by years until death using three categories: death in the current year, death in the next year, and death after the next year. That categorization requires that spending data adjusted for increases in life expectancy end two years prior to the last year of available data. For that reason, the data set includes Medicare beneficiaries enrolled in any year between 1999 and 2010 (see Appendix A for details). With adjustments to account for increases in life expectancy, the age with the highest per-beneficiary spending increased from 89 to 96 between 1999 and 2010—

Figure 6.
Cumulative Growth in the Likelihood of Beneficiaries Having Any Reported Spending on Hospice Care and in Per-User Spending on Hospice Care, 1999 to 2012

(a) Growth in likelihood of beneficiaries using hospice care



(b) Growth in per-user spending on hospice care



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. For each of the four age groups, we estimated the percentage of fee-for-service Medicare beneficiaries for whom some spending on hospice care was reported and the average spending on hospice care for those beneficiaries. Spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

the same rise that was calculated without removing the effects of increases in life expectancy on spending.¹⁰ Changes in spending on SNF and hospice care account for most of that increase.

III.3. Effects of Increased Enrollment in MA Plans

Another major development in the Medicare program, the increase in the number of beneficiaries who were enrolled in an MA plan, has also had only a very small effect on our conclusions. Expected spending differs for beneficiaries who are enrolled in the FFS program and those who are enrolled in an MA plan. Thus, changes in the likelihood of MA enrollment could lead to changes in the composition of FFS beneficiaries and therefore in FFS spending per beneficiary. To control for the effects of changes in MA enrollment on spending per FFS beneficiary, we constructed a new set of age profiles under a hypothetical scenario in which the percentage of elderly beneficiaries enrolled in MA plans stays constant over time (see Appendix B). In each of the hypothetical profiles, the age at which spending peaked still increases between 1999 and 2012, and spending on SNF and hospice care explains most of that increase.

IV. Growth in Medicare Spending by Age

If the growth in Medicare spending per beneficiary was the same at all ages, the age with the highest spending would stay constant over time. That age has shifted over time, however, indicating that the growth of per-beneficiary spending has not been uniform among age groups. This section examines those variations in the growth of Medicare spending per beneficiary for different age groups over our analysis period.

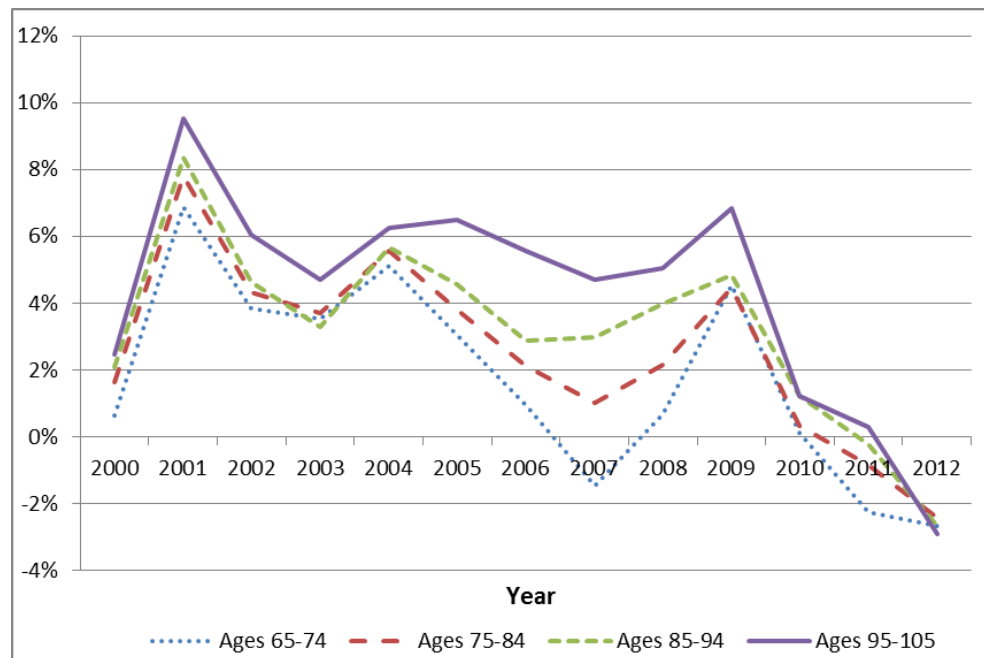
Real Medicare spending per beneficiary for all age groups generally increased each year until 2011, but the age-specific patterns changed over time. From 1999 to 2004, spending per beneficiary grew similarly for all age groups, although growth was slightly slower for younger groups (see Figure 7a). But in 2005, the average annual growth rates of spending per beneficiary for older and younger groups began to diverge; the rates for younger beneficiaries then declined faster than the rates for older beneficiaries until 2007, when the gap in spending growth between younger and older age groups began to narrow.

A comparison of the changes in the growth rates of spending for the 65–74 age group and the 85–94 age group illustrates that general pattern well. Over the entire 1999–2012 period, the average annual growth rate of real spending per beneficiary was 1.8 percent for FFS beneficiaries between ages 65 and 74 and 3.2 percent for those between ages 85 and 94. From 2004 to 2008, the period during which differences between growth rates for different age groups were greatest, the average growth rates for those two age groups were 0.8 percent and 3.6 percent, respectively. In 2007, the year with the greatest differences in spending growth between age groups, spending per beneficiary declined by 1.5 percent for the 65–74 age group and grew by 3.0 percent for the 85–94 age group.

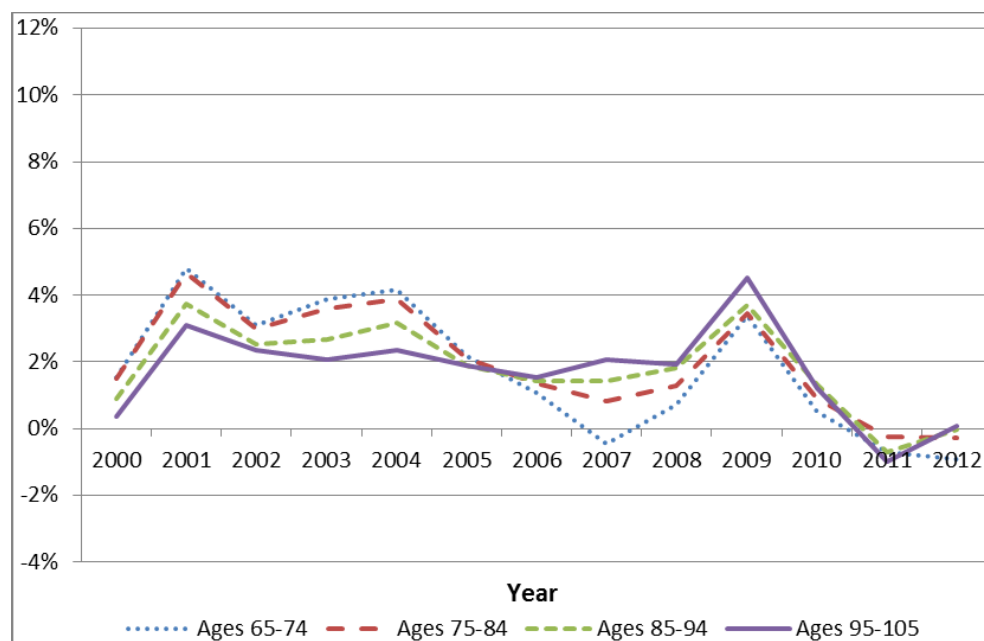
¹⁰ The age with the highest spending per beneficiary differed between the unadjusted and adjusted data sets in other years of the analysis period. With the unadjusted data set, the age with the highest spending either stayed the same or increased each year. With the adjusted data set, that age generally rose over the 1999–2010 period; it did, however, decline between 2002 and 2003.

Figure 7.
Annual Growth in Medicare Spending per Beneficiary, 1999 to 2012

(a) Growth in spending for all Parts A and B services



(b) Growth in spending, holding spending on acute inpatient hospital care, skilled-nursing-facility care, and hospice care constant over time



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. Medicare spending, which includes spending for Parts A and B, was adjusted to 2009 dollars using the price index for personal consumption expenditures. Panel (b) plots spending on all Parts A and B services such that real spending on acute inpatient hospital, SNF care, and hospice care stay at the 1999 level.

In addition to greater use of SNF and hospice services, changes in the patterns of use of acute inpatient care also contributed to the divergence in spending growth for different age groups in the second half of the analysis period. If spending on acute inpatient hospital care, SNF care, and hospice care was held constant at its 1999 level, the average annual growth rate of Medicare spending per beneficiary would have been similar for all age groups—at around 2 percent (see Figure 7b).

The proportion of Medicare beneficiaries using acute inpatient care stayed relatively constant or declined between 1999 and 2012 for all age groups (see Figure 8a). It fell more quickly for the younger beneficiaries, which caused spending on acute inpatient care to grow more slowly for them than it did for older beneficiaries. For beneficiaries between ages 65 and 74, it fell by more than 20 percent, but for those between ages 85 and 94, use fell by about 10 percent. The divergence in the rates of use for different age groups became more pronounced in the mid-2000s, which coincides with the divergence in the growth rates of spending per beneficiary for those groups. Including only those beneficiaries who used acute inpatient care, the growth rate of cost per user was similar for all age groups, increasing by almost 20 percent in real terms between 1999 and 2009 and then remaining level until 2012 (see Figure 8b).

As with shifts in the age profile, most of the differential spending growth between age groups cannot be explained by increases in life expectancy or changes in FFS enrollment. After accounting for either factor, spending growth for different age groups is still very similar (see Appendixes A and B for details).

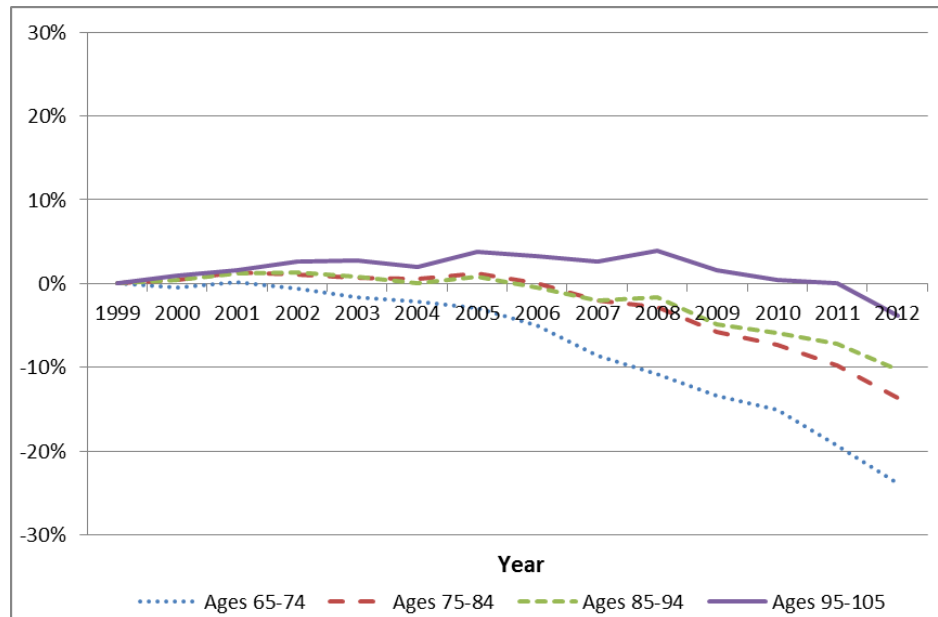
V. Discussion and Conclusion

The analysis in this paper establishes several patterns that are useful in understanding the relationship between the aging of the population and the growth of Medicare spending. Our findings, which supplement and complement those of a variety of earlier studies that bear on this issue, are as follows:

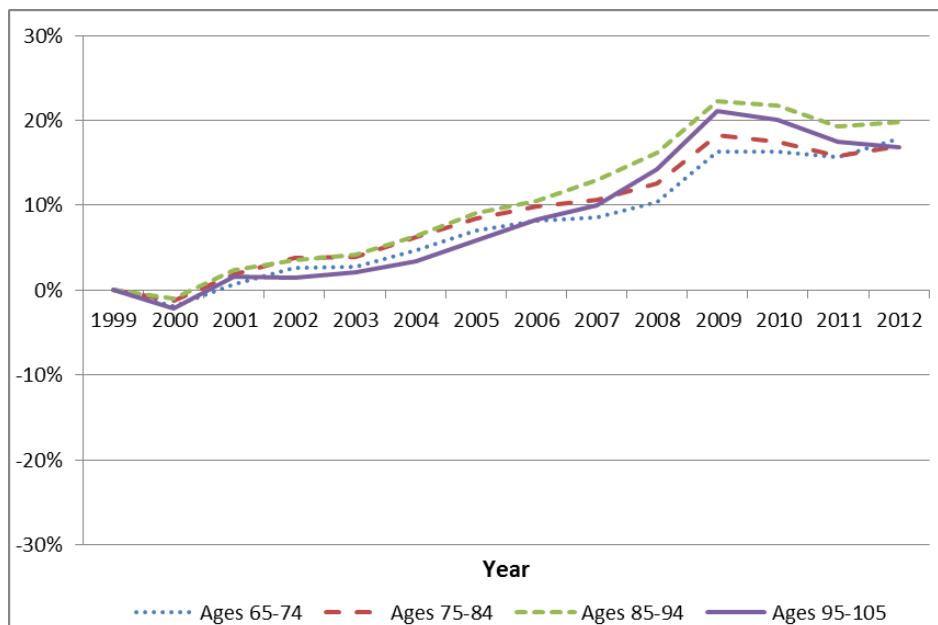
- Between 1999 and 2012, the age with the highest Medicare spending per beneficiary rose by almost a decade, from 87 to 96.
- The difference between growth rates of Medicare spending per beneficiary for different age groups was greatest from 2004 to 2008. During that period, Medicare spending for beneficiaries between ages 85 and 94 grew at an average annual rate of 3.6 percent, whereas spending for beneficiaries ages 65 to 74 grew at an average rate of just 0.8 percent per year. That gap in growth rates diminished from 2009 to 2012, the final year of our analysis period.
- Changes in spending on SNF care, hospice care, and acute inpatient care contributed to the changes in the profile of Medicare spending per beneficiary by age. During the 2000s, the shift in that age profile was driven by a rapid increase in spending on SNF and hospice care at all ages and by an increasing concentration of hospice use among the very old. In addition, we found that the faster decline among younger beneficiaries than older beneficiaries in the use of acute inpatient care that occurred over the period lowered overall spending growth among those younger beneficiaries and kept overall spending growth higher for those age 85 or older.

Figure 8.
Cumulative Growth in the Likelihood of Beneficiaries Having Any Reported Spending on Acute Inpatient Care and in Per-User Spending on Acute Inpatient Care, 1999 to 2012

(a) Growth in likelihood of beneficiaries with spending on acute inpatient care



(b) Growth in per-user spending on acute inpatient care



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. For each of the four age groups, we estimated the percentage of fee-for-service Medicare beneficiaries for whom some spending on acute inpatient care was reported and the average spending on acute inpatient care for those beneficiaries. The spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

V.1. Comparison With Previous Studies

This study supplements earlier studies on changes in health care spending for different age groups by examining that issue using a more recent and more comprehensive data set on Medicare spending. Because Medicare covers most of the elderly population in the United States and because beneficiaries are responsible for a portion of the cost of Medicare services, average Medicare spending should be highly correlated with average total health care spending among the elderly population. Medicare pays about half of total health care spending among the elderly (Lassman et al. 2014). Previous studies have found that for the first three decades after Medicare's introduction in 1967, Medicare spending grew faster on average for beneficiaries age 85 and over than for beneficiaries between ages 65 and 74 but that in the late 1990s, the difference in spending growth for older and younger age groups narrowed following reforms to the Medicare payment system (Lubitz et al. 2001).¹¹ That reversal in trend was consistent with this study's findings for the first half of the analysis period.

The difference in spending growth rates for older and younger age groups that began in 2004 that we have documented has not, however, been widely discussed in the literature. Lassman et al. (2014) noted the slightly faster growth of per capita health care spending for people age 85 or older between 2002 and 2010, although that study did not show the changing patterns of annual growth rates by age group or identify the factors responsible for the differential growth rates. Using a 5 percent sample of Medicare claims, Neuman, Cubanski, and Damico (2015) found that the age for which Medicare spending per beneficiary was highest increased from 92 in 2000 to 96 in 2011; using all Medicare claims data rather than a sample, we found that spending was greatest for 89-year-olds in 2000 and for 96-year-olds in 2011. In this report, we provide estimates of the age for which spending was highest for each year between 1999 and 2012 and present evidence that the increase reflects a steady and persistent shift in the age profile of spending over our analysis period.

This study identifies new drivers of increases in spending per beneficiary for Medicare services. Before the late 1990s, fast growth in the spending on home health care and on SNF care drove up growth rates of average Medicare spending for very old beneficiaries; the growth of per-beneficiary spending on inpatient care for that group was only slightly slower than that for younger beneficiaries (Lubitz et al. 2001).¹² We found that spending on SNF and hospice care drove up the growth rates in Medicare spending per beneficiary for the very old during the 2000s and that spending for acute inpatient care contributed to the differences in the growth of Medicare spending per beneficiary across age groups during that period.

¹¹ Keehan et al. (2004) found similar rates of growth in per capita health care spending for all age groups between 1987 and 1996 and slower growth for older elderly between 1997 and 1999. Meara, White, and Cutler (2004) also found slower growth of per capita health care spending for people ages 75 and older than for those in the 65–74 age group between 1996 and 2000. Between 1963 and 1996, spending growth was, on average, greater for older people.

¹² Cutler and Meara (2001) also found that post-acute care drove the higher growth in Medicare spending per beneficiary among the very old between 1985 and 1995. The definition of post-acute care that they used was broader than that used in this study; in addition to home health and SNF care, their definition included spending on hospice care and comprehensive outpatient rehabilitation facilities. They found similar growth rates in Medicare spending on acute care for all age groups between 1985 and 1995. They included spending on inpatient and outpatient care in hospitals and physicians' offices as acute care in their study.

The results in this paper also contribute to the literature that seeks to explain the recent slowdown in health care spending in general and in Medicare spending in particular. Among FFS Medicare beneficiaries, the rate of growth of spending per beneficiary has been declining steadily since 2004 (Levine and Buntin 2013). From 2004 to 2008, that slowdown was driven mostly by the declining growth rates of spending among younger beneficiaries. Since 2009, the growth rate of spending per beneficiary has declined for all age groups. Our findings suggest that different drivers may have been more or less important at different times within the overall slowdown period; our analysis of changes in spending patterns for different types of services provides insights into those potential factors.

V.2. Limitations of This Study

Although we have identified the Medicare services that contributed the most to changes in FFS spending for beneficiaries of different ages from 1999 to 2012, our methods do not allow us to identify the behavioral changes made by beneficiaries or providers that led to those observed spending changes.¹³ Nor do they enable us to identify or estimate the effects of changes in the payment rules for the FFS Medicare program, changes in other insurance plans, or advances in technology.

The payment rules for the FFS Medicare program have a direct effect on FFS Medicare spending through changes in the unit price and providers' responses to those price changes by adjusting the quantity of services provided; the resulting changes might or might not improve the efficiency of Medicare services. For example, Medicare reimburses hospice services on a per diem basis, regardless of the amount of services provided, so hospice providers have an incentive to enroll healthier patients with less need for services. Previous studies have noted that the number of hospices has risen substantially in recent years, particularly in the for-profit sector (Thompson, Carlson, and Bradley 2012), and we observed that there has also been a striking increase in the use of hospice care in recent years, especially among older beneficiaries. In addition, a growing percentage of those hospice patients are discharged before death, which may indicate that the payment rules might have created financial incentives that have led to inappropriate use of hospice care (Hunt et al. 2014). Conversely, the growing use of hospice services might reflect a shift to more cost-effective end-of-life care (Obermeyer et al. 2014).

Changes in other insurance plans used by elderly beneficiaries may also have affected rates of use of Medicare Parts A and B services among elderly FFS beneficiaries. For Medicare beneficiaries enrolled in Medicaid, medigap, or employer-provided supplemental insurance, a portion of their cost sharing for Medicare Parts A and B services was paid by those supplemental plans. Changes in the enrollment or generosity of those plans would have directly affected the use of Medicare services. In addition, some plans provide benefits not covered by either Medicare Part A or B. For example, since 2006, Medicare Part D has provided prescription drug benefits to Medicare beneficiaries who voluntarily enroll. Those additional benefits may have affected per-beneficiary FFS Medicare spending on Parts A and B, and the differences among age groups in the use of those additional services could have led to changes in the age profile of

¹³ Our analysis on the effects of the increase in life expectancy and FFS enrollment relies on the observed correlation between those factors and FFS Medicare spending (see Appendixes A and B); we did not identify any causal relationship.

FFS Medicare spending per beneficiary. The direction and magnitude of those effects would have depended on the substitutability and complementarity of Medicare Parts A and B services with those additional services. For example, evidence suggests that the use of prescription drugs is negatively correlated with Medicare spending on medical services (CBO 2012).

Advances in technology also may have had differential effects on the demand or supply of Medicare services for beneficiaries in different age groups. As the health of beneficiaries improves or medical procedures become less invasive, more procedures become available for treating the oldest beneficiaries. The narrowing of the gap between treatment options available to older and younger beneficiaries may have changed the age profile of Medicare spending per beneficiary.¹⁴

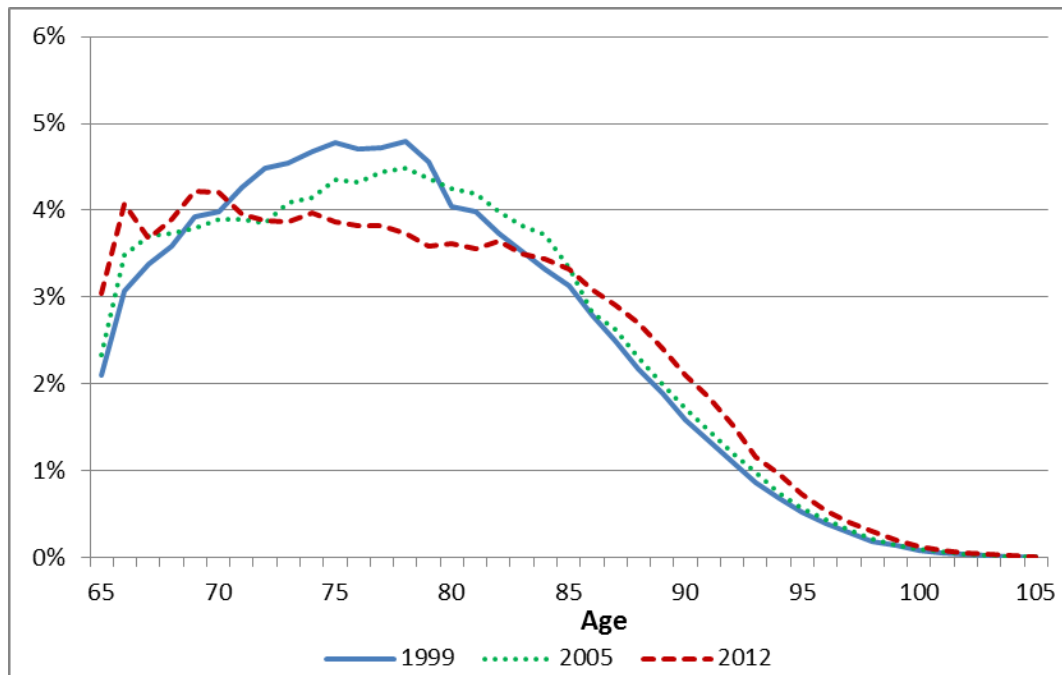
V.3. Implications for the Distribution and Projections of Medicare Spending

The shifting age profile of Medicare spending per beneficiary has implications for the distribution of aggregate Medicare spending as well as for future projections of that spending. From 1999 to 2012, the combination of the aging of the population and that shifting age profile of spending led to a growing share of Medicare spending being devoted to older beneficiaries, especially those over 85 (see Figure 9). Although the share of beneficiaries age 85 or older increased by less than 10 percent over that period, the share of aggregate spending devoted to those beneficiaries increased by almost 25 percent.

Because almost everyone age 65 or older is covered by Medicare, the aging of the population will have a significant impact on future federal spending for Medicare. Aging will also affect spending for other programs that provide benefits to the elderly population, especially Medicaid, because of its coverage of long-term care services as well as cost sharing for low-income Medicare beneficiaries. From 2015 to 2040, CBO (2015b) projects, the share of the population age 65 or older will grow from almost 15 percent to over 21 percent, and the share of the population age 85 or older will grow from almost 2 percent to nearly 4 percent. In addition, CBO (2015b, page 24) projects that aging will account for about two-fifths of the projected growth in federal spending for the major health care programs as a share of GDP between 2015 and 2040. That analysis incorporates the expectation that the age profile of spending per beneficiary will essentially retain the shape it had in 2010 over the next 25 years—that is, that in any given year, all ages will experience the same rate of growth in spending per beneficiary. That expectation about future spending growth is based on the experience from the late 1990s to the middle of the 2000s and on the most recent data from 2010 and 2012, when all age groups had similar growth rates of spending per beneficiary.

¹⁴ Sheiner (2004) presents an illustrative model of the interaction between technology and the relative spending by age.

Figure 9.
Share of Total Fee-For-Service Medicare Spending, by Age, 1999, 2005, and 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999, 2005, and 2012. For each year, the data set consists of Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year.

Box 1: Effects on CBO’s Medicare Baseline of the Changing Age Distribution of the Elderly Population

CBO projects that, under current law, net federal spending for Medicare Parts A and B will grow from \$513 billion in fiscal year 2014 to \$1,007 billion in fiscal year 2025—a cumulative increase of 87 percent and an average annual increase of 5.8 percent. Outlays for Parts A and B will grow from 2.6 percent of GDP to 3.1 percent, CBO projects (CBO 2015a).

Although much of that increase is attributable to the projected 36 percent increase in the number of Medicare enrollees, changes in the age distribution of beneficiaries also affect the rate of growth in Medicare spending. Among beneficiaries who are eligible for Medicare based on age—that is, those who are 65 or older—younger beneficiaries tend to be less expensive than older beneficiaries. From 2005 through 2014, the average age of beneficiaries who were eligible based on age declined from 75.3 years to 74.9 years. CBO projects that the average age will continue to decline through 2020, when it will reach 74.7 years, and then begin to rise. In 2025, CBO estimates, that average will be 75.0 years.

The downward shift in the age distribution of Medicare enrollees that is projected to occur through 2020 will slow the growth of Medicare spending by an average of 0.1 percentage point per year between 2014 and 2020 relative to what spending would be if the age distribution of the Medicare population stayed the same as in 2014, CBO estimates. As a result, CBO projects that Medicare spending in 2020 will be approximately \$2 billion less than it would be if the age distribution of Medicare beneficiaries was the same as it was in 2014. However, when the downward shift in the age distribution of Medicare beneficiaries reverses course in 2021, the changing age distribution will add an average of about 0.1 percentage point per year to the rate of growth in spending. In 2025, CBO estimates, changes in the age distribution will increase Medicare spending above what it would be if the distribution remained the same as it was in 2014 by approximately \$450 million—or less than 0.1 percent. Over the 2015–2025 period, the Medicare program will save a total of approximately \$19 billion because of the change in the age distribution of its enrollees over time, by CBO’s estimate.

Appendix A.

The Effects of Increases in Life Expectancy

This appendix describes the relationship between increases in life expectancy and spending per beneficiary in the fee-for-service (FFS) portion of Medicare. Between 1999 and 2012, life expectancy continued its long-standing increase. Given that average health care spending tends to increase in the last years of life, an increase in life expectancy (or, equivalently, a decline in age-specific mortality rates) could, at least theoretically, alter the age profile of Medicare spending per beneficiary. Our analysis shows, however, that the increase in life expectancy among the elderly cannot account for much of the change in the relative spending by age.

Our strategy was to determine how Medicare spending per beneficiary would have changed over time in the absence of any effect of increases in life expectancy on the composition of beneficiaries. To control for the effects of increases in life expectancy on Medicare spending, we constructed a new set of age profiles of spending in which we held age-specific mortality rates constant at their 2010 levels. We then examined how that hypothetical set of profiles changed over time.

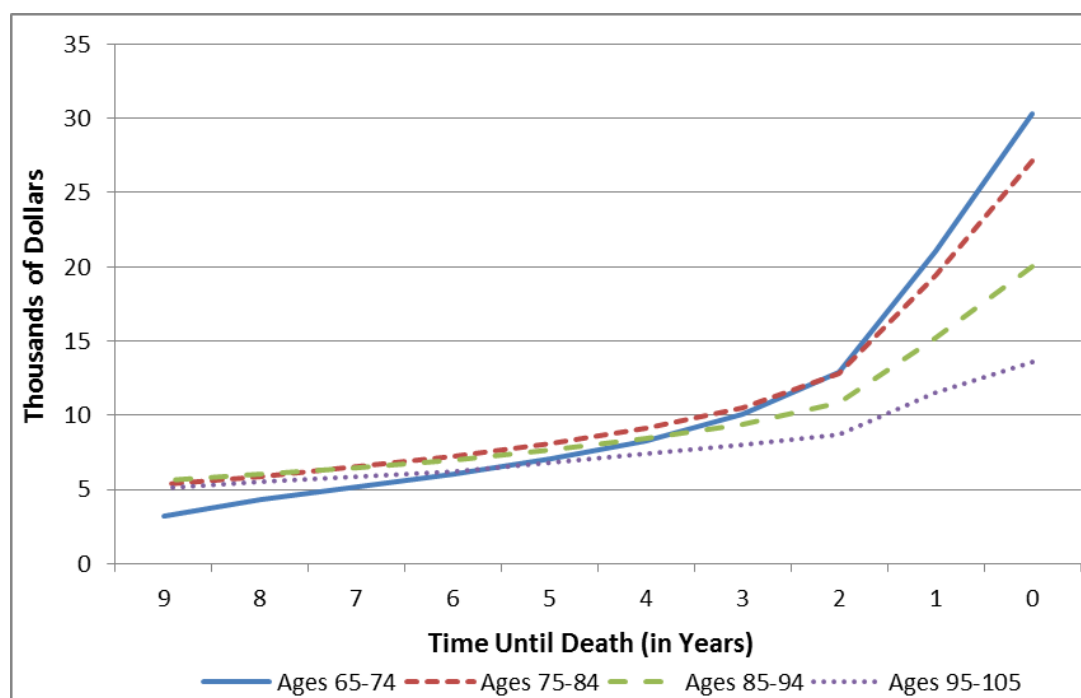
A.1. Relationship Between Life Expectancy and Spending

The relationship between life expectancy and health care spending is largely captured by the gradient of spending with respect to time until death (TUD), measured in years. By examining the composition of beneficiaries by TUD and their average spending, we captured the direct effects of increasing life expectancy on the composition of beneficiaries. Our method did not account for the effects of increasing life expectancy on relative spending by TUD. Previous empirical studies, however, have identified TUD as a strong predictor of health care spending and have found that the relationship between TUD and average health care spending was fairly stable over time in the presence of significant increases in life expectancy. For example, Miller (2001) argues that TUD is a better proxy for health status than age. In the mid-1990s, about one-quarter of all Medicare payments were made for beneficiaries in their last year of life; this result is comparable to earlier estimates using data from the mid-1970s (Hogan et al. 2001).

We used the same data set for this analysis that we used in the main text of this paper. For each year between 1999 and 2012, it includes all Medicare beneficiaries between ages 65 and 105 listed in the Master Beneficiary Summary File (MBSF) who were not enrolled in a Medicare Advantage (MA) plan at any point during the year. We used the price index for personal consumption expenditures (PCE price index) to adjust all reported Medicare spending for Parts A and B to 2009 dollars. The date of death comes from Social Security Administration (SSA) records. For those beneficiaries age 95 or older for whom that date was not provided, the last year in which spending or Part B coverage was reported for a beneficiary was presumed to be the beneficiary's year of death.

Medicare spending increases as beneficiaries approach the last year of their life, and the younger the beneficiary dies, the faster the rate of that increase is. For beneficiaries who are more than

Figure A-1.
Medicare Spending per Beneficiary, by Time Until Death, 2002



Note: The estimates are based on data from the Master Beneficiary Summary File: The spending information is based on the 2002 data, and the time until death was calculated using the linked data from 1999 to 2012. Medicare spending, which includes spending for Parts A and B, was adjusted to 2009 dollars using the price index for personal consumption expenditures. For the variable time until death, 0 indicates death in the current year, 1 indicates death in the next year, 2 indicates death in two years, and so on. The age groups are based on beneficiaries' ages at the time of death.

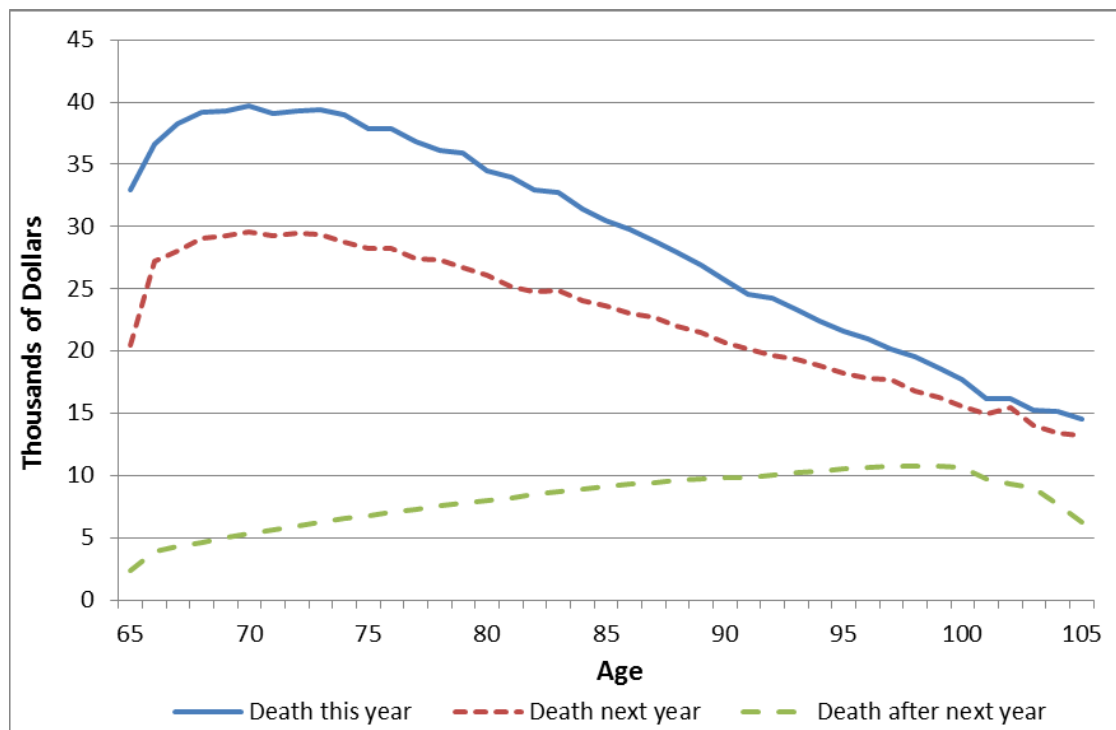
five years from death, average spending is lower for younger beneficiaries, but for those who are closer to death, the relationship between age at the time of death and spending is reversed. For example, average Medicare spending in the last year of life is about \$30,000 for beneficiaries who die between ages 65 and 74 but only about \$20,000 for those who die between ages 85 and 94. Regardless of how old beneficiaries are when they die, Medicare spending per beneficiary rises significantly between the ninth and the second years before death, and it rises at an even faster rate between that second year before death and the year of death (see Figure A-1).

We further explored the relationship between TUD and Medicare spending per beneficiary using three categories of TUD: death in the current calendar year, death in the next calendar year, and death after the next calendar year. In order to group beneficiaries into those three categories, we had to exclude the last two years for which data were available, so the data set in this section includes beneficiaries enrolled in any year between 1999 and 2010.

The age profiles of Medicare spending per beneficiary for the three TUD groups differed significantly. For those beneficiaries in their last year of life, the age profile of spending reached its peak before age 70, but for those who lived at least two more years, that profile peaked after age 90 (see Figure A-2). Because of the difference in the relative spending per beneficiary by

Figure A-2.

Real Medicare Spending per Beneficiary, by Age and by Time Until Death, 2010



Note: The estimates are based on data from the Master Beneficiary Summary File: The spending information is based on the 2010 data, and the time until death was calculated using the linked data from 1999 to 2012. Medicare spending, which includes spending for Parts A and B, was adjusted to 2009 dollars using the price index for personal consumption expenditures. The data set of elderly beneficiaries is divided into three time-until-death categories: death occurring in the current calendar year, death occurring in the next calendar year, and death occurring after the next calendar year.

TUD at any given age, changes in life expectancy, which affect the distribution of beneficiaries by TUD, would likely change the age profile of spending.

A.2 Accounting for Increases in Life Expectancy

To account for changes in the composition of beneficiaries due to rising life expectancy, the age profile of Medicare spending per beneficiary was adjusted along two dimensions: TUD and sex. The growth rate of Medicare spending between years y and y' ($y' > y$) was calculated by comparing spending per beneficiary for two groups of beneficiaries. For the first group, both the composition of beneficiaries and spending per beneficiary matched the actual data for year y . For the second, spending per beneficiary by age, sex, and TUD was the same as the first group, but the composition of beneficiaries matched that of year y' .

The age profile of Medicare spending per beneficiary in year y is expressed in the following equation, where $N_{ast}(y)$ denotes the number of Medicare beneficiaries of age a , sex s , and TUD t in year y , and $B_{ast}(y)$ denotes the Medicare spending per beneficiary of beneficiaries of age a , sex s , and TUD t in year y :

$$B_a(y) = \frac{\sum_{s,t} N_{ast}(y) * B_{ast}(y)}{\sum_{s,t} N_{ast}(y)}.$$

The age profile of spending per beneficiary in year y using the demographic composition of year y' is

$$B_a(y, y') = \frac{\sum_{s,t} N_{ast}(y') * B_{ast}(y)}{\sum_{s,t} N_{ast}(y')}.$$

The effect of increases in life expectancy between y and y' on Medicare spending per beneficiary in y is $\frac{B_a(y, y') - B_a(y)}{B_a(y)}$, or the difference in average spending between two groups of beneficiaries with the same average spending by sex and TUD at any given age but with different compositions in terms of sex and TUD.

A.3. Effects of Increases in Life Expectancy on Medicare Spending per Beneficiary

As life expectancy at age 65 increases, the share of elderly beneficiaries who die each year decreases. Because beneficiaries who are closer to death have higher average Medicare spending than beneficiaries of the same age who will live longer, increases in life expectancy would be expected to lead to an overall decline in spending per beneficiary. The data indicate that the adjustment for changes in the TUD and sex composition of beneficiaries described above decreased Medicare spending per beneficiary at younger ages and raised it at very old ages.¹⁵ The average effect of the increase in life expectancy between two consecutive years on spending at age a is given by $\frac{1}{11} \sum_{y=1999}^{2009} \frac{B_a(y, y+1) - B_a(y)}{B_a(y)}$. That average effect is generally less than 1 percent for elderly beneficiaries (see Figure A-3).

A.3.1. Effects on the Age Profile of Medicare Spending

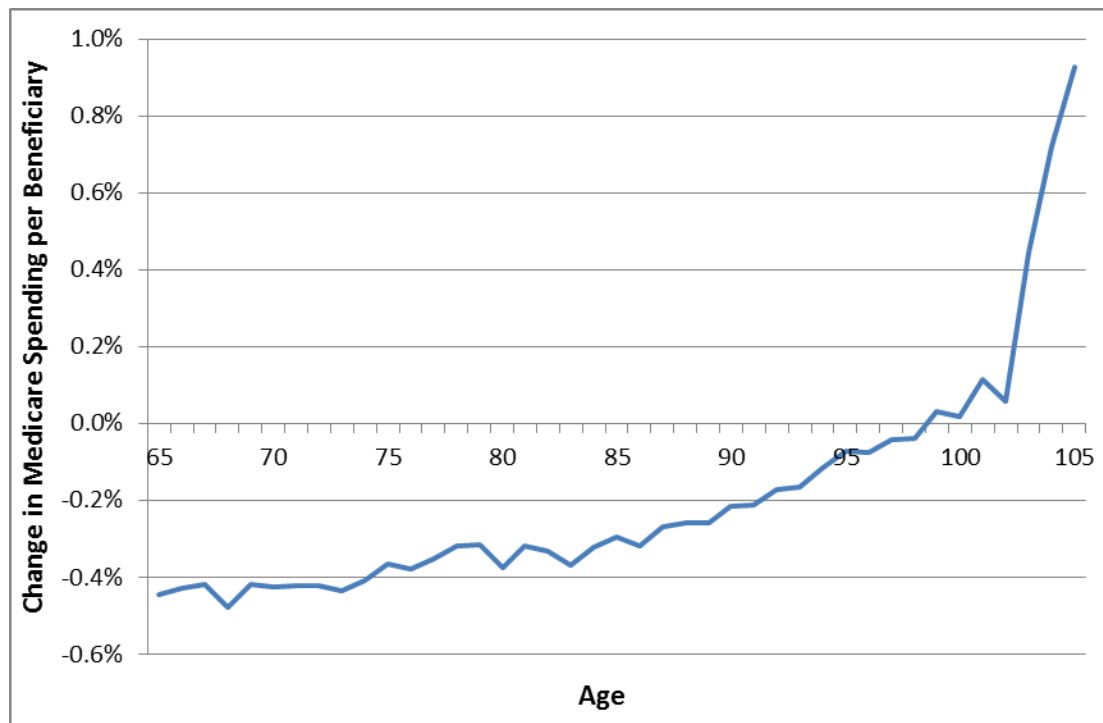
To account for increases in life expectancy over time, we constructed a new set of age profiles of spending in which we held the sex and TUD composition of FFS beneficiaries constant to reflect the 2010 composition. The new set of age profiles of spending for the years 1999 to 2010 is given by $B_a(y, 2010)$, where the notation is the same as that indicated above.

The adjustment for increases in life expectancy changed the age for which Medicare spending per beneficiary was highest in several years, but that age generally increased over the analysis period, just as it did without the adjustment. (The only decline in the adjusted profiles was from 2002 to 2003, when the age with the highest spending fell from 95 to 93.) The age with the highest adjusted spending per beneficiary increased from 89 to 96 years between 1999 and 2010 (see Figure A-4a). The range of that increase is the same as that for the unadjusted set of age

¹⁵ As life expectancy rises overall, the mortality rates for younger ages decline, and the number of deaths at older ages increases. Therefore, changes in mortality rates over time may raise Medicare spending per beneficiary at very old ages.

Figure A-3.

Effects of Increases in Life Expectancy on Medicare Spending per Beneficiary, 1999 to 2009



Note: The estimates are based on data from the Master Beneficiary Summary File: The spending information is based on the data from 1999 to 2009, and the time until death was calculated using the linked data from 1999 to 2012. To remove the effects of increases in life expectancy, the age profile of Medicare spending per beneficiary for each year was adjusted so that the composition of beneficiaries at any given age in terms of sex and of time until death was the same as in the next year. The percentage change in Medicare spending per beneficiary for each year due to increases in life expectancy was then calculated by subtracting the actual spending from the adjusted spending and dividing by the actual spending. Thus, a negative change indicates that increases in life expectancy lowered spending. The line plots the average percentage change in spending for each age over the analysis period.

profiles of spending. Also consistent with the unadjusted profiles, spending on care provided in skilled nursing facilities (SNFs) and on hospice care explained most of that increase in the age at which the age profiles of spending peaked. When we excluded spending on SNF and hospice care, the age with the highest adjusted spending per beneficiary stayed between 87 and 89 from 1999 to 2010 (see Figure A-4b).

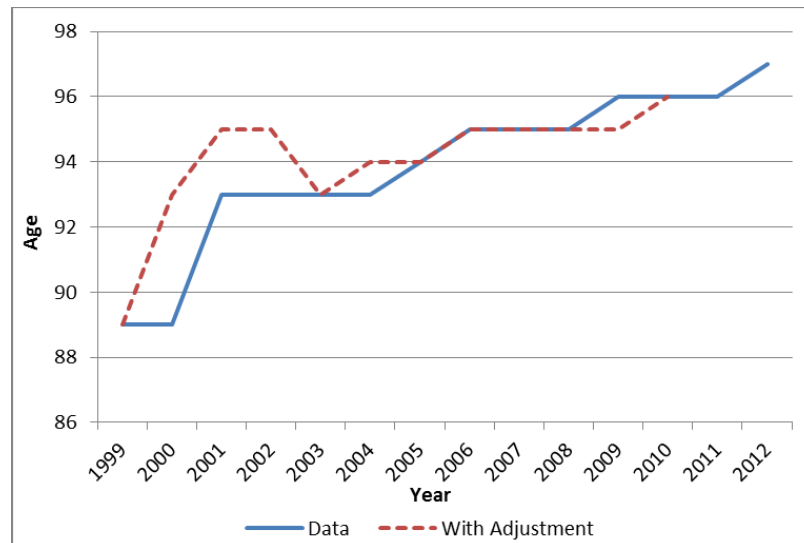
A.3.2. Effects on Spending Growth by Age Group

The patterns of changes in spending growth for different age groups were also similar before and after the adjustment to account for increases in life expectancy. Over time, increases in life expectancy lower the number of beneficiaries in the last year of their life (for whom spending is highest), so when an adjustment is made to account for the effects of increases in life expectancy, those reductions are removed, increasing the growth rate of spending. Using the series of adjusted age profiles of spending, $S_a(y, 2010)$, we calculated the average growth rate of

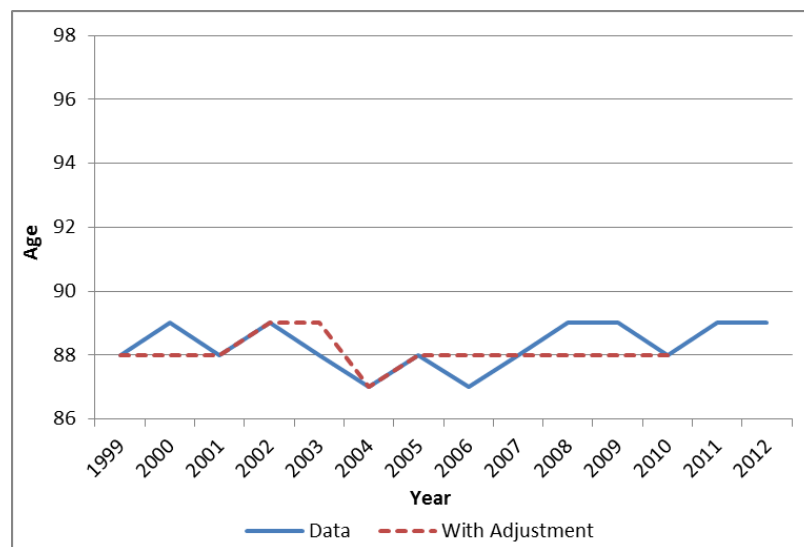
Figure A-4.

The Age for Which Medicare Spending per Beneficiary Was Highest in Each Year, With and Without Adjustment for Increases in Life Expectancy, and With and Without Care Provided in Skilled Nursing Facilities and Hospice Care, 1999 to 2012

(a) For all Parts A and B services



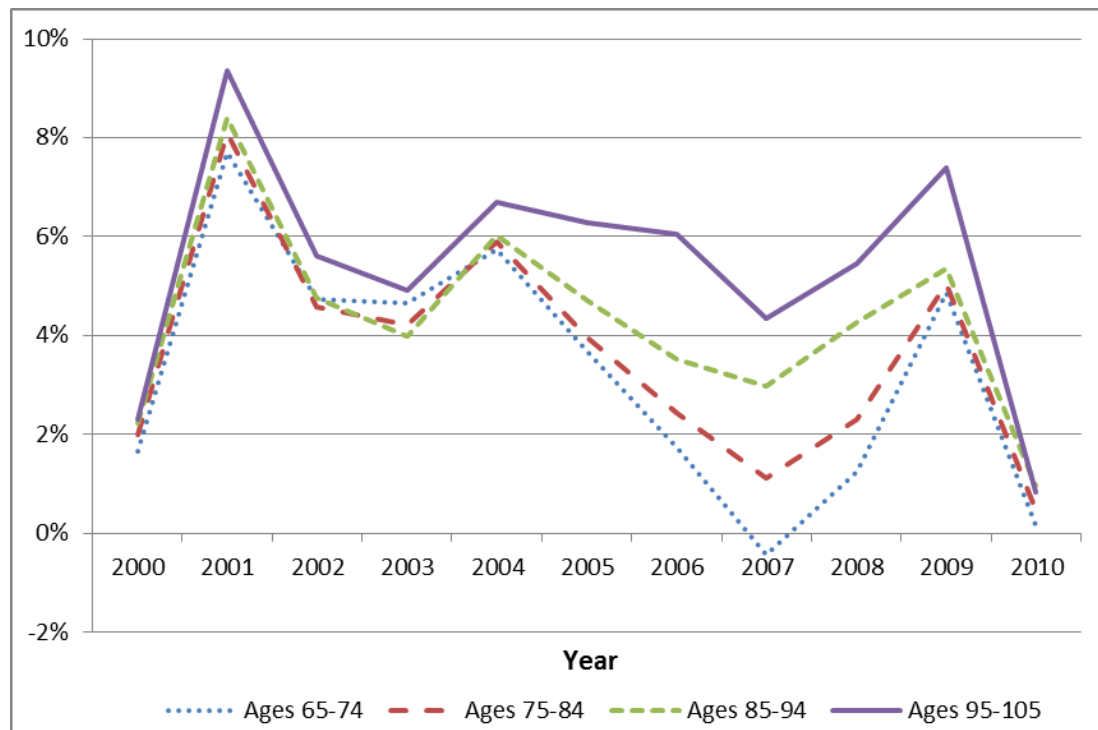
(b) Excluding SNF and hospice



Note: The estimates are based on data from the Master Beneficiary Summary File: The spending information is based on the data from 1999 to 2010, and the time until death was calculated using the linked data from 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105 who were not enrolled in a Medicare Advantage plan at any point during the year. The figures plot the age for which Medicare spending per beneficiary was highest in each year. Two sets of age profiles of spending are represented in each figure: The solid line plots the age with the highest spending from the unadjusted profiles, and the dashed line plots that age from the profiles that were adjusted to hold the composition of beneficiaries in terms of sex and time until death constant to reflect the 2010 composition. All spending was adjusted to 2009 dollars using the price index for personal consumption expenditures.

Figure A-5.

Annual Growth Rate of Medicare Spending per Beneficiary, Adjusted to Remove the Effects of Increases in Life Expectancy, 2000 to 2010



Note: The estimates are based on data from the Master Beneficiary Summary File: The spending information is based on the data from 1999 to 2010, and the time until death was calculated using the linked data from 1999 to 2012. Medicare spending, which includes spending for Parts A and B, was adjusted to 2009 dollars using the price index for personal consumption expenditures. Medicare spending per beneficiary was adjusted to hold the composition of beneficiaries in terms of sex and time until death constant to reflect the 2010 composition.

spending from 1999 to 2010 for each of the age groups: The average rate was 3.2 percent for the 65–74 age group, 3.6 percent for the 75–84 age group, 4.3 percent for the 85–94 age group, and 5.4 percent for the 95–105 age group (see Figure A–5). The corresponding rates for the unadjusted profiles were 2.5 percent, 3.4 percent, 4.0 percent, and 5.4 percent. Over the 1999–2010 period, increases in life expectancy drove up spending growth more for younger beneficiaries than for older beneficiaries, shrinking the difference in the average annual growth rate of spending per beneficiary between age groups: Whereas the difference between the average annual growth rates of the 65–74 age group and the 85–94 age group was 1.5 percent before the adjustment for increases in life expectancy, it was 1.1 percent after that adjustment. Most of the difference in spending growth between age groups could not, however, be explained by increases in life expectancy.

Appendix B.

The Effects of Selective Enrollment in Medicare Advantage

The primary objective of this appendix is to look at how changes in the composition of fee-for-service (FFS) beneficiaries brought about by changes in the FFS enrollment rate affect the age profile of FFS Medicare spending per beneficiary. After providing a brief description of the data set, this appendix estimates the differences in enrollment patterns among age groups. We then estimate the effects of changes in the likelihood of FFS enrollment on the age profile of FFS Medicare spending per beneficiary.

Medicare beneficiaries can choose to enroll in one of two types of plans: either the traditional FFS Medicare plan or a Medicare Advantage (MA) plan. The analysis in the main text focuses on FFS Medicare spending per beneficiary, which is defined as Medicare spending per beneficiary for beneficiaries who were not enrolled in an MA plan at any point during a given year. If beneficiaries who were enrolled in FFS Medicare differed in some systematic way from those who were enrolled in MA plans, changes in FFS enrollment could lead to changes in FFS Medicare spending per beneficiary—even without any change in the individual spending of FFS beneficiaries. In addition, if the extent of those changes in enrollment varied among age groups, such changes would affect the age profile of FFS spending per beneficiary.

To understand how changes in FFS enrollment might affect FFS spending per beneficiary, we estimated the difference in per-beneficiary FFS spending for enrollees in FFS Medicare and for enrollees in MA plans by comparing those individuals who switched between the two types of plans with those who stayed in the FFS plan.

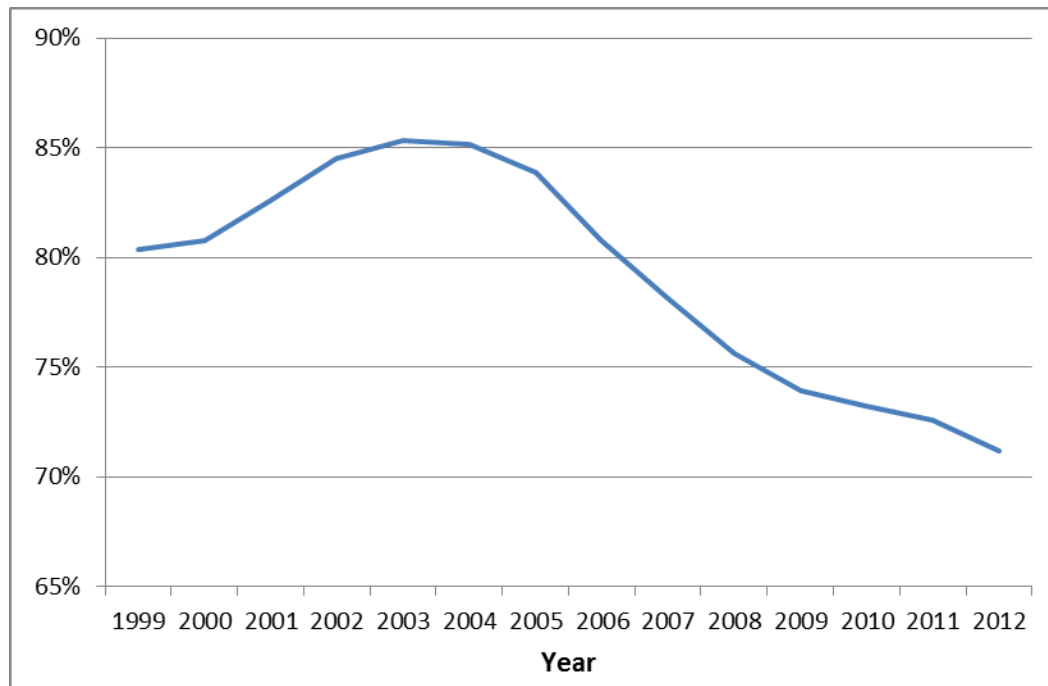
On the basis of our analysis of past enrollment and spending patterns, we estimated the effects of changes in FFS enrollment on the age profile of FFS Medicare spending per beneficiary. Our approach involved constructing a new set of age profiles of spending per beneficiary under a hypothetical scenario in which the likelihood of FFS enrollment stayed constant over time. We then examined changes in those constructed age profiles of spending over time. Our method relies on a particular set of assumptions about the expected FFS spending of MA beneficiaries to capture important differences between FFS and MA beneficiaries that have been identified in other studies. Our results suggest that changes in FFS enrollment were probably not a primary driver of changes in FFS Medicare spending per beneficiary over the 1999–2012 period.

B.1. Data Set Construction

As in the main text of this paper, this analysis uses data from the Master Beneficiary Summary File (MBSF) for the years 1999 to 2012. The MBSF data set includes all people enrolled in Medicare at any time during those years. Those beneficiaries who were not enrolled in an MA plan at any point in a given year were considered FFS beneficiaries; the rest—those with at least one month of enrollment in an MA plan—were classified as MA beneficiaries, even if they were enrolled in the FFS plan for part of the year. In calculating Medicare spending for FFS

Figure B-1.

Share of Medicare Beneficiaries Enrolled in the Fee-For-Service Plan, 1999 to 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set includes Medicare beneficiaries between ages 65 and 105. Beneficiaries were only considered fee-for-service beneficiaries if they were not enrolled in a Medicare Advantage plan at any point during the year.

beneficiaries, we included spending for Medicare Parts A and B and adjusted that spending to 2009 dollars using the price index for personal consumption expenditures.

B.2. Changes in the Age Profile of FFS Enrollment Over Time

We examined variations in the likelihood of FFS enrollment by age group from 1999 to 2012. Although previous studies have documented patterns of MA enrollment (Jacobson, Damico, et al. 2015; Jacobson, Neuman, et al. 2015), they have not focused on how those patterns varied for different age groups or how they have changed over time.¹⁶

The share of elderly beneficiaries enrolled in FFS changed significantly over the analysis period: It was about 80 percent in 1999, increased to about 85 percent in 2003 and 2004, and then began a steady decline for the next eight years, falling to just above 70 percent in 2012 (see Figure B-1). Previous studies identified several major changes to the MA program that led to those variations

¹⁶ The MA enrollment rates are higher than those reported by Jacobson, Damico, et al. (2015). That study counted beneficiaries on the basis of enrollment status in a single month (typically March) of each year; the MA data set in this study includes beneficiaries who were enrolled in an MA plan in any month of the year.

in FFS enrollment over time (Department of Health and Human Services 2014).¹⁷ Rather than identify the causes, in this appendix we estimate the effects of those changes in FFS enrollment on FFS Medicare spending per beneficiary.

The FFS enrollment rate also varies by age. The percentage of beneficiaries enrolled in the FFS plan tends to be high among beneficiaries who have just reached the Medicare eligibility age; many of those beneficiaries continue to work and have employer-sponsored health insurance with Medicare as a secondary payer. Rather than pay to enroll in an MA plan, those working beneficiaries typically enroll only in Medicare Part A, which does not require them to pay premiums. The share of FFS beneficiaries who had only Part A coverage doubled over our analysis period, from 5.5 percent in 1999 to about 11 percent in 2012. For those beneficiaries between ages 65 and 74, that share was even larger—7.5 percent in 1999 and about 16 percent in 2012.¹⁸ As more of those workers enter retirement and enroll in MA plans, the FFS enrollment rate tends to decline. Following that initial decline, the FFS enrollment rate might later rise because some enrollees might return to the FFS plan as their medical needs increase with age.

In each of the years we examined, the relationship between the FFS enrollment rate and age was negative—that is, the share of beneficiaries enrolled in FFS was lower for older beneficiaries—up to a certain age; but starting at that age, the relationship became positive—that is, the share of beneficiaries enrolled in FFS was higher for older beneficiaries (see Figure B-2). In 2012, FFS enrollment declined with age until age 71 and then began to increase, whereas in 1999 the age with the lowest share of beneficiaries in the FFS plan was 67.

The results point to a strong cohort effects in FFS enrollment. In all years analyzed, the cohort born in 1932 (which was 67 years old in 1999) had one of the lowest FFS enrollment rates. Although in 1999 the FFS enrollment rate rose immediately after reaching its lowest point at age 67, in 2012 the enrollment rate remained relatively low between ages 70 and 80 (the age of the 1932 cohort).

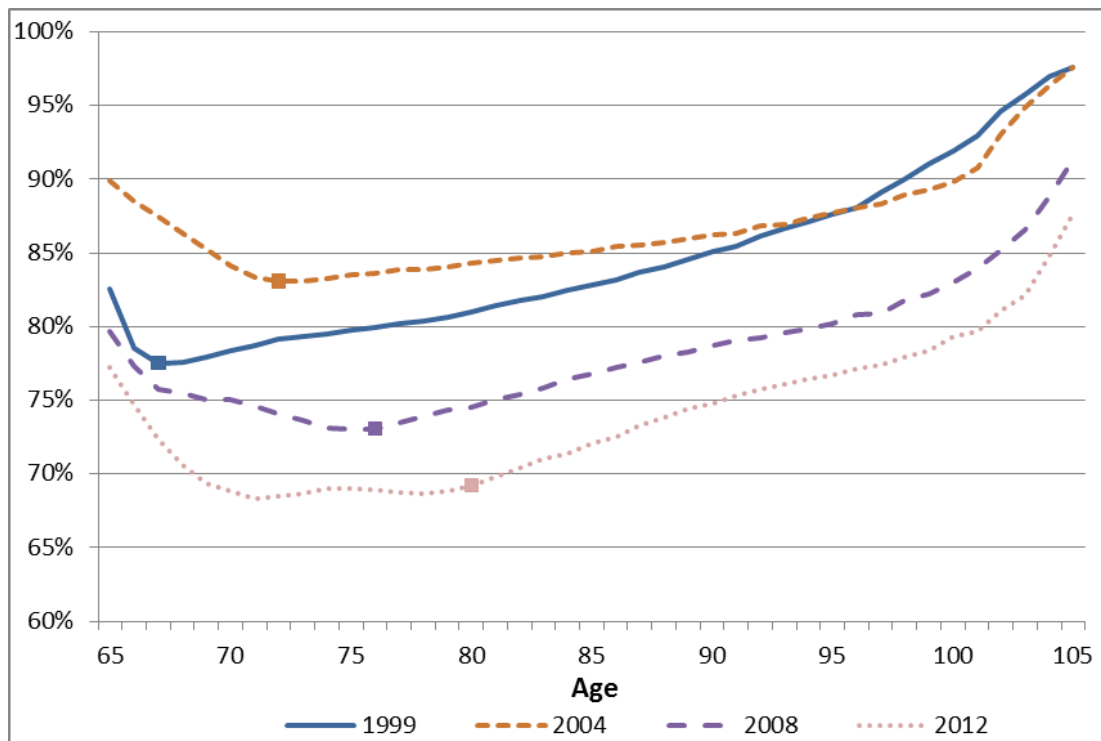
Changes in the rate of FFS enrollment were driven by a combination of changes in the initial FFS enrollment decision at age 65 and changes in the rates of switching between the FFS plan and MA plans after age 65. The initial FFS enrollment rate—that is, the FFS enrollment rate among 65-year-olds who are newly eligible for enrollment—varied over time (see Figure B-3).

¹⁷ Several provisions in the Balanced Budget Act of 1997 (BBA) and the Benefits Improvement and Protection Act of 2000 effectively reduced MA plan payment rates during a period of fast growth in health care costs. Those changes led to a decline in private plan participation and MA enrollment between 1999 and 2004. The Medicare Prescription Drug, Improvement, and Modernization Act of 2003 increased MA plan payment rates, so MA enrollment started to rise again in 2005. An increase in the number of private fee-for-service (PFFS) plans, which were established under the BBA, also contributed to that rise in MA enrollment. But the growth of PFFS plans was slowed, and the rise in MA enrollment dampened, by the Medicare Improvements for Patients and Providers Act of 2008, which included a provision that required most PFFS plans to develop written provider contracts rather than rely on the provider network of FFS Medicare.

¹⁸ These estimates are based on the enrollment information as of July 1 in each year published by the Centers for Medicare and Medicaid Services (CMS) in the annual *Medicare and Medicaid Statistical Supplement* for the years 2001 to 2013 (<http://go.usa.gov/3BsUj>).

Figure B-2.

Share of Medicare Beneficiaries Enrolled in the Fee-For-Service Plan, by Age, 1999, 2004, 2008, and 2012

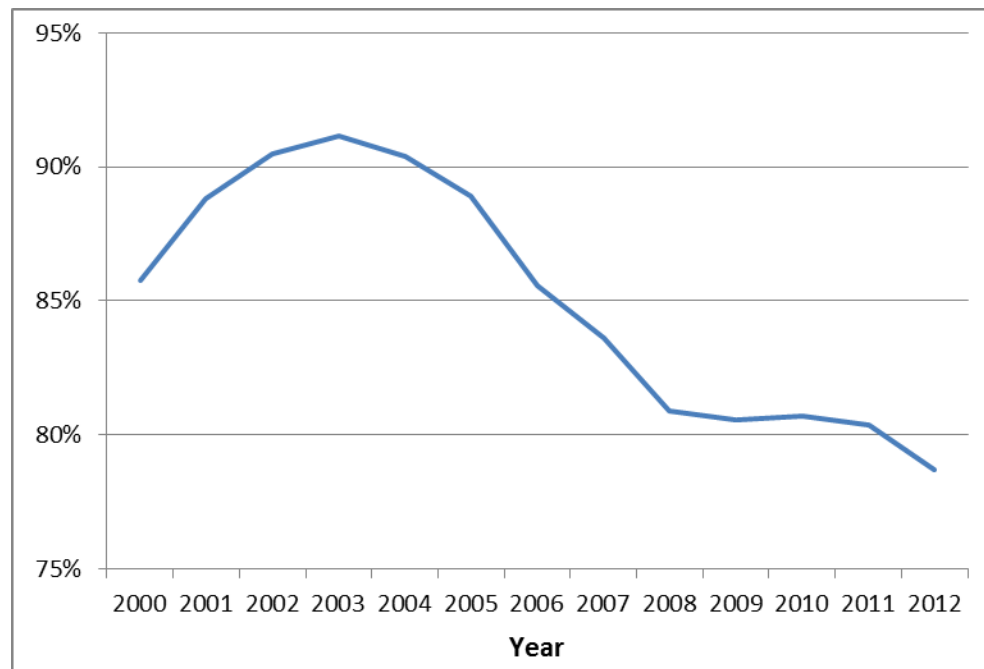


Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. For each year, the data set consists of Medicare beneficiaries between ages 65 and 105. Beneficiaries were only considered fee-for-service beneficiaries if they were not enrolled in a Medicare Advantage plan at any point during the year. The markers indicate the age of the 1932 birth cohort in each of the years plotted: 67 in 1999, 72 in 2004, 76 in 2008, and 80 in 2012.

The initial FFS enrollment rate was about 85 percent in 1999 and peaked at just above 90 percent in 2003; after declining for a few years, in 2008 that rate began to stabilize at around 80 percent before dropping again between 2011 and 2012. The graph of the initial FFS enrollment rate over the analysis period generally tracks that of the overall FFS enrollment rate among elderly beneficiaries (see Figure B-1).

For other continuously enrolled Medicare beneficiaries, the percentage of FFS enrollees each year who switched to an MA plan the following year increased rapidly from 2002 to 2005 and then declined steadily starting in 2007 (see Figure B-4a). The share of MA enrollees who switched to the FFS plan the following year declined sharply between 2001 and 2004 and then stabilized through the end of the analysis period (see Figure B-4b). Younger beneficiaries tended to switch plans at higher rates. Despite the differences in magnitude, the rates of switching between plan types for all age groups followed a similar pattern over time.

Figure B-3.
Share of New 65-Year-Old Medicare Beneficiaries Enrolled in the Fee-For-Service Plan,
2000 to 2012



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. Beneficiaries were only considered fee-for-service beneficiaries if they were not enrolled in a Medicare Advantage plan at any point during the year.

B.3. Changes in Medicare Spending by Enrollment Pattern and by Age Group Over Time

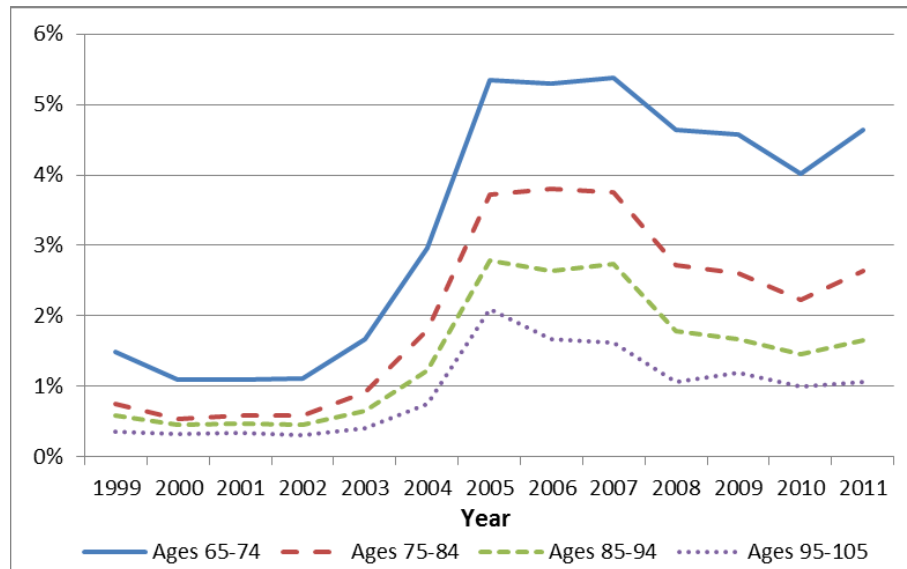
If FFS enrollees differed from MA enrollees in ways that affected their spending and if those differences varied among age groups over time, then changes in FFS enrollment patterns could lead to changes in the age profile of FFS spending per beneficiary. To see how FFS enrollees might differ from MA enrollees in their expected FFS spending, we compared the Medicare spending for FFS beneficiaries who stayed in the FFS plan with spending for FFS beneficiaries who switched to an MA plan the following year. If MA plans attracted or selected less expensive beneficiaries, FFS beneficiaries who switched to an MA plan the following year would likely spend less than those who stayed in the FFS program. We also compared spending for FFS beneficiaries who were enrolled in the FFS plan in the previous year with FFS beneficiaries who were enrolled in an MA plan in the previous year.¹⁹

¹⁹ The CMS hierarchical condition categories (CMS-HCC) model was implemented in 2004 to adjust MA payment rates with more appropriate measures of expected cost to MA plans. Previous studies disagree on the effects of the new model on the selection into MA plans. This analysis focuses on the time variation in selection patterns by age and how it affects FFS Medicare spending per beneficiary.

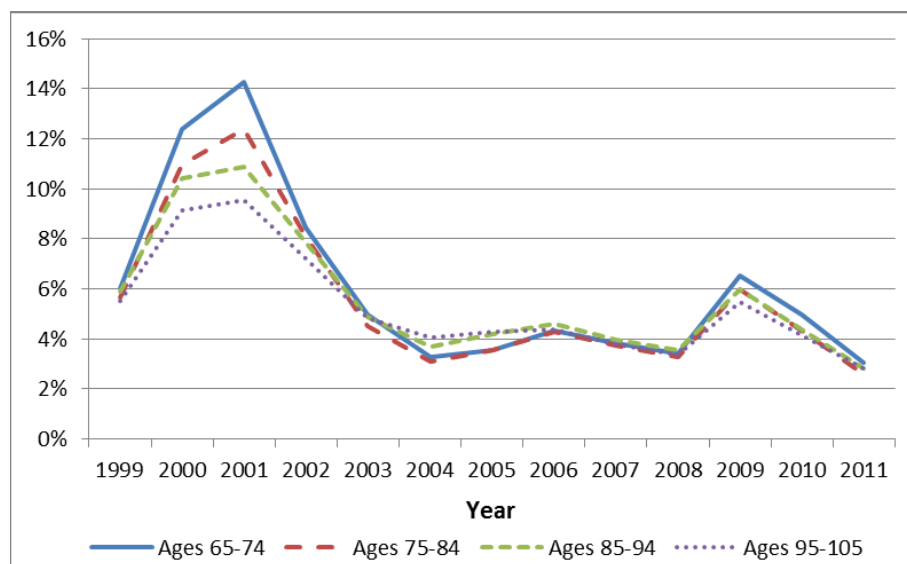
Figure B-4.

Rates of Switching Between the Fee-For-Service Plan and a Medicare Advantage Plan, by Age Group, 1999 to 2012

(a) Share of FFS beneficiaries who enrolled in an MA plan the following year



(b) Share of MA beneficiaries who enrolled in the FFS plan the following year



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. Beneficiaries were only considered fee-for-service beneficiaries if they were not enrolled in a Medicare Advantage plan at any point during the year.

Other studies have used the same identification strategy to compare the beneficiaries enrolled in the FFS plan with those enrolled in MA plans. As Newhouse and McGuire (2014) noted in their review of the literature, such an identification strategy relies on a small sample of beneficiaries who switch between the FFS plan and MA plans.

Most beneficiaries do not switch between the FFS plan and MA plans. Over the 14-year period from 1999 to 2012, about 80 percent of beneficiaries who were between ages 65 and 105 in 1999 never switched between the FFS plan and an MA plan. Of the remaining beneficiaries, the overwhelming majority switched their enrollment between the two types of plans only once (from the FFS plan to an MA plan or vice versa) or twice (from FFS to MA and back to FFS, or from MA to FFS and back to MA). Only 1 percent of all Medicare beneficiaries switched between the two types of plans more than twice. This issue of small sample size is especially pronounced for older beneficiaries, who tend to switch plans at lower rates than younger beneficiaries (see Figure B-4). The following analysis of the effects on FFS spending of beneficiaries' enrollment decisions focuses on beneficiaries between ages 65 and 94.

In all years of our analysis period, FFS beneficiaries who enrolled in an MA plan the following year ("future MA enrollees") tended to spend less than FFS beneficiaries who stayed in FFS ("FFS stayers"). The vertical axis of Figure B-5a shows the ratio of Medicare spending for future MA enrollees to spending for FFS stayers in the year before the switch. The differences in spending between the two groups varied by age group and changed over time.

Our results generally confirm the well-documented tendency of Medicare beneficiaries with lower expected FFS spending to enroll in MA plans, a tendency often referred to in the literature as favorable selection (Schone and Brown 2013). In 1999, such favorable selection into MA plans was more evident among younger beneficiaries than older ones. For beneficiaries ages 65 to 74, spending for those who enrolled in an MA plan the following year was about 60 percent of spending for those who stayed in the FFS plan. Selection into MA was considerably less favorable for beneficiaries ages 75 to 84 and slightly unfavorable for those ages 85 to 94. The difference in the degree of favorable selection in MA enrollment between age groups narrowed between 2001 and 2005 but began to grow again in 2006. In 2011, the end of the analysis period, the degree of favorable selection was still greater for younger elderly beneficiaries, but the magnitude of the difference between age groups was smaller than in 1999.

What about those who left an MA plan for the FFS plan? The vertical axis of Figure B-5b shows the ratio of FFS Medicare spending for beneficiaries who were in an MA plan in the previous year ("MA leavers") to such spending for those beneficiaries who were in the FFS plan both years ("FFS stayers"). FFS beneficiaries who were enrolled in an MA plan in the previous year tended to spend more than the FFS beneficiaries who were enrolled in the FFS plan in the previous year. That difference in spending generally increased over the analysis period, and it was greater for younger beneficiaries than for older ones.

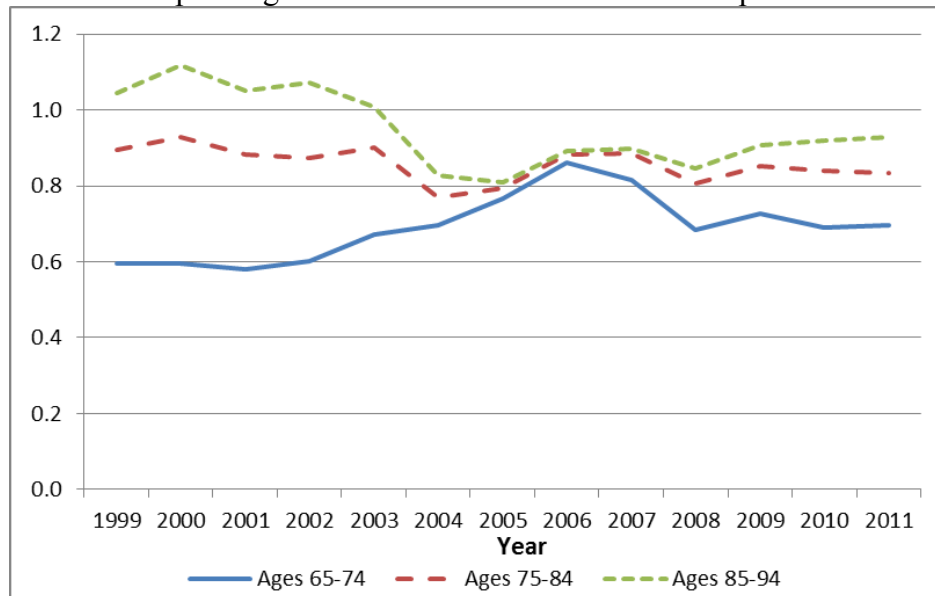
B.4. Effects of Enrollment Patterns on FFS Medicare Spending Per Beneficiary

The observed trends in the FFS enrollment decisions for different age groups might partly explain the divergence in FFS spending growth for those age groups. From 2004 to 2008, the growth rate of spending for younger beneficiaries was slower than that of spending for older beneficiaries. If selective MA enrollment alone explained the observed spending patterns, we would expect that favorable selection in MA enrollment would decline starting in 2004, resulting in a healthier pool of younger FFS beneficiaries. In our data set, the degree of favorable selection

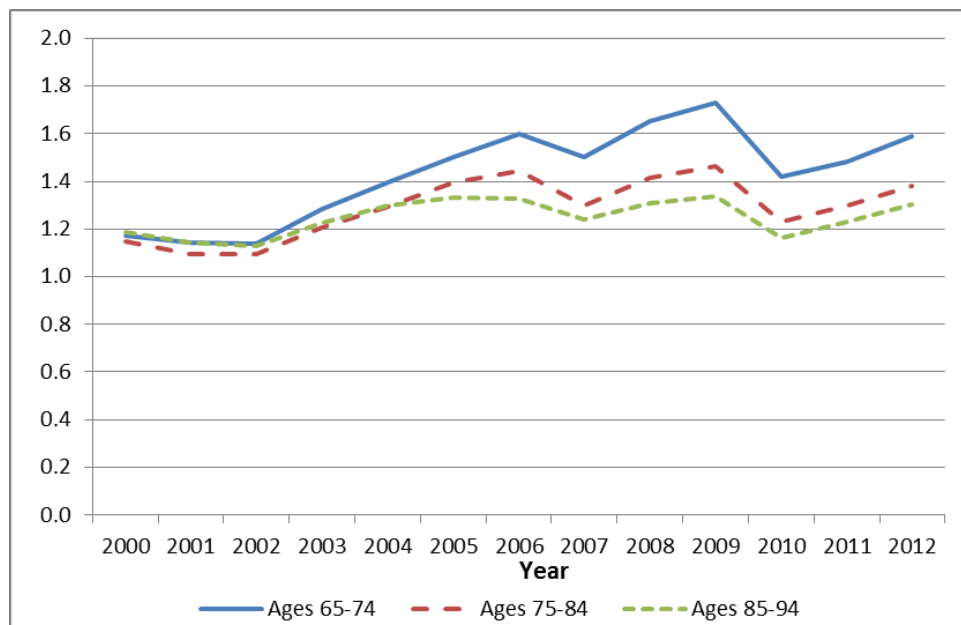
Figure B-5.

Comparison of Spending for Beneficiaries Who Switched Between the Two Types of Medicare Plans With Spending for Those Who Remained Continuously Enrolled in the Fee-For-Service Plan

(a) Ratio of spending for FFS beneficiaries who enrolled in an MA plan the following year to spending for those who remained in the FFS plan



(b) Ratio of spending for FFS beneficiaries who were enrolled in an MA plan in the previous year to spending for FFS beneficiaries who were in the FFS plan in the previous year



Note: The estimates are based on data from the Master Beneficiary Summary File for the years 1999 to 2012. Beneficiaries were only considered fee-for-service beneficiaries if they were not enrolled in a Medicare Advantage plan at any point during the year. We excluded from our analysis the 95–105 age group because it included very few beneficiaries who switched between the FFS plan and an MA plan and thus provided an insufficient sample size.

into MA plans declined rapidly for younger beneficiaries between 2002 and 2005; that decline was followed by an increase in favorable selection from 2006 to 2008 (see Figure B-5a). The patterns of selection into MA plans are consistent with the slower growth in FFS spending for younger beneficiaries.

Changes in the number and characteristics of MA enrollees were probably not, however, the primary driver of the differences in spending growth for different age groups. We estimated the effects of changes in FFS enrollment on spending per beneficiary by constructing a hypothetical scenario for Medicare plan selection that leads to a constant FFS enrollment rate over time and by imputing Medicare spending for MA enrollees who would be FFS enrollees under that scenario.

B.4.1. Effects on Spending Growth by Age Group

We used detailed year-to-year rates of switching between the two types of Medicare plans and average spending for beneficiaries who switched from FFS to MA and for those who switched from MA to FFS to study the effects of changes in FFS enrollment on annual spending growth by age group. The annual spending growth adjusted for changes in the FFS enrollment rate in a given year is the growth between the actual spending per beneficiary in the previous year and the hypothetical spending per beneficiary in that year. Under the hypothetical scenario, beneficiaries remain in their MA or FFS plan in consecutive years (that is, those who switched from the FFS plan to an MA plan are counted among FFS beneficiaries in the second year, and those who changed their enrollment from an MA plan to the FFS plan are counted among the MA beneficiaries in the second year). A certain percentage of newly eligible beneficiaries are assigned to the FFS plan to keep the overall FFS enrollment rate constant between the two years. To calculate the spending per beneficiary in the second year for the beneficiaries under the hypothetical scenario, we used the observed spending for FFS stayers and ascribed spending to those who were actually MA enrollees in the second year by multiplying the ratio of FFS spending for future MA enrollees to FFS stayers in the first year by the average spending per beneficiary of FFS stayers in the second year.²⁰ The adjustment was made for each age for each year in the data set such that all parameters used in the adjustment were age-specific.

Our adjustment for changes in FFS enrollment actually widened the average difference in annual spending growth between age groups over the 1999–2012 period. Under the hypothetical scenario, the average annual growth rates over the period were 0.0 percent for the 65–74 age

²⁰ We used a similar method to estimate average spending for new FFS beneficiaries in the second year. If the hypothetical case generated the same number of new FFS enrollees as in the actual data for the second year, the observed average spending for new FFS enrollees in the second year was ascribed to the new FFS enrollees. If the number of hypothetical new FFS beneficiaries was greater than the number in the actual data, we ascribed spending to those additional FFS beneficiaries by multiplying the ratio of FFS spending for future MA enrollees to spending for FFS stayers in the first year by the actual average spending per beneficiary for FFS stayers in the second year because they would actually have enrolled in an MA plan. In the case that the number of hypothetical new FFS beneficiaries was less than the actual number, we ascribed expected FFS spending to those additional MA beneficiaries by multiplying the ratio of FFS spending for MA leavers to spending for FFS stayers in the second year by the actual average spending per beneficiary of FFS stayers in the second year. To calculate the FFS spending per beneficiary under the hypothetical scenario, we included the spending for those additional FFS beneficiaries and removed the expected FFS spending for those additional MA beneficiaries.

group, 1.8 percent for the 75–84 age group, and 2.7 percent for the 85–94 age group; the average annual growth rates based on the unadjusted data set were 1.8 percent, 2.6 percent, and 3.2 percent. The rates of spending growth are lower under the hypothetical scenario because it does not allow switching from MA plans to the FFS plan, which tends to introduce more expensive beneficiaries into the group of FFS beneficiaries (see Figure B-5a). The widening of the difference between growth rates for different ages was driven mostly by enrollment patterns at the beginning and end of our analysis period. That result is consistent with our observation of larger differences in the degree of favorable selection between age groups at the beginning and end of our analysis period (see Figure B-5). For a group with a greater degree of favorable selection into MA, our adjustment method would slow the rate of FFS spending growth by either including FFS beneficiaries with lower expected FFS spending (if the FFS enrollment rate declined over time) or excluding beneficiaries with higher expected FFS spending (if the FFS enrollment rate increased over time) in the second year. Because the degree of favorable selection was greater for younger beneficiaries, the adjustment for changes in FFS enrollment led to even slower growth in FFS spending for younger beneficiaries than for older beneficiaries.

Even after we made the adjustment to account for changes in FFS enrollment, the conclusion we stated in the main text continues to hold: The growth in spending per beneficiary from 1999 to 2012 was faster for older beneficiaries. The year-to-year variation in the growth rate of spending per beneficiary under the hypothetical scenario follows a pattern very similar to that of the growth rate of spending for actual FFS beneficiaries.

B.4.2. Effects on the Shift in the Age Profile of Spending

To study the effects of changes in FFS enrollment rates on the age profile of FFS spending over multiple years, we used the variations in annual FFS enrollment rates by age and in average spending by switching pattern. Under the hypothetical scenario, the FFS enrollment rates for all ages remain at their 1999 levels from 2000 through 2012.

We constructed hypothetical age profiles of spending to examine how the age profile of spending per beneficiary would change over time under that scenario. If the FFS enrollment rate declined between 1999 and the year of interest, we estimated the expected average spending for the additional FFS enrollees under the hypothetical scenario by multiplying the average FFS spending for beneficiaries who stayed in FFS by the ratio of FFS spending for future MA enrollees to FFS stayers. If, instead, the FFS enrollment rate was higher in a given year than in 1999, we estimated the expected FFS spending of the additional MA enrollees under the hypothetical scenario by multiplying the average spending for FFS beneficiaries who stayed in FFS by the ratio of FFS spending for MA leavers to FFS stayers. To calculate the FFS spending per beneficiary under that hypothetical scenario, we included the spending for the additional FFS beneficiaries and removed the expected FFS spending for the additional MA beneficiaries.²¹

The above adjustment, which was specific to each age, had very little effect on the age profile of spending per beneficiary at older ages. Under the hypothetical scenario in which the share of

²¹ For each set of consecutive years, we estimated the ratio of spending for future MA enrollees to spending for FFS stayers and the ratio of spending for MA leavers to spending for FFS stayers. In the actual calculation of expected FFS spending under the hypothetical scenario, we used the average of those annual ratios between 1999 and 2012.

Medicare beneficiaries enrolled in the FFS plan remained at the 1999 level, the age for which Medicare spending per beneficiary is highest is almost identical to the actual data. The only deviation from the actual data is that the age with the highest spending per beneficiary is one year older under the hypothetical scenario in 2010. The rightward shift in the age profile of spending that we identified in the main text is still present under the hypothetical scenario. In addition, if we adjust the spending per beneficiary on care provided in skilled nursing facilities (SNFs) and on hospice care for changes in FFS enrollment using the method we have described in this appendix, we would reach the same conclusion: Changes in spending on SNF care and on hospice care explain most of the increase in the age for which Medicare spending per beneficiary is highest. The small effect of changes in FFS enrollment on our conclusions can be attributed to two factors: the smaller change in FFS enrollment rates over time among older ages than among younger ages (see Figure B-2) and the lesser degree of favorable selection into MA plans at older ages (see Figure B-5).

References

Alemayehu, Berhanu, and Kenneth E. Warner. 2004. "The Lifetime Distribution of Health Care Costs." *Health Services Research* 39 (3): 627–642.

CBO (Congressional Budget Office). 2012. *Offsetting Effects of Prescription Drug Use on Medicare's Spending for Medical Services*. www.cbo.gov/publication/43741.

———. 2015a. *Updated Budget Projections: 2015 to 2025*. www.cbo.gov/publication/49973.

———. 2015b. *The 2015 Long-Term Budget Outlook*. www.cbo.gov/publication/50250.

CMS (Centers for Medicare and Medicaid Services). 2011–2013. *Medicare and Medicaid Statistical Supplement*. <http://go.usa.gov/3BsUj>.

Crimmins, Eileen M., and Hiram Beltrán-Sánchez. 2011. "Mortality and Morbidity Trends: Is There Compression of Morbidity?" *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 66 (1): 75–86.

Cutler, David M., Kaushik Ghosh, and Mary Beth Landrum. 2013. "Evidence for Significant Compression of Morbidity in the Elderly U.S. Population." Working Paper 19268. National Bureau of Economic Research. www.nber.org/papers/w19268.

Cutler, David M., and Ellen Meara. 1998. "The Medical Costs of the Young and Old: A Forty-Year Perspective." In David Wise, ed., *Frontiers in the Economics of Aging*, pp. 215–246. Chicago: University of Chicago Press. <http://papers.nber.org/books/wise98-1>.

———. 2001. "The Concentration of Medical Spending: An Update." In David Wise, ed., *Themes in the Economics of Aging*, pp. 217–240. Chicago: University of Chicago Press. <http://papers.nber.org/books/wise01-1>.

Cutler, David M., and Louise Sheiner. 2000. "Generational Aspects of Medicare." *American Economic Review* 90 (2): 303–307.

Department of Health and Human Services, Office of the Assistant Secretary of Planning and Evaluation. 2014. *The Medicare Advantage Program in 2014*. ASPE Issue Brief, April 7. <http://go.usa.gov/3sWaA>.

Freedman, Vicki A., Linda G. Martin, and Robert F. Schoeni. 2002. "Recent Trends in Disability and Functioning among Older Adults in the United States: A Systematic Review." *Journal of the American Medical Association* 288 (24): 3137–3146.

Fries, James F., Bonnie Bruce, and Eliza Chakravarty. 2011. "Compression of Morbidity 1980–2011: A Focused Review of Paradigms and Progress." *Journal of Aging Research* 2011: 1–10.

Gruenberg, Ernest M. (1977) 2005. "The Failures of Success." *Milbank Quarterly* 83 (4): 779–800.

Hogan, Christopher, June Lunney, Jon Gabel, and Joanne Lynn. 2001. "Medicare Beneficiaries' Costs of Care in the Last Year of Life." *Health Affairs* 20 (4): 188–195.

Hunt, Meaghan, Michael E. Rezaee, Jeremy Luallen, Allyssa Pozniak, Jesse Gerteis, Alrick Edwards, Bethany Bradshaw, Alan White, Henry Goldberg, and Michael Plotzke. 2014. *Medicare Hospice Payment Reform: A Review of the Literature (2013 Update)*. Prepared by Abt Associates for the Centers for Medicare and Medicaid Services. <http://go.usa.gov/3B8jR> (PDF, 814 KB).

Jacobson, Gretchen, Anthony Damico, Tricia Neuman, and Marsha Gold. 2015. *Medicare Advantage 2015 Spotlight: Enrollment Market Update*. Issue Brief. Henry J. Kaiser Family Foundation. <http://tinyurl.com/qd5ccgd>.

Jacobson, Gretchen, Patricia Neuman, and Anthony Damico. 2015. "At Least Half of New Medicare Advantage Enrollees Had Switched From Traditional Medicare During 2006–11." *Health Affairs* 34 (1): 48–55.

Keehan, Sean P., Helen C. Lazenby, Mark A. Zezza, and Aaron C. Catlin. 2004. "Age Estimates in the National Health Accounts." *Health Care Financing Review* 26 (2): 1–16.

Kestenbaum, Bert, and B. René Ferguson. 2006. "The Number of Centenarians in the United States on January 1, 1990, 2000, and 2010 Based on Improved Medicare Data." *North American Actuarial Journal* 10 (3): 1–6.

Lassman, David, Micah Hartman, Benjamin Washington, Kimberly Andrews, and Aaron Catlin. 2014. "US Health Spending Trends by Age and Gender: Selected Years 2002–10." *Health Affairs* 33 (5): 815–822.

Levine, Michael, and Melinda Buntin (2013). *Why Has Growth in Spending for Fee-for-Service Medicare Slowed?* Working Paper 2013-6. Congressional Budget Office. www.cbo.gov/publication/44513.

Lubitz, James, Linda G. Greenberg, Yelena Gorina, Lynne Wartzman, and David Gibson. 2001. "Three Decades of Health Care Use by the Elderly, 1965–1998." *Health Affairs* 20 (2): 19–32.

Meara, Ellen, Chapin White, and David M. Cutler. 2004. "Trends in Medical Spending by Age, 1963–2000." *Health Affairs* 23 (4): 176–183.

Miller, Tim. 2001. "Increasing Longevity and Medicare Expenditures." *Demography* 38 (2): 215–226.

Neuman, Patricia, Juliette Cubanski, and Anthony Damico. 2015. "Medicare per Capita Spending by Age and Service: New Data Highlights Oldest Beneficiaries." *Health Affairs* 34 (2): 335–339.

Newhouse, Joseph P., and Thomas G. McGuire. 2014. "How Successful Is Medicare Advantage?" *Milbank Quarterly* 92 (2): 351–394.

Obermeyer, Ziad, Maggie Makar, Samer Abujaber, Francesca Dominici, Susan Block, and David M. Cutler. 2014. "Association Between the Medicare Hospice Benefit and Health Care Utilization and Costs for Patients with Poor-Prognosis Cancer." *Journal of the American Medical Association* 312 (18): 1888–1896.

ResDAC (Research Data Assistance Center). 2011. *Medicare Managed Care Enrollees and the Medicare Utilization Files*. Updated June 1, 2011. www.resdac.org/resconnect/articles/114.

———. 2012. "Sources and Use of Medicare Enrollment Information" (video presentation by Beth Virnig, October 15, 2012). www.resdac.org/training/workshops/intro-medicare/media/3.

Riley, Gerald F., and James D. Lubitz. 2010. "Long-Term Trends in Medicare Payments in the Last Year of Life." *Health Services Research* 45 (2): 565–576.

Roehrig, Charles S., and David M. Rousseau. 2001. "The Growth in Cost per Case Explains Far More of US Health Spending Increases Than Rising Disease Prevalence." *Health Affairs* 30 (9): 1657–1663.

Schone, Eric, and Randall S. Brown. 2013. *Risk Adjustment: What Is the Current State of the Art, and How Can It Be Improved?* Research Synthesis Report 25. Robert Wood Johnson Foundation. <http://tinyurl.com/ote8bm5>.

Seeman, Teresa E., Sharon S. Merkin, Eileen M. Crimmins, and Arun S. Karlamangla. 2010. "Disability Trends Among Older Americans: National Health and Nutrition Examination Surveys, 1988–1994 and 1999–2004." *American Journal of Public Health* 100 (1): 100–107.

Sheiner, Louise. 2004. *The Effects of Technology on the Age Distribution of Health Spending: A Cross-Country Perspective*. Finance and Economics Discussion Series Working Paper 2004-14. Federal Reserve Board. <http://go.usa.gov/3KkNH>.

Steuerle, C. Eugene, and Caleb Quakenbush. 2015. *Social Security and Medicare Lifetime Benefits and Taxes*. <http://tinyurl.com/njsu8uv>.

Thompson, Jennifer W., Melissa D. A. Carlson, and Elizabeth H. Bradley. 2012. "US Hospice Industry Experienced Considerable Turbulence From Changes in Ownership, Growth, and Shift to For-Profit Status." *Health Affairs* 31 (6): 1286–1293.

Thorpe, Kenneth E. 2013. "'Treated Disease Prevalence and Spending per Treated Case Drove Most of the Growth in Health Care Spending in 1987–2009.'" *Health Affairs* 32 (5): 851–858.

Yamamoto, Dale H. 2013. *Health Care Costs—From Birth to Death*. Health Care Cost Institute Independent Report Series No. 2013-1. Washington, D.C.: Society of Actuaries. www.healthcostinstitute.org/SOA-1-2013.