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Explaining The Slowdown In Medical Spending Growth Among The Elderly, 1999–2012

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ABSTRACT We examined trends in per capita spending for Medicare beneficiaries ages sixty-five and older in the United States in the period 1999–2012 to determine why spending growth has been declining since around 2005. Decomposing spending by condition, we found that half of the spending slowdown was attributable to slower growth in spending for cardiovascular diseases. Spending growth also slowed for dementia, renal and genitourinary diseases, and aftercare for people with acute illnesses. Using estimates from the medical literature of the impact of pharmaceuticals on acute disease, we found that roughly half of the reduction in major cardiovascular events was attributable to medications controlling cardiovascular risk factors. Despite this substantial cost-saving improvement in cardiovascular health, additional opportunities remain to lower spending through disease prevention and control.

The slowdown in the growth of medical spending for the elderly is one of the most important health care facts of the recent past. In the period 1992–2004 we calculate that Medicare spending per beneficiary grew by 3.8 percent annually, adjusted for economywide inflation. Since 2005 the growth rate has been 1.1 percent.

The slowdown in Medicare spending 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 of the reasons for this.

We examined the spending slowdown by medical condition. We divided medical spending for the elderly into spending for seventy-eight clinical conditions, and we examined how the trend for each condition changed in the period 1999–2012. Changes in the spending growth trend before and after 2005 were used to identify the conditions that experienced the most rapid spending reductions. We then considered the role of medical treatment advances in reducing spending growth.

Study Data And Methods

SPENDING AND CONDITION DATA We used medical spending data for 1999–2012 for the elderly population in the Medicare Current Beneficiary Survey (MCBS). We began with 1999 because claims-based disease prevalence estimates can be adjusted to national totals only using data from 1999 onward (as discussed below). The most recent year for which MCBS data were available was 2012; for aggregate spending totals, we carried the analysis through 2015. The sample population was about 10,000 annually. Spending included that for both Medicare and non-Medicare services by all payers. Our spending measure was most akin to personal health spending in the National Health Expenditure Accounts of the Centers for Medicare and Medicaid Services (CMS). Throughout the article, all dollar amounts are in real 2010 dollars.

We adjusted the survey data in several ways, described briefly here and in more detail in online appendix section A.[4] The first adjustment was to account for the lack of claims information for beneficiaries enrolled in Medicare Advantage (MA) plans. To correct for this, we dropped those beneficiaries and reweighted the population of traditional Medicare beneficiaries in each year by socioeconomic and health status to match the MA-inclusive totals. A second adjustment was to ensure that service-specific spending in the revised sample matched estimated national totals in the National Health Expenditure Accounts.[5,6]

The MCBS data contain medical claims, which allowed 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 that may still affect health and spending. This is particularly true for chronic diseases such as arthritis, which are not always listed as a cause of the visit in the medical claims.[7]

To estimate the prevalence of conditions, we imputed prevalence rates using data from the National Health and Nutrition Examination Survey (NHANES). We grouped medical conditions into seventy-eight categories (appendix table A5),[4] similar to Clinical Classifications Software categories[8] (appendix table A6).[4] Of these, some are directly asked about in NHANES, and, in addition, 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 had no claims for them in a given year. People in the MCBS sample were matched to people in the NHANES sample according to socioeconomic and health status. We used a regression model to adjust for the prevalence of conditions not directly asked about or measured in NHANES, based on the relationships between adjusted and unadjusted prevalence for other conditions. The prevalences of the resulting medical conditions better represent national totals (appendix table A5).[4] These imputations were performed five times each, creating five multiply imputed data sets.[9] The results were combined across the five imputed data sets using standard methods. For presentation purposes, we grouped the conditions into nineteen larger aggregate categories, including cardiovascular disease, cardiovascular disease risk factors, and cancers (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, using this methodology is difficult when people have multiple chronic conditions—a situation that 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, and the residual needs to be apportioned somehow.

Our methodology built on the latter literature, though we enhanced the methods considerably. For each condition, we started by grouping people into five strata based on their propensity to have that condition, using information on their sociodemographic and behavioral characteristics. Within each stratum we then estimated the average difference in spending between people with and without the condition. When summed, these condition-based spending measures did not necessarily add up to spending totals. Furthermore, they missed some properties of the distribution of individual spending, such as very wide tails. We thus implemented a second-stage adjustment model that predicted person-specific observed spending as a product of the sum of the disease spending and a polynomial dependent on the number of health conditions, history of hospitalization and institutionalization, and death within a given year. These adjustment factors were then used to adjust spending for all conditions at the person level. The results were estimates of spending at the condition level that summed to total spending and tracked 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 used a methodology[13] similar to existing disease models (see appendix section C for details about the disease models we used).[4] We divided the population into two groups: people with and without a previous major cardiovascular event. For each group, we used the existing literature to determine the relative risk of having an event as a function of medication use. The medication classes we considered were angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, 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 gave 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 calculated the simulated change in event rates over time.

We compared the simulated reduction in acute events to the actual reduction. The ratio of these terms was the share of the actual change in event rates that can be explained by increased use of medications.

LIMITATIONS Our analysis had several limitations. First, while we adjusted for lack of clinical data among MA enrollees using socioeconomic and health information, any individual characteristics that were not correlated with those we included could have led to biased population estimates. Second, conditions that were imputed were necessarily measured with error. Third, we did not examine interactions between medical conditions in the spending estimation model. The appendix examines our assumptions and suggests that our results were not very sensitive to variations in how we did the estimation.[4]

Study Results

In 1992 the typical elderly person used more than $10,000 of medical care annually (in 2010 dollars based on aggregate data reported by CMS, with our National Health Expenditure Accounts adjustments) (exhibit 1). In the period 1992–2004 spending increased roughly linearly in real terms, increasing by $500 per person per year, on average. With the passage of 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 became 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 wished to gauge the dollar decline in spending relative to a hypothetical no-slowdown scenario. Because our later person-level analysis used data from 1999 on, we started by estimating a counterfactual forecast that assumed a continuation after 2004 of the nearly linear growth rate in dollar terms in the period 1999–2004 (labeled "projected spending" in exhibit 1). By 2012, the last year of our survey data, actual spending was $2,899 (14 percent) less than the forecasted trend. The divergence continued through 2015.

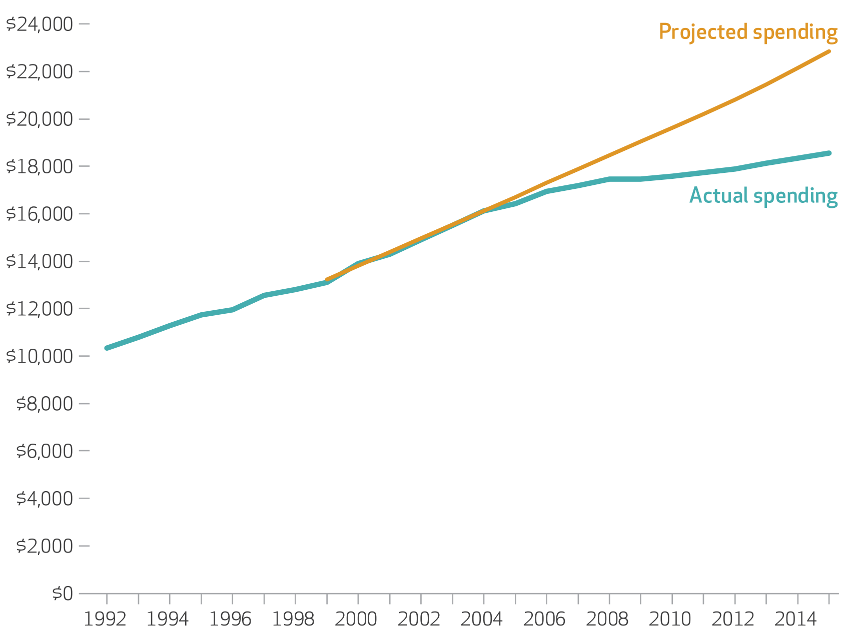
We explored several other ways of defining the counterfactual. When we used the spending trend in the period 1992–2004 to form projections, the gap between projected and actual spending was still $1,666 per person in 2012 (data not shown). More commonly, spending is measured in growth rates rather than levels. When we estimated the models in the period 1999–2004 in logarithms, the gap between predicted and actual spending was $3,209 per person in 2012. Exhibit 1 does not show much of an effect resulting from 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 0.[14] Thus, we did not perform an income adjustment in estimating the slowdown.

The demographic characteristics of the elderly population were changing over this time period, but this also was not a major contributor to the spending slowdown.[1] Using the MCBS data for the period 1999–2004, we estimated spending as a function of age, sex, race, ethnicity, and year. Forecasting out to 2012 implied that demographically adjusted spending was $2,640 per beneficiary lower than forecast (data not shown).

Spending growth declined for virtually all services with the exception of dental care (appendix figure A3).[4] The largest contributions to the slowdown were from hospital and physician and clinical services, but growth in postacute spending and spending on pharmaceuticals declined as well. The widespread slowdown in spending growth suggests that factors beyond payment policy for a single industry were important. Spending growth also fell for every payer, including Medicare, Medicaid, and private payments (appendix figure A4).[4] About 75 percent of

EXHIBIT 1

Real per capita health care spending for the elderly, 1992–2015



SOURCE Authors' analysis of data from the Medicare Current Beneficiary Survey and National Health Expenditure Accounts. **NOTES** Per capita spending is adjusted to 2010 dollars using the gross domestic product deflator. Spending includes spending on both Medicare and non-Medicare services by all payers. Projected spending is based on a counterfactual forecast that assumed a continuation after 2004 of the nearly linear growth rate in dollar terms in the period 1999–2004.

the spending slowdown was in Medicare, and the remaining 25 percent was among other payers.

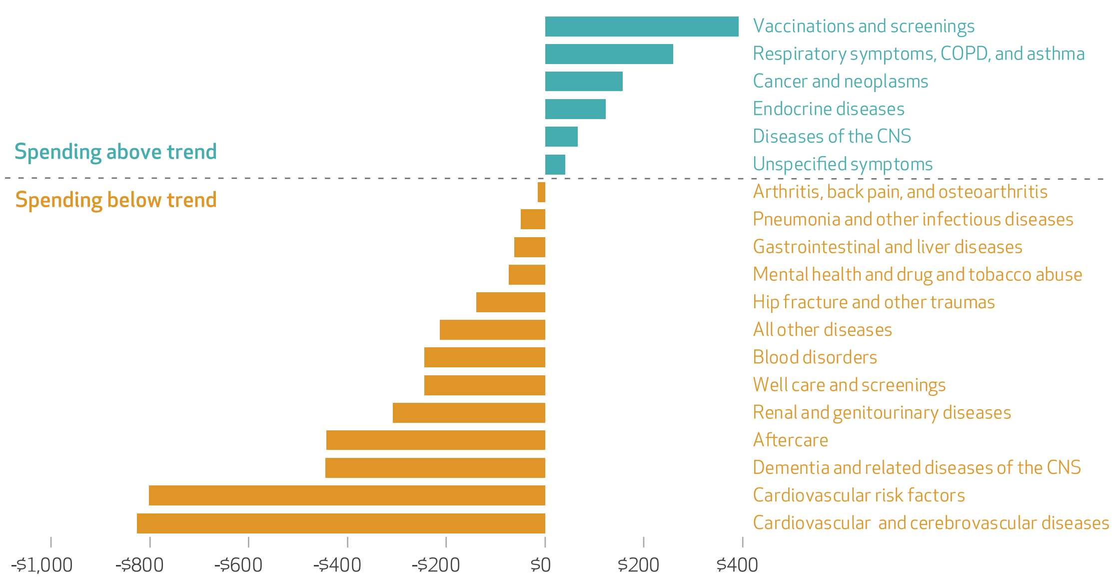
SPENDING GROWTH SLOWDOWN BY CONDITION To decompose the slowdown in spending growth by clinical conditions (exhibit 2), we used a methodology similar to the one described above (see appendix section B for a detailed explanation).[4] For each of the seventy-eight conditions, we related the condition prevalence and the spending per case to a time trend for the period 1999–2012, allowing for a break in trend in 2005. The predicted effect, assuming the coefficient on the post-2005 trend was 0, was used to obtain the counterfactual estimate, which we compared to the fitted value of the estimate in 2012 that allowed for the break in trend. Multiplying the counterfactual prevalence by the counterfactual spending per case gave the counterfactual spending per capita, assuming that there was no break in trend. This was compared to the product of the fitted values of the prevalence and spending per case in 2012 that allowed for the break in trend, which gave us a smoothed estimate of actual spending per capita. The difference in 2012 between the fitted spending per capita and the counterfactual spending per capita that assumed no break in trend was the estimated spending slowdown for that condition (see appendix section B for details).[4]

The major concern in estimating these models was that the time series was short, so trends for individual conditions could be sensitive to outlier observations—particularly in the beginning or ending years. To account for this sensitivity, we estimated the models at various levels of disease aggregation and using different years for break points. For example, we estimated the spending slowdown separately for each of the seventy-eight conditions and again for the nineteen broader categories of conditions. We also explored a variety of break points from 2003 to 2007 (appendix figure B3).[4] Neither the level of disease aggregation (data not shown) nor the specific year for the break point materially affected our estimates. In light of this, we used estimates for each condition separately and present just the results using the break in 2005. For presentation purposes, we aggregated the spending slowdown for individual conditions into that for the nineteen major disease categories noted above and shown in exhibit 2.

The fact that the bars to the left in exhibit 2 are cumulatively larger than the bars to the right demonstrates the spending slowdown relative to trend. The most important contributor to the spending slowdown was reduced spending on cardiovascular diseases. This is seen in the two bars at the bottom of the exhibit: Cardiovascular

EXHIBIT 2

Per capita spending slowdown by major medical condition, 1999–2012



SOURCE Authors' analysis of data from the Medicare Current Beneficiary Survey, National Health and Nutrition Examination Survey, and National Health Expenditure Accounts. **NOTES** Per capita spending is adjusted to 2010 dollars using the gross domestic product deflator. The totals in this exhibit across all categories differ from those in exhibit 1 because the former are based on predicted prevalence and spending per case. "Trend" refers to disease-specific projected spending. "Vaccinations and screenings" refers to screening for infectious diseases as well as cancer. "Diseases of the CNS" (central nervous system) excludes Alzheimer's and dementia, which are in a separate category, "Dementia and related diseases of the CNS." "Aftercare" is explained in the text. COPD is chronic obstructive pulmonary disease.

and cerebrovascular diseases grew by $827 less per person relative to trend, and cardiovascular risk factors declined by $802 per person relative to trend. Together, these two groups of conditions accounted for 56 percent of the spending slowdown.

Cardiovascular and cerebrovascular diseases included twelve specific categories that were combined into four groups: ischemic heart disease (including acute myocardial infarction 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 slowdowns were for ischemic heart disease and other diseases.

Closely related to the decline in spending on acute cardiovascular disease was the decline attributable to cardiovascular disease risk factors (hypertension, hyperlipidemia, and diabetes). We treated each risk factor as a separate condition and then added a condition for people who had any one of the three risk factors but were undiagnosed (which we imputed from NHANES). The majority of the slowdown in the combined cardiovascular disease risk factor category was 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 were dementia and other disease of the central nervous system (a total slowdown of $445 per person) and aftercare (a slowdown of $443 per person) (exhibit 2). "Other disease of the central nervous system" did not have a single cause that dominated. The aftercare category included diagnosis codes related to follow-up after surgery—for example, long-term use of anticoagulants and therapeutic drug monitoring.

Spending growth on renal and genitourinary diseases also declined. This category included a number of conditions, most of which declined in spending growth relative to pre-2005 totals (appendix table A7).[4] The exception was chronic renal failure, for which spending rose over time. Blood disorders had a slowdown in spending, mostly due to a slowdown in spending on anemias.

Not all categories experienced a spending slowdown. Vaccinations and screenings increased $391 per person relative to trend (exhibit 2). This category included immunizations (largely influenza vaccination) and prostate cancer screening. There were minor changes in population spending associated with screenings for cervical, breast, and colon cancer (appendix table A7).[4]

Our conclusion is that medically driven prevention can save money over time.

There was also an increase in spending on respiratory diseases, driven primarily by increased spending on acute respiratory infections. In contrast, spending on smoking-related respiratory conditions such as chronic obstructive pulmonary disease 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 spending throughout the study period. There was a slowdown in spending on the four largest solid tumors: lung, prostate, breast, and colon cancer. In contrast, there was an increase in spending on skin cancers, benign neoplasms, and hematologic cancers. The increased spending on benign neoplasms might be attributable to increased use of physician and clinical services and early detection and treatment of these tumors.

PREVALENCE VERSUS CONDITIONAL SPENDING

The change in total spending for each condition was a product of the change in its population prevalence and the change in spending for people 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 considered the models for prevalence and spending per case separately. We first considered only the effect of changes in prevalence, holding constant the spending per case. We then reestimated the slowdown allowing only for the change in spending per case. The sum of these two terms was the total change in spending per capita, absent the covariance term.

Appendix figure A5 is analogous to exhibit 2, though in the appendix figure each bar for the total spending slowdown was divided into the change due to prevalence and the change due to per 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 in the prevalence of conditions. In the period 1999–2005 the prevalence of major cardiovascular disease increased by 1.4 percent annually; in the period 2005–12 it fell by 0.8 percent annually (data not shown). For cardiovascular risk factors, the slowdown in spending was mostly from lower spending per case. The prevalence of hypertension, high cholesterol, and diabetes all rose at a relatively smooth rate over the study period.

Closer examination shows that the decline in spending per case for cardiovascular risk factors was 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 people with hypertension.[4] This showed up as lower spending per person with hypertension but generally reflected less prevalent acute disease.

The importance of both risk-factor management and treatment of people 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 declined (appendix figure A7).[4] The decrease in a combined measure of acute events among people without a prior event was 4.8 percent annually in the period 1999–2004 and 7.1 percent annually in 2005–12 (calculated values). For people with prior events, the comparable declines were 1.7 percent annually in the first period and 4.1 percent annually in the second.

EXPLAINING THE CARDIOVASCULAR DISEASE EVENT SLOWDOWN The natural question to ask is why the rate of acute cardiovascular events slowed so rapidly. Here we consider whether greater use of pharmaceuticals could explain these trends. There are many pharmaceutical treatments for cardiovascular diseases and risk factors, including antihypertensives, 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 for 1999–2014 from NHANES to show treatment and control rates for hypertension, high cholesterol, and diabetes.[4] Treatment and control increased for all three conditions. Over the period 1999—2014 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 the use of aspirin are not as widespread, but we also found an increase of 15 percentage points in its use in 2012, compared to that 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 allowed 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 explained 51 percent of the reduction in cardiovascular disease events (data not shown). The reductions were generally similar for the four groups noted above. While large, even this impact of medications is likely to be understated. In later years of the sample more people would 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 multiplied the predicted reduction in event rates by the ninety-day spending of each event—which we define as beginning with an index hospital admission and including all acute and nonacute spending within the ninety-day period. The MCBS data yielded average medical spending of about $32,000 for events in 2012 (data not shown).

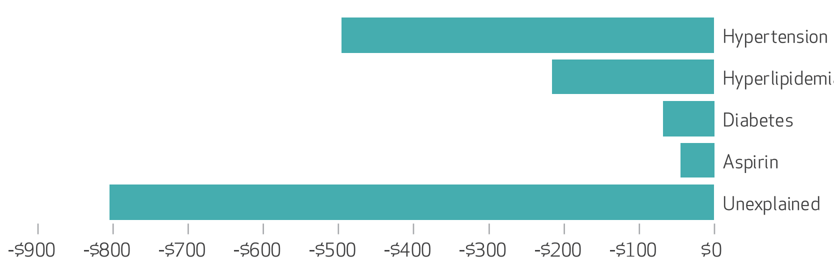
There was a slowdown of $1,629 resulting from lower spending growth for cardiovascular disease events and risk factors (exhibit 2). Out of that, $824 (51 percent) was attributed to increased use of cardiovascular medications (exhibit 3). In addition, part of the unexplained reduction in spending is likely due to reduced event rates as a result of advances in surgery and medical devices.[13] We have not estimated the impact of these therapies on event rates and in turn 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 related to medical care. For over a decade the growth of Medicare

EXHIBIT 3

Impact of medications to treat various cardiovascular diseases and risk factors on overall spending for cardiovascular disease, 1999–2012



SOURCE Authors' analysis of data for 1999–2012 from the Medicare Current Beneficiary Survey, National Health and Nutrition Examination Survey, and National Health Expenditure Accounts. **NOTES** Per capita spending is adjusted to 2010 dollars using the gross domestic product deflator. The "unexplained" category is defined in the text. The bars for "hypertension," "hyperlipidemia," and "diabetes" measure the impacts of medications for those conditions on spending.

spending has been well below historical values. In this study we considered why spending growth has slowed so markedly. We found that about half of the reduced spending growth was explained by fewer acute events among people with cardiovascular disease. In turn, about half of the reduction in cardiovascular events can be attributed to the greater use of preventive medications for cardiovascular risk factors.

There is a growing literature that assesses the factors that could explain the slowdown in Medicare spending. Lower prices have clearly contributed to the spending trend. Medicare payment updates for hospitals, home health agencies, and private plans were reduced by the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, the Deficit Reduction Act of 2005, the Affordable Care Act (ACA) of 2010, and the Budget Control Act of 2011.[18] About 12 percent of the observed slowdown in 2012 can be explained by recent reductions in Medicare payments (see appendix section D).[4] There may have been changes in Medicaid payments, coinsurance payments, or specific item adjustments, which we did not model. Indeed, these price reductions would show up as lower spending per case in our data. However, the bulk of the spending slowdown was 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 spending growth. Furthermore, the spending slowdown predated 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 could have had a spillover effect on Medicare spending.[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 in the spending slowdown not discussed in prior literature: the impact of successful prevention of cardiovascular disease. The reduction in acute cardiovascular events has been dramatic: Hospital admissions for ischemic heart disease are down 56 percent since 1999, and admissions for stroke have fallen by 41 percent (data not shown). 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 period. Rather, the therapies that were previously available are now used much more frequently. We estimate that greater use of preventive cardiovascular disease medications accounted 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 the 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 period. Furthermore, the Medicare drug benefit was implemented in 2006, which lowered out-of-pocket pharmaceutical spending for many seniors.

The implications of our findings for the future of spending 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 though great progress has been made in preventing cardiovascular disease, there is still a long way to go. Only 55–60 percent of people have their risk factors under control. Changes in definitions of people at risk might also lead to additional savings for other groups. And since it is clear 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 people with other health conditions is a subject for future research. So too is the issue of how to encourage more use of therapies that yield long-term reductions in acute events and thus savings in medical spending. ■

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4 To access the appendix, click on the Details tab of the article online.

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