Published in final edited form as:

Ann Intern Med. 2015 June 16; 162(12): 825–833. doi:10.7326/M14-0726.

Did Medicare Part D Affect National Trends in Health Outcomes or Hospitalizations?:

A Time-Series Analysis

Becky A. Briesacher, PhD, Jeanne M. Madden, PhD, Fang Zhang, PhD, Hassan Fouayzi, MS, Dennis Ross-Degnan, ScD, Jerry H. Gurwitz, MD, and Stephen B. Soumerai, ScD
Northeastern University, Harvard Medical School, and Harvard Pilgrim Health Care Institute, Boston, and University of Massachusetts Medical School, Worcester, Massachusetts

Abstract

Background—Medicare Part D increased economic access to medications, but its effect on population-level health outcomes and use of other medical services remains unclear.

Objective—To examine changes in health outcomes and medical services in the Medicare population after implementation of Part D.

Design—Population-level longitudinal time-series analysis with generalized linear models.

Setting—Community.

Requests for Single Reprints: Becky A. Briesacher, PhD, School of Pharmacy, Northeastern University, 360 Huntington Avenue, R218 TF, Boston, MA 02115; b.briesacher@neu.edu..

Current Author Addresses: Dr. Briesacher: School of Pharmacy, Northeastern University, 360 Huntington Avenue, R218 TF, Boston, MA 02115.

Drs. Madden, Zhang, Ross-Degnan, and Soumerai: Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, 133 Brookline Avenue, 6th Floor, Boston, MA 02215.

Mr. Fouayzi and Dr. Gurwitz: Department of Medicine, Division of Geriatric Medicine, University of Massachusetts Medical School, 365 Plantation Street, Biotech One, Suite 100, Worcester, MA 01605.

Preliminary findings from this study were presented at the Pharmaceutical Policy Research Seminar at Harvard Medical School in Boston, Massachusetts, in May 2013 and at the Quantitative Health Science Methods Seminar at University of Massachusetts in Worcester, Massachusetts, in April 2013.

Disclaimer: Dr. Briesacher had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Reproducible Research Statement: *Study protocol and data set:* Not available. *Statistical code:* Available from Dr. Briesacher (b.briesacher@neu.edu).

Current author addresses and author contributions are available at www.annals.org.

Author Contributions: Conception and design: B.A. Briesacher, J.M. Madden, F. Zhang, H. Fouayzi, D. Ross-Degnan, J.H. Gurwitz, S.B. Soumerai.

Analysis and interpretation of the data: B.A. Briesacher, J.M. Madden, F. Zhang, H. Fouayzi, S.B. Soumerai.

Drafting of the article: B.A. Briesacher, D. Ross-Degnan, J.H. Gurwitz.

Critical revision of the article for important intellectual content: B.A. Briesacher, J.M. Madden, F. Zhang, H. Fouayzi, D. Ross-Degnan, J.H. Gurwitz, S.B. Soumerai.

Final approval of the article: J.M. Madden, F. Zhang, H. Fouayzi, D. Ross-Degnan, J.H. Gurwitz, S.B. Soumerai.

Provision of study materials or patients: S.B. Soumerai.

Statistical expertise: B.A. Briesacher, F. Zhang, H. Fouayzi.

Obtaining of funding: J.M. Madden, D. Ross-Degnan, S.B. Soumerai.

Administrative, technical, or logistic support: B.A. Briesacher, J.M. Madden, S.B. Soumerai.

Collection and assembly of data: J.M. Madden, S.B. Soumerai.

Disclosures:

Authors not named here have disclosed no conflicts of interest. Disclosures can also be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M14-0726.

Patients—Nationally representative sample of Medicare beneficiaries ($n = 56\,293$ [unweighted and unique]) from 2000 to 2010.

Measurements—Changes in self-reported health status, limitations in activities of daily living (ADLs) (ADLs and instrumental ADLs), emergency department visits and hospital admissions (prevalence, counts, and spending), and mortality. Medicare claims data were used for confirmatory analyses.

Results—Five years after Part D implementation, no clinically or statistically significant reductions in the prevalence of fair or poor health status or limitations in ADLs or instrumental ADLs, relative to historical trends, were detected. Compared with trends before Part D, no changes in emergency department visits, hospital admissions or days, inpatient costs, or mortality after Part D were seen. Confirmatory analyses were consistent.

Limitations—Only total population-level outcomes were studied. Self-reported measures may lack sensitivity.

Conclusion—Five years after implementation, and contrary to previous reports, no evidence was found of Part D's effect on a range of population-level health indicators among Medicare enrollees. Further, there was no clear evidence of gains in medical care efficiencies.

The broader implications of the Medicare prescription drug insurance benefit (Part D) are of national importance because the benefit substantially increased access to prescription drugs for more than 47 million older adults and adults with disabilities (1). Since its implementation in 2006, Part D has become so widespread that even patient groups who previously had drug coverage substantially increased their medication use (1); nonadherence related to difficulties in paying for medication also declined (2, 3). Medication use can influence health; however, little is known about the role of Part D in improving the health of the Medicare population, reducing the need for other medical services, or changing the efficiency of care.

Several studies have detected encouraging reductions in spending on nondrug medical services after Part D implementation, but all used data from the early transition years (2006 to 2007) and were limited by a focus on population subgroups, particularly those who voluntarily enrolled to obtain drug coverage or more generous coverage (4). These self-selected enrollees were likely to differ from other subgroups in unmeasured ways and to be better prepared to take advantage of their new coverage. Their experience with Part D is probably more striking than that of the entire Medicare population on average. Medicare beneficiaries with limited or no drug benefits before 2006 saw statistically significant decreases in nondrug medical spending after enrolling in Part D (5, 6). Medicare hospitalizations decreased after Part D implementation in states where preimplementation drug coverage rates had been especially low (7). These associations in selected subgroups may not be generalizable to the larger Medicare population, however, because most of the population previously had drug coverage (8). Nevertheless, the U.S. Congressional Budget Office, partially in response to the subgroup evaluations, recently adopted a new costing method that assumes that increases in prescription fills at the full population level offset overall costs in other Medicare services (9).

To address the lack of information about possible population-wide cost offsets associated with Part D, we estimated changes in health outcomes and medical services across the entire community-dwelling Medicare population to determine its comprehensive long-term policy effects. We used 11 years of survey data from the Medicare Current Beneficiary Survey (MCBS) (2000 to 2010 [latest data available]). To our knowledge, this is the only data set with nationally representative information on the health, functioning, and health service use of both the fee-for-service and Medicare Advantage populations. Medicare Advantage enrollees are a large and growing segment of the Medicare population, and they are missing in Medicare claims-based evaluations. We used a longitudinal study design with strong external validity for assessing the national implications of Part D (8). We hypothesized that, in the absence of Part D, population-level trends in health and medical services would have followed previously established trends; any statistically significant and consistent change in those trends after 2006 may be attributable to Part D.

Methods

The MCBS is a continuous face-to-face panel survey of a representative national sample of Medicare enrollees conducted by the Centers for Medicare & Medicaid Services (10). Since 1991, the MCBS has provided detailed longitudinal data on annual samples of Medicare enrollees, with a current sample size of approximately 12 000 community-dwelling and institutionalized elderly and disabled beneficiaries. The rich variety of measures includes demographic information, income, assets, living arrangements, family support, health status, changes in health status, functioning, health behaviors, health insurance coverage, drug coverage, health services use (including services not covered), and access to medical services.

The sample for the MCBS is extracted from Medicare enrollment records according to a multistage rotating panel sampling plan, with the sample replenished each year to remain representative. Respondents are interviewed in person 3 times a year using computer-assisted personal interviewing, which yields very high response rates (initially about 85%). The typical MCBS interview lasts approximately 1 hour. Cycles begin with a comprehensive annual fall interview on health status. Subsequent interviews collect additional details on health care use and expenditures that are aggregated into annual measures. Each respondent is asked to keep a record of insurance statements and receipts to enhance the accuracy of data. Self-reported use is validated using standard methods, such as construct validation, and the MCBS uses outcome measures that had previously been extensively validated, such as perceived health status and functioning. Medicare claims data are available for the subset of respondents enrolled in the fee-for-service Medicare program. Our analysis used the MCBS Cost and Use files, the survey's main source of data on health services use, through 2010 (the most recent year available) but also included fee-for-service claims as confirmatory analyses in the subgroup in which they were available.

Sample

The sample included community-dwelling Medicare enrollees from 2000 through 2010. We excluded institutionalized respondents for whom MCBS does not collect information about

medical care use. Our annual samples ranged from 11 761 in 2000 to 9760 in 2010. When we accounted for overlapping panels across years of data, the total sample was 56 293 unique persons who contributed 120 566 person-years to this study.

An important feature of our sample is the inclusion of Medicare enrollees who are in the managed care program (Medicare Advantage). Participation in Medicare Advantage is voluntary, and enrollment nearly doubled during this period, from a low of 13% of the Medicare population in 2003 to a high of 24% in 2010 (11). However, Medicare Advantage enrollees do not have Medicare claims. Part D evaluations based on only Medicare claims may be susceptible to confounding biases due to this increase in Medicare Advantage enrollment. We included these enrollees in our evaluation and excluded them only when comparing self-reported use with claims-based use, which required identifying the subgroup with full-year Medicare Parts A and B fee-for-service coverage.

In addition, we identified a vulnerable subgroup with cardiovascular disease as persons who reported that a physician had previously told them that they had atherosclerosis, angina pectoris, coronary heart disease, high blood pressure, heart attack, or stroke (or equivalent terms); this population is especially dependent on access to effective medications. The proportion of enrollees with cardiovascular disease increased gradually over time, ranging from 66% to 73% of the total annual samples. (Results from the cardiovascular subgroup analysis are available in the Appendix Table 1, available at annals.org.)

Study Variables

Health Status—We used previously validated measures to assess changes in the proportion of enrollees reporting poor health outcomes (12, 13), which was a strong predictor of adverse clinical outcomes. The negative outcomes included a self-rated general health status of either fair or poor, as opposed to excellent, very good, or good. We also defined any functional health status limitations as self-reported difficulty performing any of 6 activities of daily living (ADLs) (for example, bathing without help) and, separately, any of 8 instrumental ADLs (for example, shopping without help). We measured mortality based on a Medicare indicator of death available in the MCBS.

Emergency Department and Inpatient Utilization—We used survey-reported health care encounters during the year as the primary way to assess use of medical services because these measures are also available for the Medicare Advantage population, whose use is not captured in Medicare claims data. Self-reported use is somewhat lower than claims-based use, but the underreporting is consistent over time (14). To show this, we also compared changes after Part D in survey-based use and claims-based use for the subgroup of persons with both types of data available. Annual prevalence rates of self-reported medical service use were measured as the proportion of the sample reporting any emergency department visit or any hospitalization. We also calculated annual mean counts of emergency department visits, hospitalizations, hospital days per person, and mean total costs for emergency department and inpatient services. All costs were adjusted to 2010 U.S. dollars using the consumer price index to account for inflation (15). Quarterly mean counts and prevalence

rates were measured for the fee-for-service sample with claims for emergency department visits or hospitalizations in each calendar quarter.

Other measures included age, sex, race and Hispanic ethnicity, geographic residence, disease burden as measured by a count of specific conditions, Medicaid enrollment, income, and prescription drug coverage (3, 12). All variables were self-reported by survey respondents, except for sex, Medicaid enrollment, and age, which come from Medicare's administrative files. Drug coverage was measured by using a combination of Medicare administrative records (Part D or Medicaid) and self-reported drug coverage.

Statistical Analysis

All analyses used MCBS cross-sectional weights to represent the overall population of community-dwelling Medicare enrollees (10). Further details about the probability-weighted file structure of the MCBS are available in the Appendix (available at www.annals.org). We examined demographic and health characteristics of the MCBS population across all study years, from 2000 to 2010, to ensure stability. We calculated unadjusted frequencies and means for all study variables with 95% CIs from 2000 to 2010 and assessed their year-to-year consistency.

To model changes in health and use outcomes, we employed an interrupted time-series study design, generalized linear models, and survey data estimators suitable for handling probability weights and clustering within primary sampling units (16). We used logit link for binary measures, negative binomial link for counts, and log link with γ distributions for costs. For each outcome, the model contained an intercept, an indicator of the trend before Part D, a dummy variable to capture the level change in 2006, and an indicator of the trend after Part D (2007 to 2010). We estimated models with quarterly measures for changes at 3 and 5 years after Part D to assess the stability and onset of trend changes.

We also adjusted our models for the following demographic characteristics: age, age squared, sex, and race and Hispanic ethnicity. Our model is based on the null hypothesis that the data would follow the historical trend (from 2000 to 2005) in the absence of Part D implementation. Results from an alternative modeling approach using generalized estimation equations are provided in Appendix Table 2 (available at www.annals.org). These models and a third approach based on aggregate time-series models and bootstrapping (not shown) yielded results nearly identical to those of the main models presented in this report.

We conducted all analyses using Stata, version 11.2 (StataCorp), and SAS, version 9.3 (SAS Institute); the a priori level of statistical significance was a *P* value less than 0.05. This study was approved by the Human Subjects Committee of the Harvard Pilgrim Health Care Institute.

Role of the Funding Source

The National Institute on Aging and the Agency for Healthcare Research and Quality had no role in the design and conduct of the study; collection, analysis, and interpretation of the data; or in the preparation, review, or approval of the manuscript.

Results

Characteristics of Medicare Enrollees, From 2000 and 2010

Table 1 shows the demographic and health characteristics of the community-dwelling Medicare population in 2000 and 2010 and the fee-for-service-only population; annual rates were also examined for the interim years, and the results were consistent. In general, the characteristics of the total MCBS community-dwelling population were stable over time and indicated steady increases in the proportion of enrollees younger than 65 years, the wealthier strata, and persons with multiple comorbid conditions. The exception to stable trends was drug coverage. In 2000, about one quarter of enrollees reported having no drug coverage. In 2006, this rate decreased sharply to 10%; by 2010, only 5% of enrollees reported having no drug coverage. Compared with the total population, the subgroup with full-year Medicare fee-for-service coverage was disproportionately older and had greater proportions of white or non-Hispanic persons and persons with nonmetropolitan residence; most important, Medicare enrollees with fee-for-service coverage more often lacked drug coverage before Part D (22.6% vs. 27.3% in 2000).

Changes in Health Outcomes for Medicare Enrollees

As shown in Figure 1 and Table 2, we found no evidence of improvements in the health outcomes of all Medicare enrollees 5 years after implementation of Part D, after accounting for historical trends. Relative to the prepolicy years of 2000 to 2005, there was no significant change in reported fair or poor health status; we estimated this proportion at 26.6% in 2006 and 24.6% in 2010, which corresponds to the historical trend of -0.24% per year. Compared with prior trends, there was also no evidence of a change in the proportion of Medicare enrollees with any limitations in ADLs after implementation of Part D (estimated at 29.1% in 2006 and 30.7% in 2010 vs. the historical trend of -0.007% per year) or any limitations in instrumental ADLs (38.7% in 2006 and 38.8% in 2010 vs. the historical trend of -0.01% per year). Mortality rates remained flat at 3.0% of the population throughout the observation period.

Changes in Use and Spending

Figure 2 and Table 2 show no consistent evidence of change in the use of emergency department or inpatient services 5 years after implementation of Part D relative to historical trends. The prevalence of having any emergency department visits remained at a steady 13% during the study period (13.51% in 2000 [95% CI, 12.78% to 14.25%] vs. 13.26% in 2010 [CI, 12.5% to 14.02%]). Mean emergency department visits per 100 persons also remained stable (18.37% in 2000 [CI, 17.17% to 19.57%] vs. 18.45% in 2010 [CI, 17.17% to 19.62%]) and within predicted bounds. Further, there were no changes in the prevalence or mean counts of hospital admissions after implementation of Part D compared with historical trends. Further, we detected no clinically or statistically significant decreases after Part D in average annual spending on inpatient hospitalization ($-\$29$ [CI, $-\$121$ to $\$61$]; $P = 0.52$) or emergency department visits ($\$4$ [CI, $-\$2$ to $\$11$]; $P = 0.24$) relative to levels before Part D.

Our statistical models indicate no significant changes in outcomes in the first 5 years after implementation of Part D (Table 2). Although a single data point occasionally reached

statistical significance, these instances seem to be due to random variation rather than a true change in level or trend. We did not observe any decreases in hospital admissions or emergency department visits, the proportions of the population with fair or poor health, 1 or more ADL limitations, 1 or more instrumental ADL limitations, or enrollees who died during the year.

Figure 3 and Table 3 show the results of our confirmatory analyses limited to the subgroup with full-year fee-for-service coverage. Using both annual survey-based and quarterly claims-based data, we detected no statistically significant change in use in 23 of 24 measures; the exception was a modest decrease in the trend of the number of emergency department visits (incidence rate ratio, 0.991 [CI, 0.983 to 0.998]), which was not apparent 3 years after Part D implementation and only weakly evident 5 years later.

The analyses of changes in health status and use of medical services of the vulnerable subgroup reporting cardiovascular disease also showed no consistent evidence of changes from historical trends and were consistent with those in the total population (Appendix Table 1).

Discussion

Our study did not find a consistent link between the statistically significant and population-wide increases in prescription drug use attributed to Part D and population-level health improvements 5 years after the start of the program. We did not see any evidence of overall changes in self-reported health status or functional limitations, nor did we see reductions attributable to Part D in the use of inpatient and emergency department services.

Unlike earlier evaluations of Part D that used population subgroups (5–7), we did not find decreased hospital admissions, days, or spending in the national community-dwelling Medicare population. Previous studies used only 1 or 2 years of data before Part D implementation, which may have been insufficient to detect and control for the observed downward secular trends in hospital use. Given random year-to-year measurement variation, 1 or 2 years of measurement after Part D may also be insufficient to draw reliable conclusions. Further, previous studies examined Part D's effects in selected patient groups (for example, those without prior drug coverage who chose to enroll in Part D), which probably biases analyses because of associations among coverage choices and other characteristics and behaviors (17). Our analysis was conducted in the entire community-dwelling Medicare population, including those in managed care, and was not subject to selection bias. Our previous evaluation found a 14% increase in prescription drug use in this same population within 2 years after implementation of Part D. Previous government analyses of Part D's effects in enrollees who only had fee-for-service Medicare also failed to detect any reductions in inpatient and emergency department events (18).

The results of this study suggest that the Congressional Budget Office's decision to adopt a new method that presumes population-level offsetting savings from policies that increase prescription drug use, a decision based largely on previous Part D evaluations, may be premature. The Congressional Budget Office's estimates of Medicare spending on medical

services are now routinely reduced by one fifth of 1% for each 1% increase in drug prescriptions filled. The budgetary effects of this assumption are not trivial. For example, provisions in the Patient Protection and Affordable Care Act to decrease Part D cost-sharing (by closing coverage gaps) are based on the Congressional Budget Office prediction that Medicare's nondrug spending will be reduced by \$35 billion through cost savings in medical services, primarily through decreased hospitalizations (9). Decreases in hospitalization during the first few years may indeed be possible, but they probably resulted from prior secular trends, rather than Part D, or were limited to selected subgroups.

Our study offers a unique combination of nationally representative data spanning 6 years before and 5 years after the implementation of Part D, a broad set of health status and service use measures, and a rigorous longitudinal study design. Our use of a time-series study design and generalized linear models allowed us to provide robust estimates of Part D's effects, especially after the early transitional years. To our knowledge, this study also offers one of the first assessments of whether the program had widespread effects across the entire community-dwelling Medicare population. Using self-reported medical services to ensure complete capture of the Medicare Advantage and fee-for-service Medicare populations is a unique feature of this study; this approach overcomes several common biases of claims-based studies, including omission of services provided at free clinics, services bundled into capitation arrangements that increased after Part D, and those not paid for by Medicare.

Our study has several limitations. The 6 years of prepolicy data provide an important comparison and context for our analyses. However, additional postpolicy years would provide more clarity about the long-term effects of implementing Part D. The first year of the new program was a transitional period. The self-reported measures may have been too crude to detect modest changes. Although measures of health status and physical function are most important for assessing the population-level effects of changes in health policy, the effect of changes in medication use may first become apparent in improvements in surrogate measures (for example, reduced lipid levels). We did not have the ability to assess changes in these types of measures. Certain clinical groups of patients may have benefited from Part D, but our study lacked the sample size to explore most disease-specific effects. Our supplemental analysis of the subgroup of beneficiaries with cardiovascular disease yielded results consistent with our full population results. Study power may also have been insufficient, although our calculations using an α level of 0.05 and autocorrelation of 0.5 showed more than 94% power to detect an effect size of 3 units (for example, a decrease in observed vs. expected physician visits). It is also possible that the lack of positive health outcomes resulted from increases in inappropriate and appropriate medication use or that many Medicare patients were able to obtain essential medications before Part D because of existing insurance coverage. In addition, those who benefited from Part D may have been a small subgroup that would not have affected overall rates of population health. This study also does not consider other previously observed benefits of Part D, such as increased affordability of medications or decreased cost-related adherence among poor and disabled persons. Lastly, other unmeasured changes may have occurred concurrent with Part D implementation and masked its effects. For example, enrollment in Medicare Advantage increased with Part D implementation and the latest economic recession began in late 2007.

Given the consistency of trends in measures of health status and use before and after implementation of Part D, however, it is unlikely that the effects of these other changes would have exactly offset the effects of a major national policy, such as Part D coverage.

In conclusion, in comparison to historical trends, we did not find evidence of improvements in population-level health outcomes or offsetting of emergency department and inpatient services in the 5 years after implementation of Medicare Part D. Further long-term longitudinal research is needed to determine whether certain demographic or clinical subgroups benefited more by implementation of Part D than others and whether policy changes beyond increasing access to medications are necessary for improving the health of the Medicare population and its efficient use of the health care system.

Acknowledgments

Grant Support: By the National Institute on Aging (NIA) (grants R01AG028745 and R01AG022362; Dr. Soumerai [principal investigator]), a Research Scientist Award from the NIA (K01AG031836; Dr. Briesacher), and related support from the NIA and Agency for Healthcare Research and Quality (grants R01AG032249 and R01HS018577, respectively; Drs. Madden, Zhang, Ross-Degnan, and Soumerai).

Dr. Briesacher reports grants from National Institutes of Health during the conduct of the study and grants from Daiichi Sankyo outside the submitted work. Mr. Fouayzi received an unrestricted research grant from Daiichi Sankyo for an unrelated study. Dr. Ross-Degnan reports grants from National Institute of Aging during the conduct of the study and grants and personal fees from Novartis Pharma outside the submitted work. Dr. Gurwitz reports grants from National Institutes of Health during the conduct of the study.

Appendix: Detailing the Analytic Approach

For this evaluation, we followed the technical guidance provided by the MCBS data documentation and the best statistical practices for using probability-weighted survey data as described by Sarndal and colleagues (16).

The MCBS is a probability-weighted survey designed for the specialized purpose of generating nationally representative estimates that are generalizable to the Medicare population. Each respondent in the MCBS has a sampling weight equal to the inverse probability of being sampled and postsampling adjustments for nonresponse. Estimates that do not include the weights are biased and are not generalizable to the Medicare population.

Standard statistical approaches are inappropriate to use with the MCBS because the sample is not a random draw of the Medicare population but rather a selected draw from 107 primary sampling units chosen to represent the nation and a second stage of 1163 geographic clusters defined by ZIP code. As a result of this design, the primary sampling unit is the most important unit of clustering that must be addressed in the statistical approach. Secondary levels of clustering (for example, the panel structure of the data) will influence variance estimates, but this will appear through its effect on the residual variance at the clustering level.

We used the survey estimators in Stata software, version 11.2, to apply the sampling weights and specified clustering within primary sampling units for all estimates. For the interrupted time-series models, which require time-invariant sampling weights, we averaged the cross-sectional weights of each subject and used the robust variance estimator known as the

Huber–White sandwich estimator. Postestimation commands were used to estimate the weighted marginal effects from the models.

Appendix Table 1

Health Outcomes and Rates of Medicare Care Use in Community-Dwelling Medicare Population With Cardiovascular Disease*

Variable	2006	2007	2008	2009	2010
Health indicators					
Proportion in fair or poor general health	23.92	25.51	24.75	22.33	21.71
Predicted	23.87	25.58	24.65	22.22	21.40
95% CI	22.63-25.11	24.27-26.89	23.26-26.03	21.00-23.44	20.24-22.56
Proportion with 1 or more ADL	30.25	29.69	30.57	30.15	31.02
Predicted	30.14	29.53	30.29	29.99	30.92
95% CI	28.31-31.98	27.80-31.25	28.47-32.12	28.36-31.61	29.37-32.47
Proportion with 1 or more IADL	37.69	38.55	36.38	37.69	37.31
Predicted	37.60	38.41	36.20	37.61	37.18
95% CI	35.82-39.39	36.82-40.01	34.54-37.85	35.93-39.29	35.50-38.86
Proportion who died	3.73	3.39	3.58	3.59	3.47
Predicted	3.73	3.28	3.41	3.41	3.40
95% CI	3.26-4.21	2.85-3.71	3.04-3.78	2.92-3.90	3.01-3.80
Health services indicators					
Proportion with any ED visits	13.27	13.70	13.56	13.18	13.43
Predicted	13.19	13.71	13.56	13.20	13.59
95% CI	12.40-13.97	12.95-14.47	12.61-14.51	12.14-14.26	12.67-14.52
Proportion with any inpatient hospitalizations	18.98	19.34	18.71	17.64	17.76
Predicted	18.95	19.14	18.64	17.58	17.85
95% CI	18.12-19.78	18.20-20.08	17.59-19.68	16.60-18.56	16.80-18.90
Hospitalization indicators					
Hospital admissions per beneficiary	0.28	0.28	0.27	0.26	0.25
Predicted	0.28	0.28	0.27	0.25	0.25
95% CI	0.26-0.30	0.26-0.30	0.26-0.29	0.24-0.27	0.24-0.27
Hospital days per beneficiary	1.39	1.36	1.32	1.23	1.11

Variable	2006	2007	2008	2009	2010
Predicted	1.39	1.36	1.31	1.17	1.11
95% CI	1.26-1.51	1.22-1.50	1.19-1.43	1.04-1.31	1.00-1.21
Average annual hospital cost per beneficiary	3138	3104	2909	2740	2633
Predicted	3120	3150	2924	2713	2573
95% CI	2835-3404	2894-3405	2647-3200	2433-2992	2335-2812
ED admissions per beneficiary	0.17	0.18	0.18	0.17	0.18
Predicted	0.17	0.18	0.18	0.17	0.18
95% CI	0.16-0.18	0.17-0.19	0.16-0.19	0.16-0.19	0.17-0.20
Average annual ED cost per beneficiary	82	94	109	110	119
Predicted	87	94	109	110	113
95% CI	72-102	82-107	89-128	88-132	97-128

ADL = activities of daily living; ED = emergency department; IADL = instrumental ADL.

* Results from subgroup analyses of Medicare enrollees with cardiovascular disease are shown. The sample includes beneficiaries with fee-for-service Medicare and beneficiaries in Medicare Advantage. The subgroup analysis concurs with the main analysis and shows no consistent evidence of change in the study outcomes 5 y after implementation of Part D, relative to historical trends. Occasional data points occur outside the predicted 95% CI because of random variation rather than trend change. Predicted estimates and 95% CIs come from aggregate interrupted time-series generalized linear models with pretrend indicators; annual posttrend indicators; and covariates for age, sex, and race. The CIs were generated with bootstrapping analyses.

Appendix Table 2

Adjusted* Trend Changes in Survey-Reported Annual Outcomes After Implementation of Part D: GLM vs. GEE Estimators[†]

Variable	GLMs With Survey Estimators		GLMs With Weighted GEEs	
	Exponentiated β -Coefficient [‡]	95% CI	Exponentiated β -Coefficient [‡]	95% CI
Proportion in fair or poor health				
Difference in trend between before and after Part D, OR	0.983	0.957-1.009	0.995	0.975-1.015
Proportion with any ADL limitations				
Difference in trend between before and after Part D, OR	1.026	0.986-1.067	1.021	1.001-1.041
Proportion with any IADL limitations				
Difference in trend between before and after Part D, OR	1.009	0.968-1.052	1.006	0.988-1.024
Proportion who died during the year				

Variable	GLMs With Survey Estimators		GLMs With Weighted GEEs	
	Exponentiated β -Coefficient [‡]	95% CI	Exponentiated β -Coefficient [‡]	95% CI
Difference in trend between before and after Part D, OR	0.994	0.958-1.031	0.994	0.950-1.039
Proportion with any inpatient hospital visits				
Difference in trend between before and after Part D, OR	0.998	0.975-1.023	1.003	0.980-1.026
Number of inpatient hospital visits				
Difference in trend between before and after Part D, IRR	0.996	0.971-1.022	1.002	0.977-1.026
Proportion with any ED visits				
Difference in trend between before and after Part D, OR	1.008	0.978-1.039	1.018	0.993-1.044
Number of ED visits				
Difference in trend between before and after Part D, IRR	0.990	0.954-1.026	1.003	0.975-1.032

ADL = activities of daily living; ED = emergency department; GEE = generalized estimating equation; GLM = generalized linear model; IADL = instrumental ADL; IRR = incidence rate ratio; OR = odds ratio.

* Estimates come from GLMs estimated with survey estimators or weighted xtGEE estimators with robust variance estimation and indicators for trend before Part D; change in trend after part D; a dummy variable for level change after part D; and covariates for age, sex, and race.

[‡] Comparison of GLMs vs. GEE models with full community-dwelling Medicare sample.

[‡] Estimate is average change in trend from log linear trends.

References

1. Briesacher BA, Zhao Y, Madden JM, Zhang F, Adams AS, Tjia J, et al. Medicare part D and changes in prescription drug use and cost burden: national estimates for the Medicare population, 2000 to 2007. *Med Care*. 2011; 49:834–41. [PMID: 21544002] doi:10.1097/MLR.0b013e3182162afb. [PubMed: 21544002]
2. Madden JM, Graves AJ, Ross-Degnan D, Briesacher BA, Soumerai SB. Cost-related medication nonadherence after implementation of Medicare Part D, 2006-2007. *JAMA*. 2009; 302:1755–6. [PMID: 19861666] doi:10.1001/jama.2009.1516. [PubMed: 19861666]
3. Madden JM, Graves AJ, Zhang F, Adams AS, Briesacher BA, Ross-Degnan D, et al. Cost-related medication nonadherence and spending on basic needs following implementation of Medicare Part D. *JAMA*. 2008; 299:1922–8. [PMID: 18430911] doi:10.1001/jama.299.16.1922. [PubMed: 18430911]
4. Polinski JM, Kilabuk E, Schneeweiss S, Brennan T, Shrank WH. Changes in drug use and out-of-pocket costs associated with Medicare Part D implementation: a systematic review. *J Am Geriatr Soc*. 2010; 58:1764–79. [PMID: 20863336] doi:10.1111/j.1532-5415.2010.03025.x. [PubMed: 20863336]
5. Zhang Y, Donohue JM, Lave JR, O'Donnell G, Newhouse JP. The effect of Medicare Part D on drug and medical spending. *N Engl J Med*. 2009; 361:52–61. [PMID: 19571283] doi:10.1056/NEJMsa0807998. [PubMed: 19571283]
6. McWilliams JM, Zaslavsky AM, Huskamp HA. Implementation of Medicare Part D and nondrug medical spending for elderly adults with limited prior drug coverage. *JAMA*. 2011; 306:402–9. [PMID: 21791689] doi:10.1001/jama.2011.1026. [PubMed: 21791689]

7. Afendulis CC, He Y, Zaslavsky AM, Chernew ME. The impact of Medicare Part D on hospitalization rates. *Health Serv Res.* 2011; 46:1022–38. [PMID: 21306369] doi:10.1111/j.1475-6773.2011.01244.x. [PubMed: 21306369]
8. Shadish, WR.; Cook, TD.; Campbell, DT. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference.* Houghton Mifflin; New York: 2002.
9. Offsetting effects of prescription drug use on Medicare's spending for medical services. U.S. Congressional Budget Office; Washington, DC: 2012. Accessed at www.cbo.gov/sites/default/files/43741-MedicalOffsets-11-29-12.pdf [on 6 April 2015]
10. Adler GS. A profile of the Medicare Current Beneficiary Survey. *Health Care Financ Rev.* 1994; 15:153–63. [PMID: 10138483]. [PubMed: 10138483]
11. Medicare Payment Advisory Commission. *Health care spending and the Medicare program: a data book.* Medicare Payment Advisory Commission; Washington, DC: 2014. Accessed at www.medpac.gov/documents/publications/jun14databookentirereport.pdf?sfvrsn=1 [on 6 April 2015]
12. DeSalvo KB, Fan VS, McDonell MB, Fihn SD. Predicting mortality and healthcare utilization with a single question. *Health Serv Res.* 2005; 40:1234–46. [PMID: 16033502]. [PubMed: 16033502]
13. Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. *J Am Geriatr Soc.* 1983; 31:721–7. [PMID: 6418786]. [PubMed: 6418786]
14. 2010 Cost and Use Codebook. Centers for Medicare & Medicaid Services; Baltimore, MD: 2010.
15. Consumer expenditures in 2005. U.S. Bureau of Labor Statistics; Washington, DC: 2007. Accessed at www.bls.gov/opub/reports/cex/consumer_expenditures2005.pdf [on 6 April 2015]
16. Sarndal, C.; Swensson, B.; Wretman, J. *Model Assisted Survey Sampling.* 2nd ed.. Springer-Verlag; New York: 2003.
17. Majumdar SR, Soumerai SB. The unhealthy state of health policy research. *Health Aff (Millwood).* 2009; 28:w900–8. [PMID: 19671571] doi:10.1377/hlthaff.28.5.w900. [PubMed: 19671571]
18. Ingber, MJ.; Freeman, S.; Healy, D.; Kautter, J.; Siegel, S. *Medicare Part D program evaluation: analysis of the impact of Medicare Part D on the FFS program and issues related to medication adherence for six chronic conditions—2008.* Centers for Medicare & Medicaid Services; Rockville, MD: 2011. Accessed at www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Reports/Downloads/Ingber_Part_D_Meds_Adherence_June_2011.pdf [on 6 April 2015]

EDITORS' NOTES**Context**

Medicare Part D increased access to medications, but not enough is known about how it affects outcomes.

Contribution

These investigators studied outcomes 5 years after implementation of Part D and did not find reductions in emergency department visits, hospital admissions, or inpatient costs or improvements in health status, activities of daily living, or mortality.

Caution

The study used self-reported data.

Implication

Other studies that were based on claims data have found improved outcomes, and the differences between the 2 types of findings need to be understood.

Figure 1.

Health status of community-dwelling Medicare population before and after Part D implementation.

All estimates have been weighted to account for the complex survey design. Unweighted sample sizes ranged from 11 761 in 2000 to 9760 in 2010. ADL = activities of daily living; IADL = instrumental ADL.

Figure 2. Prevalence and average use of medical services in the community-dwelling Medicare population.

Figure 3.

Prevalence and average use of medical services in the FFS Medicare population.

FFS = fee-for-service; Q = quarter.

Table 1Characteristics of Community-Dwelling Medicare Enrollees, 2000 and 2010^{*}

Characteristic	All Enrollees (95% CI), %		Subset With FFS Medicare Parts A and B in All Months (95% CI), %	
	2000 (n = 11 761)	2010 (n = 9760)	2000 (n = 7957)	2010 (n = 5964)
Age				
55 y	8.4 (7.9-9.0)	9.2 (8.5-9.9)	8.1 (7.5-8.8)	9.3 (8.3-10.2)
56-64 y	5.2 (4.6-5.8)	7.1 (6.4-7.8)	4.8 (4.3-5.3)	6.3 (5.6-7.1)
65-74 y	46.1 (45.2-47.0)	45.5 (44.4-46.6)	41.2 (40.1-42.3)	39.5 (38.0-41.1)
75-84 y	31.1 (30.3-31.9)	27.4 (26.5-28.3)	35.4 (34.4-36.4)	31.8 (30.6-33.0)
85 y	9.2 (8.7-9.6)	10.9 (10.2-11.6)	10.5 (10.0-11.0)	13.1 (12.1-14.1)
Sex				
Male	44.2 (43.4-45.0)	45.6 (44.4-46.8)	43.1 (42.2-44.0)	43.0 (41.3-44.6)
Female	55.8 (55.0-56.6)	54.4 (53.2-55.6)	56.9 (56-57.8)	57.0 (55.4-58.7)
Race/ethnicity				
Hispanic	7.1 (5.8-8.4)	8.9 (7.5-10.3)	6.0 (4.5-7.5)	6.2 (5.0-7.5)
Black/non-Hispanic	9.1 (8.0-10.3)	9.4 (7.9-11.0)	8.4 (7.3-9.6)	8.8 (7.0-10.6)
White/non-Hispanic	79.7 (78.0-81.4)	76.7 (74.6-78.8)	82.0 (80.1-84.0)	80.0 (77.7-82.2)
Other	4.1 (3.4-4.7)	5.0 (4.1-5.8)	3.5 (2.8-4.2)	5.0 (3.9-6.1)
Residence				
Metropolitan	76.1 (73.8-78.3)	76.6 (75.1-78.0)	70.3 (67.5-73.1)	72.0 (70.1-73.9)
Nonmetropolitan	23.9 (21.6-26.1)	23.4 (22.0-24.9)	29.7 (26.9-32.5)	28.0 (26.1-29.9)
Poverty status				
Medicaid	13.1 (12.1-14.1)	14.7 (13.6-15.8)	15.0 (13.8-16.2)	16.0 (14.5-17.6)
0%-100% of the FPL	5.6 (5.0-6.2)	3.7 (3.2-4.2)	4.8 (4.2-5.5)	3.2 (2.7-3.8)
101%-150% of the FPL	11.3 (10.5-12.1)	9.2 (8.5-9.9)	10.6 (9.6-11.5)	8.7 (7.8-9.6)
151%-200% of the FPL	12.6 (11.9-13.4)	11.3 (10.4-12.2)	12.3 (11.4-13.2)	11.0 (10.0-12.0)
201%-300% of the FPL	21.2 (20.4-22.1)	21.5 (20.5-22.6)	20.2 (19.2-21.2)	21.2 (19.8-22.6)
301% of the FPL	36.2 (34.3-38.0)	39.6 (37.8-41.4)	37.1 (35.0-39.2)	39.8 (37.6-42.0)
Number of comorbid conditions[†]				
0	11.0 (10.1-11.9)	8.5 (7.7-9.2)	9.7 (8.7-10.7)	7.3 (6.5-8.1)

Characteristic	All Enrollees (95% CI), %		Subset With FFS Medicare Parts A and B in All Months (95% CI), %	
	2000 (n = 11 761)	2010 (n = 9760)	2000 (n = 7957)	2010 (n = 5964)
1-2	33.4 (32.4-34.4)	29.6 (28.4-30.7)	33.2 (31.9-34.4)	28.9 (27.3-30.5)
3	55.6 (54.2-57.0)	62.0 (60.6-63.4)	57.2 (55.6-58.8)	63.8 (62.1-65.5)
Self-reported cardiovascular disease	65.9 (64.9-66.9)	72.5 (71.3-73.8)	67.5 (66.4-68.7)	74.6 (73.2-76.1)
Drug coverage				
No coverage	22.6 (21.2-23.9)	4.9 (4.3-5.4)	27.3 (25.7-28.8)	5.2 (4.5-6.0)
Has coverage	77.4 (76.1-78.8)	95.1 (94.6-95.7)	72.7 (71.2-74.3)	94.8 (94.0-95.5)

FFS = fee-for-service; FPL = federal poverty level.

* Percentages may not sum to 100 due to rounding. Estimates weighted to represent the national Medicare population.

[†] Includes cardiac disease, hypertension, cerebrovascular disease, lung disease, cancer, diabetes mellitus, arthritis, psychiatric disorder or depression, dementia, and other neurologic conditions.

Table 2

Adjusted Level and Trend Changes in Self-Reported Outcomes After Implementation of Part D in Community-Dwelling Medicare Beneficiaries*

Variable	Exponentiated β -Coefficient (95% CI)
Proportion in fair or poor health	
Level change	1.084 (1.019 to 1.153) [†]
Difference in trend before and after Part D	0.983 (0.957 to 1.009) [†]
Proportion with any ADL limitations	
Level change	0.951 (0.873 to 1.036) [†]
Difference in trend before and after Part D	1.026 (0.986 to 1.067) [†]
Proportion with any IADL limitations	
Level change	1.005 (0.937 to 1.077) [†]
Difference in trend before and after Part D	1.009 (0.968 to 1.052) [†]
Proportion who died during the year	
Level change	1.002 (0.862 to 1.164) [†]
Difference in trend before and after Part D	0.994 (0.958 to 1.031) [†]
Any inpatient hospital visits	
Level change	0.991 (0.925 to 1.061) [†]
Difference in trend before and after Part D	0.998 (0.975 to 1.023) [†]
Number of inpatient hospital visits	
Level change	0.993 (0.921 to 1.072) [‡]
Difference in trend before and after Part D	0.996 (0.971 to 1.022) [‡]
Any ED visits	
Level change	1.034 (0.958 to 1.115) [†]
Difference in trend before and after Part D	1.008 (0.978 to 1.039) [†]
Number of ED visits	
Level change	1.005 (0.931 to 1.085) [‡]
Difference in trend before and after Part D	0.990 (0.954 to 1.026) [‡]

Variable	Exponentiated β -Coefficient (95% CI)
Mean inpatient hospital costs, \$	
Level change	7.50 (−261.47 to 276.40)
Difference in trend before and after Part D	−29.70 (−121.37 to 61.96)
Mean ED costs, \$	
Level change	−12.08 (−34.54 to 10.38)
Difference in trend before and after Part D	4.40 (−2.99 to 11.80)

ADL = activities of daily living; ED = emergency department; IADL = instrumental ADL.

* Estimated difference in trend between before and after Part D represents average change in trend exponentiated from log linear models adjusted for age, sex, and race. Survey models were based on 11 annual observation points.

[†]Odds ratio.

[‡]Incidence rate ratio.

Table 3

Adjusted Level and Trend Changes in Outcomes After Implementation of Part D in Medicare Beneficiaries With Full-Year Medicare Part A and B FFS Coverage: Survey Versus Claims Data*

Variable	Survey-Based Utilization 5 y After Part D	Claims-Based Utilization	
		3 y After Part D	5 y After Part D
Any inpatient hospital visits			
Level change	0.988 (0.916-1.066) [†]	0.962 (0.887-1.044) [†]	0.989 (0.922-1.060) [†]
Difference in trend between before and after Part D	0.985 (0.958-1.013) [†]	1.000 (0.988-1.011) [†]	0.994 (0.988-1.000) [†]
Number of inpatient hospital visits			
Level change	0.989 (0.913-1.073) [‡]	0.973 (0.888-1.066) [‡]	0.997 (0.925-1.075) [‡]
Difference in trend between before and after Part D	0.981 (0.952-1.010) [‡]	0.998 (0.985-1.012) [‡]	0.993 (0.985-1.001) [‡]
Any ED visits			
Level change	0.964 (0.881-1.055) [†]	0.991 (0.933-1.052) [†]	0.996 (0.941-1.055) [†]
Difference in trend between before and after Part D	1.007 (0.973-1.043) [†]	0.996 (0.986-1.006) [†]	0.994 (0.988-1.000) [†]
Number of ED visits			
Level change	0.943 (0.862-1.031) [‡]	0.979 (0.893-1.073) [‡]	0.962 (0.890-1.039) [‡]
Difference in trend between before and after Part D	0.991 (0.951-1.032) [‡]	0.988 (0.976-1.002) [‡]	0.991 (0.983-0.998) [‡]

ED = emergency department; FFS = fee-for-service.

* Values are exponentiated β -coefficients (95% CIs). Estimated difference in trend between before and after Part D represents average change in trend exponentiated from log linear models adjusted for age, sex, and race. Survey models were based on 11 annual observation points, and claims models were based on 36 and 44 quarterly observation points.

[†] Odds ratio.

[‡] Incidence rate ratio.