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Explaining the Slowdown in Medical Spending Growth in the Elderly Population

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Abstract

We examined trends in per-capita spending for Medicare beneficiaries age 65 and over in the United States in 1999–2012 to determine why spending growth has declined over time. The reduction in spending growth began around 2005. Decomposing spending by condition, we found that half of the spending slowdown was attributable to slower growth of spending for cardiovascular disease. Spending growth also slowed for dementia, renal and genitourinary disease, and after care for people with acute illnesses. Using estimates in the medical literature of the impact of pharmaceuticals on acute disease, we found that roughly half of the reduction in major cardiovascular events can be attributed to drugs to control cardiovascular risk factors. Despite this significant slowdown in cardiovascular diseases, additional opportunities remain in efforts to lower spending through disease prevention.

The slowdown in the growth of medical spending for the elderly is one of the most important health care facts of the past decade. Between 1992 and 2004, Medicare spending per beneficiary grew by 3.8 percent annually, adjusted for economy-wide inflation. Since 2005, the growth rate has been 1.1 percent (data from figure 1).

The slowdown in Medicare cost growth is not a reflection of the rapid enrollment growth of younger beneficiaries, nor is it concentrated in a small set of service items.¹ The slowdown has been most pronounced among beneficiaries with chronic conditions.^{2,3} However, there is little understanding as to the reasons for this.

This paper examines the spending slowdown by medical condition. We divide medical spending for the elderly into 78 clinical conditions and examine how the trend in each has changed between 1999 and 2012. Changes in the spending growth trend before and after 2005 are used to identify the conditions that experienced the most rapid spending reductions. We then consider the role of medical treatment advances in reducing spending growth.

Study Data and Methods

Spending and condition data

We employ medical spending data from the elderly population in the Medicare Current Beneficiary Survey (MCBS), 1999 through 2012. We begin with 1999 because claims-based disease prevalence estimates can only be adjusted to national totals using data from 1999 onward (as discussed below). The most recent year of MCBS micro data available was 2012; for aggregate spending totals, we carry the analysis through 2015. The sample is about 10,000 annually. Spending includes both Medicare and non-Medicare services, by all payers. Our spending measure is most akin to personal health spending in the National Health Expenditure Accounts (NHEA). Throughout the paper, all dollar amounts are in real 2010 dollars.

We adjust the MCBS data in several ways, described briefly here and in more detail in online appendix section A.⁴ The first adjustment is to account for the lack of claims information for beneficiaries enrolled in Medicare Advantage (MA) plans. To correct for this, we drop these beneficiaries and reweight the population of traditional Medicare beneficiaries in each year by socioeconomic and health status to match the MA-inclusive totals. A second adjustment is to ensure that service-specific spending in the revised sample matches estimated national totals in the NHEA.^{5,6}

The MCBS contains medical claims that allow us to determine the diagnosis for each service provided. However, claims do not provide a complete clinical description of each patient; they reflect conditions treated or diagnosed in the current year but not previously diagnosed conditions which still may affect health and spending. This is particularly true for chronic diseases like arthritis which are not always listed as a cause of the visit in the medical claims.⁷

To estimate the prevalence of conditions, we impute prevalence rates using data from the National Health and Nutrition Examination Survey (NHANES). We group medical conditions into 78 categories (appendix table A5) similar to CCS categories,⁸ shown in appendix table A6.⁴ Of these, some are directly asked about in NHANES, and additionally three cardiovascular risk factors (diabetes, hypertension, and hypercholesterolemia) are physically measured. We used a multiple imputation process to assign these conditions to beneficiaries who were most likely to have had them, but not had claims for them that year.

Individuals were matched on socioeconomic and health status. We used a regression model to adjust the prevalence of conditions not directly asked about or measured in NHANES, based on the relationships between adjusted and unadjusted prevalence for other conditions. We term the resulting conditions “calibrated conditions” to reflect the fact that they are calibrated to better represent national totals, as shown in appendix table A5.⁴ These imputations are performed five times each, creating five multiply imputed data sets.⁹ Results are combined across the five imputed datasets using standard methods. For presentation purposes, we group the conditions into 19 larger aggregates, including cardiovascular disease, cardiovascular disease risk factors, and cancers, as shown in appendix table A5.⁴

Spending by Condition

Several methods have been proposed in the literature to disaggregate spending into clinical conditions. One common path is to assign the dollars in each claim to one or more conditions, based on the physician’s diagnosis.^{10–11} However this methodology is difficult when people have multiple chronic conditions – a situation which characterizes much of the elderly population. A second strand of literature attributes spending to medical conditions using regression analysis. Total medical spending in a year is related to the set of conditions a person had during the year.¹² The major difficulty with this approach is that not all spending gets allocated to diseases; the residual needs to be apportioned somehow.

Our methodology builds on this latter literature, though we enhance the methods considerably. For each condition, we start by grouping individuals into 5 strata based on their propensity to have that condition, using information on sociodemographic and behavioral characteristics. Within each stratum, we then estimate the average difference in spending for individuals with and without the condition. When added up, these condition-based spending measures do not necessarily add to spending totals. Further, they miss some properties of the distribution of individual spending, such as very wide tails. We thus implement a second stage adjustment model that predicts person-specific observed cost as a product of the sum of the disease costs, and a polynomial dependent on the number of the health conditions, history of hospitalization, institutionalization, and death within a given year. These adjustment factors are then used to adjust spending for all conditions at the person-level. The results are estimates of spending at the condition level that sum to total spending and track the distribution of spending as well as possible across individuals.

Impact of pharmaceuticals on event rates

To estimate the role of pharmaceuticals in reducing cardiovascular disease events, we use a methodology¹³ similar to existing disease models (see appendix section C for details about the disease models we employ).⁴ We divide the population into two groups, those without a previous major cardiovascular event and those with a previous event. For each group, we use existing literature to determine the relative risk of having an event as a function of medication use. The medication classes we consider are ACE inhibitors, ARBs and beta-blockers for hypertension, statins for high cholesterol, metformin and insulin for diabetes, and aspirin for general heart disease reduction. Multiplying the relative risk of an event by the utilization rate of each medication gives the reduction in acute events predicted to be attributable to the use of that medication in that year. Using the change in medication rates

over time, we then calculate the simulated change in event rates over time. We compare the simulated reduction in acute events to the actual reduction. The ratio of these terms is the share of the actual change in event rates can be explained by increased use of medications.

Limitations

There are several limitations of our analysis. First, while we adjust for lack of clinical data among MA enrollees using socioeconomic and health information, any individual characteristics that are not correlated with those we include could lead to biased population estimates. Second, conditions that are imputed are necessarily measured with error. Third, we do not examine interactions between medical conditions in the cost estimation model. The appendix examines these assumptions and suggests that our results are not very sensitive to variations in how we do the estimation.⁴

Study Results

In 1992, the typical elderly person used more than \$10,000 in medical care annually (in 2010 dollars based on aggregate data reported by CMS with our NHEA adjustments (Exhibit 1). From 1992 through 2004, spending increased roughly linearly in real terms, increasing on average by \$500 per person per year. With the Balanced Budget Act of 1997, designed to reduce federal spending, there was a slight and relatively temporary slowdown. Beginning around 2005, the growth of spending slowed markedly. The change was gradual but becomes apparent around that year. In dollar terms, spending increases fell by more than half. In percentage terms, growth rates fell by two-thirds.

For our quantitative analysis, we wish to gauge the dollar decline in spending relative to a hypothetical no-slowdown scenario. Because our later individual-level analysis uses data from 1999 on, we start by estimating a counterfactual forecast assuming a continuation after 2005 of the nearly linear growth rate in dollar terms from 1999 through 2004. The red line in Exhibit 1 shows the counterfactual forecast. By 2012, the last year of our micro data, actual spending is \$2,899 (14 percent) less than the forecasted trend. The divergence continues through 2015.

We explored several other ways of defining the counterfactual. If we use the spending trend from 1992–2004 to form projections, the gap between projected and actual spending is still \$1,666 per person in 2012 (data not shown). More commonly, spending is measured in growth rates rather than levels. If we estimate the models from 1999–2004 in logarithms, the gap between predicted and actual spending is \$3,209 per person in 2012 (data not shown). Exhibit 1 does not show much of an effect due to changes in income; the 2007–09 Great Recession is barely noticeable. Indeed, studies suggest that the income elasticity of Medicare spending is typically negative and insignificantly different from zero.¹⁴ Thus, we do not perform an income adjustment in estimating the slowdown.

The demographics of the elderly population were changing over this time period, but this also is not a major contributor to the spending slowdown.¹ Using the MCBS micro data from 1999 through 2004, we estimated spending as a function of age, sex, race, ethnicity, and

year. Forecasting out to 2012 implies that demographically-adjusted spending is \$2,640 per beneficiary lower than forecast (data not shown).

Spending growth fell for virtually all services, with the exception of dental care, as shown in appendix figure A3.⁴ The largest contributions to the slowdown are from hospital and physician/clinic services, but post-acute spending and spending on pharmaceuticals fell as well. The widespread slowdown in cost growth suggests that factors beyond payment policy for a single industry are important. Spending growth also fell for every payer, including Medicare, Medicaid, and private payments (appendix figure A4).⁴ About 75 percent of the spending slowdown was due to Medicare and remaining 25% due to other payers.

Spending Slowdown by Condition

To decompose the slowdown in cost growth by clinical conditions (Exhibit 2), we use a methodology similar to the one above (see appendix section B for a detailed explanation).⁴ For each of the 78 conditions, we relate the condition prevalence and the cost per case to a time trend for the years 1999–2012, allowing for a break in trend in 2005. The predicted effect assuming the coefficient on the post-2005 trend is zero is used to obtain the counterfactual estimate, which we compare to the fitted value of the estimate in 2012 allowing for the break in trend. Multiplying the counterfactual prevalence by the counterfactual cost per case gives the counterfactual cost per capita, assuming there was no break in trend. This is compared to the product of the fitted values of the prevalence and cost per case in 2012 allowing for the break in trend, which gives us a smoothed estimate of actual spending per capita. The difference between the fitted cost per capita in 2012 and the counterfactual cost per capita assuming no break in trend is the estimated spending slowdown for that condition (see appendix section B for details).⁴

The major concern in estimating these models is that the time series is short, thus trends for individual conditions can be sensitive to outlier observations, particularly in the beginning or ending years. To account for this sensitivity, we estimate the models at various levels of disease aggregation and using different years for break points. For example, we estimate the spending slowdown separately for each of the 78 conditions, and again for 19 broader categories of conditions. We also explore a variety of break points from 2003–07 (appendix figure B3).⁴ The level of disease aggregation (data not shown) nor the specific year for the break point materially affect our estimates. In light of this, we use estimates for each condition separately and present just the results using the break in 2005. For presentation purposes, we aggregate the spending slowdown for individual conditions into the 19 major disease categories noted above and shown in Exhibit 2.

Bars to the left of 0 indicate that spending for that condition in 2012 was below what was forecast on the basis of pre-2005 trends; bars to the right indicate the opposite. The fact that the bars to the left are cumulatively larger than the bars to the right demonstrates the spending slowdown relative to trend. The most important contributor to the spending slowdown is reduced spending on cardiovascular diseases. This is seen in the two bars at the bottom of the figure: major cardiovascular diseases, which grew by \$827 less per person relative to trend; and cardiovascular disease risk factors, which declined by \$802 per person

relative to trend. Together, these two groups of conditions account for 56 percent of the spending slowdown.

Cardiovascular disease includes 12 specific categories, which are compiled into four groupings: ischemic heart disease (including AMI and coronary atherosclerosis); congestive heart failure; cerebrovascular disease; and a catchall category consisting of other cardiovascular and peripheral vascular diseases (appendix table A7).⁴ Among these, the largest spending slowdown was for ischemic heart disease and other heart and peripheral vascular disease, though most declined.

Closely related to the decline in acute cardiovascular disease is the decline in spending attributable to cardiovascular disease risk factors: hypertension, hyperlipidemia, and diabetes. We treat each risk factor as a separate condition, and then add a condition for people with any one of the three risk factors but who are undiagnosed (which we impute from NHANES). The majority of the slowdown in the combined cardiovascular disease risk factor category is due to a slowdown in spending on people with hypertension.

Beyond these two cardiovascular disease categories, the other major categories for which the spending slowdown was pronounced are dementia, Alzheimer's, and other diseases of the central nervous system (a total slowdown of \$445 per person); and aftercare (a slowdown of \$443 per person). "Other diseases of the central nervous system" does not have a single cause that dominates. The aftercare category includes diagnosis codes related to follow-up from surgery, for example long-term use of anticoagulants and therapeutic drug monitoring.

Spending growth on renal and genitourinary diseases also declined significantly. This category includes a number of conditions, most of which declined in spending growth relative to pre-2005 totals. The exception is chronic renal failure, which rose over time. Blood disorders had a slowdown in spending, mostly due to a slowdown in anemias.

Not all categories experienced a spending slowdown. Vaccinations and screening increased \$391 per person relative to trend. This category includes immunizations (largely influenza vaccination) and prostate cancer screening. There were minor changes in population costs associated with cervical cancer screening, breast cancer screening, and colon cancer screening.

There was also an increase in spending on respiratory disease, driven primarily by increased spending on acute respiratory infections. Spending on smoking-related respiratory conditions such as chronic obstructive pulmonary disease, in contrast, fell, consistent with the decline in smoking over this period.

There was little change in cancer spending overall relative to trend, despite the high level and rapid growth of cancer costs throughout the time period we examine. There was a slowdown in spending for the four largest solid tumors: lung, prostate, breast, and colon cancer. In contrast, there was an increase in spending on skin cancers, benign neoplasm, and hematologic cancers. The increased spending on benign neoplasm might be attributable to increased utilization of physician and clinical services and early detection and treatment of these tumors.

Prevalence v. Conditional Spending

The change in total spending for each condition is a product of the change in its population prevalence and the change in spending for those with the condition. A first step in understanding why these changes occurred is to divide the spending slowdown into those two components. To do this, we consider the models for prevalence and cost per case separately. We first consider only the effect of changes in prevalence, holding constant cost per case. We then re-estimate the slowdown allowing only for the change in cost per case. The sum of these two terms is the total change in cost per capita, absent the covariance term.

Appendix Figure A5 is analogous to exhibit 2, though here each line for the total spending slowdown is divided into the change due to prevalence and the change due to case spending; the details by underlying condition are shown in appendix table A7.⁴ For the major cardiovascular diseases, the primary contributor to the spending slowdown was a reduction the prevalence of conditions. Between 1999 and 2005, the prevalence of major cardiovascular disease increased by 1.4 percent annually; between 2005 and 2012, it fell by 0.8 percent annually (data not shown). For cardiovascular risk factors, the slowdown in spending was mostly from lower cost per case. The prevalence of hypertension, high cholesterol, and diabetes all rose at a relatively smooth rate over the time period.

Closer examination shows that the decline in cost per case for cardiovascular risk factors is closely related to the reduction in cardiovascular disease events noted above. As shown in appendix figure A6, nearly half of the slowdown was in hospital spending for the hypertensive cohort.⁴ This shows up as lower spending per person with hypertension but generally reflects less prevalent acute disease.

The importance of both risk factor management and treatment of those with existing cardiovascular disease can be seen in trends in acute cardiovascular events. The hospitalization rates for those with and without a prior event for each of the cardiovascular conditions (Appendix Figure A7).⁴ The decline in a combined measure of acute events among those without a prior event was 4.8 percent annually from 1999–2004 and 7.1 percent annually from 2005–2012 (calculated values). For people with prior events, the comparable declines are 1.7 percent annually from 1999 through 2004 and 4.1 percent annually from 2005–2012.

Explaining the cardiovascular disease event slowdown

The natural question to ask is why the rate of acute cardiovascular events slowed so rapidly. Thus, this section considers whether greater use of pharmaceuticals can explain these trends. There are many pharmaceutical treatments for cardiovascular disease, including anti-hypertensives, cholesterol-lowering agents, medications to reduce blood sugar, and medications to prevent clotting.

The greater use of medications translates into greater risk factor control. Appendix figure A8 uses data from the 1999–2014 NHANES to show treatment and control rates for hypertension, high cholesterol, and diabetes.⁴ Treatment and control increased for all three conditions. Over the 1999–2014 time period, the share of people with controlled hypertension and controlled cholesterol rose by nearly 25 percentage points. The share with

controlled diabetes rose by 12 percentage points. Data on use of aspirin are not as widespread but also show 15 percentage points more use in 2012 than in 1999.

The empirical question is whether these changes in risk factor control are large enough to explain the trend in reduced hospitalizations over time. The model described above allows us to estimate changes in incidence rates resulting from these changes in medication use. Overall, the combination of increased medication use for hypertension, high cholesterol, and diabetes explains about half (51 percent) of the reduction in cardiovascular disease events (data not shown). The reductions are generally similar for the four groupings noted above. While large, even this impact of medications is likely to be understated. In later years of the sample, more people will have taken cardiovascular disease medications for a longer period of time. Studies suggest that the relative risk of an acute event declines with time on medication.^{15–17} Thus, the predicted probability of acute events should decline even more rapidly than the rate above implies.

To estimate the dollar value of the implied savings, we multiply the predicted reduction in event rates by the 90-day cost of each event – which we count as beginning with an index hospital admission and including all acute and non-acute spending within the 90 days episode period. The MCBS data yield average medical spending of about \$32,000 for events in 2012 (data not shown).

Exhibit 3 shows the final calculation for the slowdown in spending from the increased use of medications. In total, there was a slowdown of \$1,629 due to lower spending growth for cardiovascular disease events and risk factors. Out of that, \$824, or 51 percent, is attributed to increased use of cardiovascular medications. In addition, part of the “unexplained” reduction in event rates is likely due to advances in surgery and medical devices.¹³ We have not estimated the impact of these therapies on medical spending.

Discussion

Understanding the growth of medical spending for the elderly is central to the future of the medical sector and of public policy towards medical care. For over a decade, the growth of Medicare spending has been well below historical values. In this paper, we consider why spending growth has slowed so markedly. We found that about half of the reduced cost growth is explained by fewer acute events among those with cardiovascular disease. In turn, about half of this reduction in cardiovascular events can be attributed to greater use of preventive medication for cardiovascular risk factors.

There is a growing literature assessing the factors that might explain the slowdown in Medicare costs. Lower prices have clearly contributed to the cost trend. Medicare payment updates for hospitals, home health agencies, and private plans were reduced by the Medicare Modernization Act of 2003, the Deficit Reduction Act of 2005, the Affordable Care Act of 2010, and the Budget Control Act of 2011.¹⁸ As appendix section D shows, about 12 percent of the observed slowdown in 2012 can be explained by recent reductions in Medicare payments.⁴ There may have been changes in Medicaid payments, coinsurance pays or specific item adjustments, which we do not model. Indeed, these price reductions would

show up as lower cost per case in our data; however, the bulk of the spending slowdown is due to declining rates of acute events.

Changes in payments may matter in other ways as well. Payment reforms such as the accountable care organization program and bundled payment initiatives in the ACA lowered costs.^{19,20} Again, the savings from these initiatives are nowhere near enough to explain the marked reduction in overall cost growth. Further, the spending slowdown predates the ACA by several years.

Other studies have attributed the overall slowdown in medical spending to the Great Recession and the slow recovery that followed,²¹ or to the spread of high deductible health insurance policies in the private sector, which might have had a spillover effect on Medicare costs.²² In practice, however, long-term data suggest that Medicare spending rises during recessions.¹⁴ And in any case, the Great Recession is long over, with no sign of resurgent Medicare spending.

Our findings highlight an important factor for the cost slowdown not discussed in prior literature: the impact of successful prevention of cardiovascular disease. The reduction in acute cardiovascular events has been dramatic: admissions for ischemic heart disease are down 56 percent since 1999, and admissions for stroke have fallen by 41 percent. Each of these events is preventable, and our analysis shows significant advances in prevention. It is not that new therapies to treat cardiovascular disease risk were developed during this time period; rather, the therapies that were previously available are now used much more frequently. We estimate that greater use of preventive cardiovascular disease medications accounts for half of the reduction in cardiovascular disease spending, or about one-quarter of the overall medical care spending slowdown.

Our data do not indicate why use of preventive medications rose so greatly. Some of the increased use is likely attributable to greater recognition of the need for treatment. Price changes likely also played a role. A number of important medications went generic over this time period. Further, the Medicare drug benefit was implemented in 2006, which lowered out-of-pocket pharmaceutical prices for many seniors.

The implications of our findings for the future of cost growth is unclear. On the one hand, there is an upper limit to the share of people who can be treated preventively. When that limit is reached, hospitalizations will be at a lower level, but might stop declining. Thus, one might expect Medicare spending to resume its former growth rate after that point. On the other hand, even having made great progress in preventing cardiovascular disease, there is still a long way to go. Only 55–60 percent of people have their risk factors under control. Further, changes in definitions of people at risk might lead to additional savings for other groups. And having shown that prevention can have a material impact on overall spending for cardiovascular disease, it is possible that other conditions can be prevented as well. For all of these reasons, it is possible that Medicare spending growth could remain low for an extended period of time.

Conclusion

Our conclusion is that medically-driven prevention can save money over time. The extent to which such savings could be achieved among those with other health conditions is a subject for future research. So too is the issue of how to encourage more use of therapies yielding long-term reductions in acute events and thus medical cost savings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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