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THE EFFECTS OF PRESCRIPTION DRUG COST SHARING: EVIDENCE FROM THE MEDICARE MODERNIZATION ACT

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Abstract

This study assesses the impact of reductions in cost sharing for prescription drugs on preventable hospitalizations and outpatient care utilization among the elderly in the United States. In addition to affecting demand for drugs, drug cost sharing can also affect the demand for complement services, such as primary or preventive care. In order to evaluate this possibility, I analyze the effects of varying patient cost sharing for prescription drugs on hospitalizations from ambulatory care sensitive conditions (ACSC), which can represent a failure of preventive and outpatient care. To address endogeneity from selection and sorting of individuals into insurance plans, I aggregate data from the 2000-2009 Medical Expenditure Panel Survey (MEPS) to the region-year level, and use an instrumental variables strategy. The analysis exploits exogenous variation in prescription drug cost sharing that occurred as a result of the Medicare Modernization Act of 2003, and therefore plausibly identifies causal effects of cost sharing. Results show that for the elderly in the United States, who have generous insurance coverage for other outpatient services, reductions in prescription drug cost sharing do not have an effect on hospitalizations related to ambulatory care sensitive conditions, or on specific types of preventive care utilization.

JEL Classification: I12

Key words: cost sharing, prescription drugs, Medicare Part D, preventive care, ambulatory care sensitive conditions.

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I. INTRODUCTION

Health insurance cost sharing is an important component of a plan's financial responsibility arrangement, as out-of-pocket costs at the point of service can influence an individual's demand for health care services. Due to subsequent effects on the health and health spending of enrollees, it is important to understand relationships between cost sharing and specific types of care utilization. This study focuses on the influence of prescription drug cost sharing on ambulatory care sensitive condition (ACSC) hospitalizations and outpatient care use by the Medicare-aged population in the United States. These hospitalizations can be avoided with timely and adequate outpatient care, and thus represent a failure of preventive care or disease management (1). I address the endogeneity problem caused by selection and sorting of enrollees into insurance plans by exploiting exogenous variation in cost sharing that occurred with the introduction of the Medicare Modernization Act in 2006, thereby plausibly isolating causal effects. I use data from the Medical Expenditure Panel Survey (MEPS), over the period 2000-2009, restricted to respondents aged 65 and higher (2).

The effects of prescription drug cost sharing on health and health care utilization among seniors is an important research area because of the large and increasing level of spending in this sector. Health care utilization among the elderly is higher than the rest of the population; in 2009 United States senior citizens spent an average of \$9744 per person, compared to \$5511 for people aged 45-64, and \$2739 for those aged 25-44 (3). In 2010, prescription drug costs were \$259.1 billion, or 10 percent of total U.S. health expenditures (4), and drugs have been one of the fastest growing sectors of health care, with public drug spending averaging 6.1 percent growth over the years 2008-2012 (5). In order to maximize the utility gained from this spending, health insurance plans must strive to appropriately balance the goals of reducing moral hazard consumption of care, while maintaining appropriate risk protection (6). This research will contribute to the literature and policy debates on the implications of varying cost sharing across a key subpopulation.

Cost sharing at the point of service has an important role in health insurance, where it is designed to mitigate moral hazard consumption of medical care. Such overconsumption can be detrimental to the pool of enrollees, who finance the care of fellow enrollees, and to society overall, due to allocative inefficiency. A consequence of dissuading plan enrollees from overusing care is that the same enrollees may be deterred from using necessary care. Uncertainty regarding the necessity and efficacy of care can make perceptions of marginal value inaccurate. While we already have a lot of evidence regarding how price alterations from prescription drug cost sharing influence demand for drugs (7-10), we know much less about how they influence the use of complement and substitute services via elastic cross-price demand. The associated health effects of these utilization changes are often referred to as offset effects (11). In the case of prescription drug cost sharing, it is possible that cross-price effects on primary care, a complement service, could cause offset effects on health in the future. Such a scenario could unfold if preventive care use was altered, as the lack of these services may result in severe health problems (12). This paper addresses the existing knowledge gap regarding both cross-price effects and offset effects by examining whether or not prescription drug cost sharing affects hospitalizations from ambulatory care sensitive conditions (ACSCs), which represent a failure of preventive and outpatient care (1).

Given that perceptions regarding the value of complement services such as preventive care can be inaccurate, does prescription drug cost sharing cause enrollees to forego these services? Do cost sharing responsibilities for one type of care affect the use of other types of care, via cross-price elastic demand (e.g., prescription drug cost sharing affecting outpatient care utilization)? Most importantly, do associated alterations to care utilization have an influence on enrollee health? These questions are difficult to answer in observational settings, due to the endogenous relationship between health insurance plan characteristics and health. External factors, especially health-risk, have a role in the selection and sorting of individuals into insurance plans, and also influence care utilization and health outcomes. In past literature, this problem has been approached with a variety of strategies, most notably with randomized experiments (13, 14). These studies have examined the effects of health insurance, and characteristics thereof, but lack applicability to some contexts.

While the literature agrees that cost sharing reduces the use of health services, cross-price effects have not been examined in detail. The precise effects of prescription drug cost sharing for the elderly on primary care, and the ensuing health consequences of utilization alterations, are not clear. Some empirical evidence exists, with some research indicating that preventable hospitalizations are increased by cost sharing (12, 15, 16), and others indicating no effect (17). The effects of the cost sharing reductions that accompanied the Medicare Modernization Act are especially interesting, because they feature an environment where enrollees maintained consistently good coverage of outpatient and inpatient services, yet saw dramatic increases in prescription drug coverage. The results of this study show that in such an environment, there is no effect of changes in prescription drug cost sharing on ACSC hospitalizations, evidence that at least one important health indicator does not respond to cost sharing. Additionally, results show that Medicare-aged individuals' utilization of routine checkups, and other preventive care measures, are unaffected by the cost sharing reductions that occurred with the Medicare Modernization Act.

The rest of the paper will proceed as follows: Section II gives background information and a literature review of research on the effects of health insurance cost sharing on health care utilization and health. Section III describes the endogenous selection and sorting of enrollees into health insurance plans, and explains how the Medicare Modernization Act of 2003 introduced exogenous variation in cost sharing. Section IV describes the methods, Section V the results, and Section VI provides a discussion of the results and their validity. Section VII concludes, and offers policy implications.

II. BACKGROUND AND LITERATURE REVIEW

The rising costs of health care have brought attention to improving the efficiency of spending in the health sector. In the United States, for example, total health expenditures have risen to nearly 18 percent of gross domestic product (18). In an effort to reduce costs and incentivize more efficient utilization of care, health insurance plans use cost sharing for both consumers and providers of health care. High costs to the consumer at the point of service may, however, have health consequences.

Theoretical Effects of Cost Sharing on Health Care Demand and Health

Cost sharing at the point of service in health insurance plans comes as a response to the threat of moral hazard consumption of health care. Insurance allows people to transfer income from when they need it less to when they need it more (19). But, the transfer is not perfect: instead of transferring income, health insurance pays some portion of the costs of medical care use. Because patients do not face the full marginal cost of care when they make decisions about utilization, the medical care subsidy can lead to overuse, where the marginal benefit of care is less than its marginal cost. This overuse is known as moral hazard – the overconsumption of purchases for which the consumer faces a price below the true marginal cost (20-25). Insurance requires that others pay nearly the full portion of one's losses, and the reduced price thus creates an incentive to use additional medical resources (19). Even in the absence of insurance, efficient outcomes are unlikely in the health care market due to the presence of uncertainty and asymmetric information, which cause inaccurate perceptions of marginal costs and benefits (26). With insurance, these incorrect perceptions can increase the consumption of care to a quantity where marginal cost exceeds marginal benefit, and resources are allocated inefficiently.

In order to dissuade moral hazard consumption of health care by insured individuals, insurance plans place some portion of health costs on the enrollee at the point of service. Modern cost sharing exists with different structures and levels for different types of health care services, taking various forms such as deductibles, coinsurance rates, and copays. In any form, cost sharing at the point of service is effectively the marginal cost. Theory predicts that in the face of increased marginal cost, consumers should forego care that has perceived value below its marginal cost (19). In addition to affecting the demand for the service at hand (own-price elastic demand), these price changes may also cause alterations in the use of substitute and complement services, via cross-price elastic demand. This cross-price elasticity of demand is negative for complements, and positive for substitutes.

In this paper, I analyze effects of changes to prescription drug cost sharing that accompanied the Medicare Modernization Act of 2003 (MMA, enacted 2006). This legislation introduced Medicare Part D, which made public prescription drug insurance available to Medicare eligible seniors. Since drugs are frequently used in conjunction with other types of care, we expect changes in cost sharing for drugs to have wide-ranging effects on health care utilization. In addition to effects on the demand for drugs, drug cost sharing has the potential to influence the use of other services such as primary care, which is a complement service to prescription drugs, at least among initial purchases. That is, since prescriptions for drugs can only be obtained from a physician, primary care is necessary before acquiring any prescription drugs. This cross-price mechanism, in the case of the MMA reducing cost sharing, implies that patients would be more likely to seek primary care as a result of their newly improved coverage for the drugs that could be prescribed. Preventive care, often delivered with primary care, may be especially susceptible to the cross-price effect, because patients do not actually feel ill at the time when decisions about preventive care are made. Demand for this seemingly less essential care could thus be more price elastic than other types of care (eg: curative, or non-preventive). Perceptions regarding the need and efficacy of medical care are obscured by imperfect information (26, 27), and preventive care, with less obvious short term benefits, is especially likely to be incorrectly valued by consumers.

An important consequence of utilization alterations caused by cost sharing is the offset effect, which refers to the associated health effects of utilization alterations. Preventive care, by its nature, is designed to improve long term health, by preventing the occurrence of adverse health events, and lessening their severity. Thus, if changes to cost sharing influence preventive care use, there is a chance that long term health will be influenced. In the case of the MMA, in which drug cost sharing was reduced for the Medicare eligible population of the US, it is possible that positive offset effects would improve long term health. This could occur via own-price effects on drug usage, or via cross-price effects on services like preventive care. In this study, I examine effects of the MMA's prescription drug cost sharing reductions on primary care utilization, and on ambulatory care sensitive condition (ACSC) hospitalizations. ACSC hospitalizations can result from inadequate preventive and outpatient care (1), and are thus especially likely to capture offset effects of cost sharing. In doing so, I am assessing the effects of the policy, beyond the better established effects on drug utilization (7-10). There is a lack of clear evidence on cross-price effects and offset effects in the literature, and the results from this study contribute to the understanding of these mechanisms.

Literature Review

The literature on the effects of health insurance cost sharing is extensive, and examines impacts on general utilization, specific services, and health. In this paper, I focus on the relationship between prescription drug cost sharing, and the primary care utilization and preventable hospitalizations of the elderly. I give specific attention to the cross-price effects of drug costs, and associated offset effects on health outcomes. Previous research has examined these issues with varying degrees of specificity, but even among studies with strong methodologies, the results vary, mostly due to the differing approaches to dealing with the selection/sorting problem. Many studies are purely observational and make no attempt to identify anything beyond a correlation. The causal research exploits some types of natural experiments, but results from such specific settings lack comparability. The lack of decisive, generalizable results alludes to the complicated nature of health insurance cost sharing.

The first studies on cost sharing examine effects on general utilization, and often seeks to identify the own-price elasticity of medical care demand. Evidence exists from natural experiments, cross-sectional studies, observational comparisons, and most notably from a randomized experiment. While my paper has a much more specific focus, it is important to note the contribution of the RAND Health Insurance Experiment (HIE), which, in the early 1970s, randomized nearly 6000 people to insurance plans that varied by coinsurance rates. This randomized variation in cost sharing makes the HIE's results particularly robust. Researchers found an own-price elasticity of -0.2, which was relatively insensitive to differences in income or health status (28). This important result gave a decisive confirmation of the theoretical prediction that cost sharing reduces overall utilization. Such a conclusion begs the question: which services are reduced, and what are the effects on health? If moral hazard consumption is truly excessive care, and increased cost sharing reduces the consumption of only the least beneficial services, then the health consequences should be minimal.

The HIE also provided strong evidence on the effects of cost sharing on the use of particular services, and on health. Contrary to the hypothesis that the least valued care will be reduced the most in the presence of cost sharing, the HIE found that with the exception of emergency care, cost sharing reduced all services indiscriminately, regardless of appropriateness or efficacy. More recent studies have also found that cost sharing caused reductions in care, regardless of that care's necessity; Tamblyn et al showed that increased drug cost sharing caused reductions in both essential and less-essential drugs (15). Other relevant findings from the HIE include a cost sharing induced reduction in the use of preventive care. Additionally, it was found that for the average person, there was no substantial health benefit of reduced cost sharing, despite a 40 percent increase in services used (13). The study also found no evidence that high coinsurance, by dissuading individuals from using effective preventive care, would increase expenditures later on (for example, by inducing hospitalization) (29). Further evidence on the relationship between cost sharing and preventive care use was provided by Trivedi, Rakowski, and Ayanian (30), which showed that that the introduction of relatively small copayments caused significantly lower mammography rates for women who should be screening according to clinical guidelines.

Despite sound methodology in the health insurance experiment, it is now 30 to 40 years old, and the health care and health insurance markets have changed. As noted by Zweifel and Manning (28), the experiment's results may not apply to modern situations, with large plans influencing physician decisions and much more common managed care. A more modern randomized health insurance experiment was conducted with the 2008 expansion of Oregon's Medicaid system. Findings showed that in the first two years, Medicaid coverage increased utilization of health care services, raised the rate of diabetes detection and management, reduced depression rates, and reduced financial strain, but caused no significant improvement in measured health outcomes (14). This experiment contributes strong evidence on the effects of providing full insurance to low-income people, but did not test variations in cost sharing.

Another problem with the HIE is that it did not include senior citizens in its sample, meaning that its conclusions may not apply to the Medicare population used in the sample for this study. Of greater comparability is evidence that focuses on the elderly population; Rice and Matsuoka (31) provide a review of studies of cost sharing's effects on senior citizens. Of the papers that focus on types of cost sharing and outcomes relevant to this study, six papers plausibly address the problem caused by endogenous selection/sorting of enrollees into insurance plans (15, 32-36). All of these results showed that drug cost sharing reduced the appropriate usage of prescription drugs, while the effects on other services were less definitive. In another important paper on the effects of cost sharing for the elderly, Shigeoka (37) showed that the reduced price of outpatient care at age 70 in Japan causes individuals to increase their outpatient visits related to ACSCs. This indicates that demand for this type of care, which could prevent the ACSC hospitalizations that serve as on outcome in this paper, is sensitive to its own price.

A negative own-price elasticity of demand reveals that cost sharing for one type of service will reduce its own utilization. As noted above, it is possible that the same cost sharing could affect the use of other types of services, even if those other services are fully insured. This study focuses on the possibility that reduced cost sharing for prescription drugs may affect the use of primary care, which may then in turn affect hospitalizations, or other health outcomes. The first of these effects, on care utilization, is dependent on the elasticity of demand for the services in question. While the HIE gave robust evidence that the own-price elasticity of demand is negative, there has been far less research on the cross-price elasticity of demand, in which cost sharing for one type of service affects the use of another type of service. My study examines one such cross-elasticity, between prescription drug cost sharing, and primary care utilization. The best example of research in this area is from Winkelmann (38), who used a 1997 German health care reform as a natural experiment, and found that increased prescription drug copays reduced the number of doctor visits by ten percent. The significant effect on physician visits was induced by a relatively large price shock; copayments for drugs were increased by up to 200 percent. In comparison, this study looks at the effects of a cost sharing reduction with an average value of $8.60, a 27 percent reduction (Tables 1 and 2).

As a consequence of changes in primary care utilization, effects on hospitalizations and other health outcomes can occur. In many studies, these consequences are referred to as "offset effects," because the health consequences of initial utilization reductions offset any savings that may have resulted from the cost sharing. An example of this is Gaynor, Li, and Vogt (11), who showed that for the nonelderly US population, 35 percent of expenditure reductions associated with increased prescription drug cost sharing were offset by increases in other spending. The work of Trivedi, Moloo, and Mor (39) found that increased ambulatory care copayments caused reduced outpatient visits, increased admissions, and increased inpatient days. The particularly strong contribution from Tamblyn et al (15), mentioned above, found offset effects of cost sharing induced care reductions, including a higher rate of serious adverse events and emergency department visits.

Chandra, Gruber, and McKnight (12) studied the effects of increased outpatient and prescription medicine cost sharing imposed by a private supplemental insurer for California's public sector retirees. While their results confirmed the price elasticities of demand for physician visits and drug use that were found in the HIE, they found substantial offset effects, including increased probability of hospitalization. Interestingly, the savings from increased cost sharing went to the supplemental insurer, while the costs from increased hospitalization fell mostly to Medicare. A later paper by the same authors (40), which assessed exogenous variation in cost sharing among the Massachusetts poor, again found utilization reductions in outpatient services as an effect of higher cost sharing. This time, however, there was no evidence of increases in hospitalizations or emergency department visits in response to higher copayments. Culler, Parchman, and Przybylski's study (17), despite its failure to address the endogeneity of insurance coverage type, is relevant because it uses ambulatory care sensitive condition (ACSC) hospitalizations as an outcome variable. This study found no evidence of offset effects for Medicare beneficiaries, with potentially preventable hospitalizations not associated with prescription drug cost sharing.

Even among studies with strong causal methods, the estimates for cross-price and offset effects range widely, suggesting that the effects of cost sharing are complex, and may be sensitive to the context and population studied. While studies consistently find negative own-price elasticities, cross-price effects, and their associated health effects, lack clarity. This paper evaluates the role of prescription drug cost sharing in the care decisions of the elderly in the United States, and assesses its potential impact on hospitalizations from ambulatory care sensitive conditions. It will contribute to the evidence on cross-price elasticities of demand across types of health care, specifically regarding the effects of prescription drug price reductions. This question is of particular importance, because of the large portion of health care spending that is consumed by senior citizens, and the large portion that is used on prescription drugs.

III. ENDOGENEITY AND THE MEDICARE MODERNIZATION ACT

Investigating the effects of insurance plan characteristics is difficult, due to non-random selection and sorting of individuals into insurance plans. It is likely that individuals with certain health and health care tendencies enroll in plans with particular levels and types of cost sharing. This is effectively an omitted variables problem, with unobserved heterogeneity influencing relevant dependent and independent variables in the study. More specifically, these unobserved factors, especially health risk, affect an individual’s choice of insurance plan, as well as their health care utilization and health.

The direction of the relationship between health risk and health insurance plan choice is unclear, because of two conflicting forces. On one hand, we expect that high risk individuals, who would be likely to need more care, would select more generous insurance plans (lower cost sharing). On the other hand, empirical evidence on the gradient between health and socioeconomic status shows that lower risk (healthier) individuals have higher incomes (41). High incomes and better insurance benefits from their jobs make these healthier individuals more likely have more generous plans. In general, evidence shows that the former effect dominates, with lower risk individuals opting for less expensive, less generous plans (42). The presence of adverse selection requires that analyses seeking to identify causal effects of insurance plan characteristics, such as cost sharing, use exogenous variation in their explanatory variables.

In order to account for unobserved factors that attract individuals to certain types of health insurance plans, the ideal setup for answering this question would be to randomly assign individuals to health insurance plans with varying levels of cost sharing. After tracking these individuals over time, variation in health care utilization and health could be identified as causal effects of the cost sharing differences among insurance plans. In the absence of a randomized experiment, the second best option is to isolate exogenous variation in cost sharing across time. The associated variation in ACSC hospitalizations can then be interpreted as a causal effect of the cost sharing arrangements.

Medicare Modernization Act of 2003: Exogenous Variation in Cost Sharing

The source of exogenous variation in this study is the Medicare Prescription Drug, Improvement, and Modernization Act, more commonly known as the Medicare Modernization Act (MMA), which went into effect on January 1, 2006. This legislation made a number of changes to Medicare, including the expansion of benefits to cover prescription drugs. This program, known as Medicare Part D, covers prescription drugs according to a “standard benefit” cost sharing structure. Prior to the MMA, in 1999, 75 percent of Medicare beneficiaries received drug coverage from a number of sources, including Medicaid (15.9 percent), employment-based plans (29.6 percent), Medigap (11.2 percent), other public sources (4.1 percent), and managed care plans (14.2 percent), leaving 25 percent without any drug coverage (43). In 2006, 53 percent of enrollees joined a Part D plan, and only 10 percent were uninsured for drug costs by 2010 (44).

Figure 1 shows the standard benefit structure for Part D plans in 2006. When millions of Medicare enrollees joined Part D plans in 2006, their prescription drug cost sharing began to follow this structure, or an actuarially equivalent structure. These benefits entailed that the patient was responsible for a $250 deductible, then 25 percent of expenses from $251-2250, 100 percent of expenses from $2251- 5100, and five percent of expenses above $5100. Figure 2 depicts the shares of prescription drug spending across sources and time for Medicare enrollees, and demonstrates a clear discontinuity in 2006 when Medicare Part D was enacted. Medicare’s share of expenses increased from less than ten percent in 2005, to nearly 40 percent in 2006. Figure 3 shows a similar graph, with a breakdown of payment sources for all medical expenses across time. Figure 4, showing the interquartile range of the region-level shares of drug spending by self or family across time, depicts the significant variation that existed in rates of drug coverage among the elderly across geographic regions. As explained above, when these enrollees joined Part D, they did so from a variety of sources, including Medicaid, employer-sponsored plans, and a lack of drug coverage. Table 1 shows that for MEPS respondents aged 65 and higher, the mean prescription drug coinsurance rate dropped from 56.65 to 44.88 between 2005 and 2006, with larger drops for those without insurance in 2005. Regardless of the previous situation for enrollees, the new cost sharing structure was an exogenous change, unassociated with the unobserved heterogeneity that would typically confound an analysis looking at the effects of cost sharing. Therefore, using the variation in cost sharing that stemmed from the differential effects of MMA across time and space, associated changes in utilization and health care can be interpreted as causal effects.

While the primary analyses of this study use variation in Medicare prescription drug insurance coverage as the source of exogenous variation in cost sharing, supplemental analyses exploit variation from another part of the MMA. In addition to introducing drug coverage, the MMA also made private Medicare plans more attractive to Medicare enrollees, thus channeling a larger portion of the Medicare market towards those private insurers (45). Prior to 2006, Medicare parts A and B were available privately, in a program then known as Medicare Part C (or "Medicare + Choice"). After Part D was introduced with the MMA, Medicare + Choice was renamed "Medicare Advantage," which provides parts A, B, and D through private insurance companies. If they so choose, beneficiaries can alternatively receive stand-alone private Part D drug coverage in addition to original Medicare (public A and B).

Medicare options, prior to the Medicare Modernization Act (MMA):

1. Original A (public).
2. Original Medicare (public A and B).
3. Part C: Private A and B. Formerly known as Medicare + Choice, via the Balanced Budget Act of 1997. Now called Medicare Advantage.

Two additional options to add Part D (prescription drug coverage) became available in 2006, when the MMA was enacted:

1. Stand-alone private Prescription Drug Plan (PDP).
2. Medicare Advantage with Part D (MA-PD): A, B, and D through private plan.

After the MMA, the Medicare Advantage (MA) plans became more popular (45). In addition to the lure of drug coverage, many of the MA plans offer incentives related to the cost sharing for important prescription drugs (46). Figure 5 shows the enrollment in private Medicare plans across time, and after years of declining rates of enrollment, the trend reversed in 2006 when the MMA was enacted. Private enrollment increased from 5.3 million (12 percent of Medicare beneficiaries) in 2005, to 11.4 million (24 percent of beneficiaries) in 2010. Beneficiaries' transitions into Medicare Advantage plans are representative of the effects of the MMA, and associated changes in cost sharing can be interpreted as exogenous. To assess the robustness of results that use variation in Medicare prescription drug coverage as the source of exogenous variation, supplemental analyses exploit variation in Medicare Advantage penetration for the same purpose. Detailed information about isolating these various effects of the MMA can be found in the Methods section.

IV. METHODS

The key independent variable in this analysis is the portion of expenses that was paid by the patient or their family for some amount of health care utilization. Specifically, I use the share of prescription medicine spending paid for by self or family, because this is the type of spending that responds most directly to the Medicare Modernization Act (MMA). The interquartile range for this variable is displayed across time in Figure 4.

The most important dependent variable in my analysis is the portion of hospitalizations in a region-year for which the primary diagnosis was an ambulatory care sensitive condition (ACSC). ACSC hospitalizations are hospital admissions that could be avoided with timely and adequate outpatient care (1). The following 20 hospitalization diagnoses are commonly cited as ACSCs: angina, asthma, bacterial pneumonia, bronchitis, cellulitis, congenital syphilis, congestive heart failure, chronic obstructive pulmonary disease (COPD), dental conditions, diabetes, gastroenteritis, grand mal seizure disorders, hypertension, hypoglycemia, kidney and urinary tract infections, nutritional deficiency, pelvic inflammatory disease (women only), ruptured appendix, severe ENT infection, and tuberculosis (47). In short, proper outpatient care and chronic disease management should prevent patients from being hospitalized for these conditions. As such, they represent an outcome of access to outpatient services, utilization decisions, and the quality of care received. Figure 6 shows the interquartile range of ACSC related hospitalizations across time. The diagnoses are defined according to International Statistical Classification of Diseases and Related Health Problems codes (ICD-9), and Clinical Classification Codes (CCC), which are reported in the appendix.

In addition to ACSC hospitalizations, I also examine dependent variables for utilization of preventive and outpatient care. The most important of these is an indicator for whether or not the respondent has received a routine checkup in the past year. This outcome should capture the negative cross-price effect of prescription drug costs sharing, because primary care and prescription drugs are complements, at least among initial purchases. Additionally, routine checkups represent an intermediate step in the causal chain between cost sharing and ACSC hospitalizations, which should only occur in the absence of proper primary and preventive care.

Data

Data for this study come from the 2000-2009 Medical Expenditure Panel Survey (MEPS), from the Agency for Healthcare Research and Quality (AHRQ) (2). MEPS is a set of surveys of individuals and families in the United States, covering the specific health services that they use, their costs, and how they are paid for. It is a series of two year panels, each consisting of five rounds of interviews, with a new panel beginning every year. Most of the data comes from the following publicly available files: Hospital Inpatient Stays, Prescribed Medicines, Outpatient Visits, Full-Year Population Characteristics, Point-in-Time Population Characteristics, and Person Round Plan files. The Confidential Master files (Geographic Master files) from MEPS are also used for geographic identifiers. The only data not from MEPS was regional Medicare information, measured by the Health Resource and Services Administration (HRSA) and detailed in the Area Health Resource File (AHRF) (48). This analysis is limited to the sample population age 65 or greater.

Aggregation
I aggregate most variables to the region-year level, to create a decade-long panel of region-years, which allows the exploitation of exogenous changes in cost sharing that accompanied the MMA. Since MEPS only follows each participant for two years, individual-level panel analysis is not possible over the course of a decade. Even if it was possible, it would still suffer from selection bias, in which individuals choose (or are sorted into) plans according to their riskiness. Identification in a fixed effects model would be driven by those individuals who switched their insurance plan, which could be done for health/risk reasons. Therefore, I aggregate the individual-level variables by geographic units and years, using the person weights provided in MEPS. The regions are designated market areas (DMAs), of which there are 210 in the United States. With the panel of region-years, the identifying variation of my analyses is the temporal and geographic variation in cost sharing that was induced by the MMA.

Analysis
I use instrumental variables (Two Stage Least Squares) regressions with standard errors clustered at the DMA level, to identify the causal effects of cost sharing on ACSC hospitalizations. The use of confidential geographic identifiers was necessary for aggregation and clustering, and therefore all analyses were conducted remotely at the AHRQ Data Center in Rockville, Maryland.

1st Stage:

$$SFCost_{rt-1} = \alpha + \beta IV_{rt-1} + \gamma TotCost_{rt-1} + \delta X_{irt-1} + u_{irt-1}$$

2nd Stage:

$$Y_{rt} = \alpha + \beta Predicted\, SFCost_{rt-1} + \gamma TotCost_{rt-1} + \delta X_{irt} + \varepsilon_{irt}$$

Independent variable (SFCost):
The key explanatory variable, represented as *SFCost* in the above equations, is the share of prescription medicine expenses paid by self or family (lagged). At the aggregate level, this is the mean portion of prescription medicine expenses paid by self or family, among prescription medicine events in a region-year. The movement of this variable across time can be seen in Figure 4.

Outcome variables (Y):
The most important outcome variable is based on an event-level indicator for ambulatory care sensitive condition (ACSC) hospitalizations. At the aggregate level, this is the portion of hospital admissions in a region-year for which the primary diagnosis was an ACSC. The other major outcome I examine is based on an individual-level indicator for having had a routine checkup in the past year. At the aggregate level, this is the share of individuals in a region-year who received a routine checkup in the last 12 months.

Due to non-linear cost sharing schemes that exist in many insurance plans, I restrict the event-based variables to events (such as hospitalizations, outpatient visits, or drug prescriptions) that were the patient's first of the year. This first event is the most likely to be susceptible to a deductible, and the least likely to be covered by some type of "stop-loss" or maximum expenditure limit that would nullify the effect of cost sharing on care decisions. I use only first time ACSC hospitalizations because in order for primary care use alterations to plausibly cause an ACSC hospitalization, there should be no other admission in the period prior to this hospitalization.

Controls (X):
At the individual level, I include controls for age, race, gender, marriage, and income quintiles. There are also region and year fixed effects, and region-year level variables for education and unemployment. Region fixed effects control for features of the regions that may confound the analysis, due to their association with the effects of the MMA and with health and utilization outcomes. More details on these relationships can be found in the description of the instruments, below. As an additional control, I include the total level of spending (lagged) from all payment sources ($TotCost$). Its inclusion allows me to isolate the effects of out-of-pocket spending, net of the total spending on the episode in question.

Instruments:
The instruments are related to changes that occurred as a result of the Medicare Modernization Act (MMA), and exploit the fact that the MMA impacted geographic areas differently. As mentioned above, the MMA introduced coverage for prescription drugs. Prior to 2006, Medicare beneficiaries received drug coverage from a variety of sources, including Medicaid, employer-sponsored plans, and elsewhere, with 25 percent uninsured in 1999 (43). In 2006, 53 percent of Medicare beneficiaries were enrolled in a Part D plan. The figure rose to 60 percent by 2010, with only ten percent uninsured (44). The MMA not only induced a shock in drug coverage across time, but also across regions. Figure 7 shows the interquartile range for regional levels of drug coverage across time, showing the large variation that exists across regions within each year. Figure 8 shows the same variable, but only for those regions in the bottom 20 percent of drug coverage in the pre-MMA years. The regions in the bottom 20 percent of drug coverage saw an increase in coverage in the post-MMA years. The disparate effects of the policy change across regions is crucial for variables related to the policy to be useful instruments.

The standard benefit structure imposed by the MMA (Figure 1) makes policy-related variables correlated with cost sharing, as is necessary for the variables to be strong instruments. The effects of the policy on the prescription drug coinsurance rate is well illustrated in Table 1, which shows that the mean percent of drug costs paid by self or family dropped from 56.65 to 44.88 from 2005 to 2006 for MEPS respondents aged 65 and higher. In addition to being strongly associated with cost sharing, these instruments should not be correlated with the outcomes, aside from through cost sharing. The main instrumental variable, which uses the effects of the MMA to isolate exogenous variation in cost sharing, is the portion of the region with Medicare Part D in 2008 interacted with an indicator for the years that the MMA was active (MRX08). The source of region-level data on Part D is not MEPS; rather, these figures are measured by the Health Resource and Services Administration (HRSA) and detailed in the Area Health Resource File (AHRF) (48), which was then merged by region with the MEPS data.

The validity of the instrument is determined by the nature of the variable's regional and time variation. The MRX08 variable serves a similar role to an indicator variable for MMA, except it is not collinear with the year fixed effects. Therefore the time variation is shaped by the MMA, which became law on January 1, 2006. Regional variation in MRX08 is shaped by the portion of the region that took up Medicare prescription drug coverage in the wake of the MMA. The pre-MMA drug coverage was a major determinant of this transition; those regions with the lowest coverage prior to the legislation saw the greatest increases post-legislation. This change is well-illustrated in Figure 8, which depicts a large increase in drug coverage for those regions in the bottom 20 percent of drug coverage in the pre-MMA years. Additionally, Table 1 shows that individuals without drug coverage (and other forms of health insurance) had much greater reductions in their net prescription drug coinsurance rate between 2005 and 2006. The main determinant of individuals' and regional pre-MMA drug coverage was income, with the lowest income people on Medicaid, and the highest income people in employer-based plans. The largest group of seniors without drug coverage prior to 2006 was the middle to low income group, who fell between eligibility for Medicaid and employer-based plans (43).

Income is related to many risk factors that affect the outcomes of interest, meaning that instruments related to income may violate the exclusion restriction. To account for this, I control for time-varying income. I also use region fixed effects, which controls for regional variation in risk, as long as it is not time-varying.

As will be displayed in the results, Part D penetration shows a strong association with prescription drug cost sharing in the first stage regressions, and provides the principal results of this study. As with any IV analysis, the effect identified is a local average treatment effect (LATE), and lacks generalizability to portions of the population unaffected by the instrument. In order to identify a different LATE, and confirm the validity of the results in the primary analyses, I performed supplemental analyses with instruments that exploited variation from the changes that occurred to private Medicare with the MMA. These changes are explained in Section III, and the instruments that I use are as follows: the portions of the region with Medicare Advantage (MA) in 2005 and 2008, interacted with the MMA indicator (MADV05 and MADV08). These private Medicare options became much more popular after the MMA was enacted, and cost sharing changes associated with beneficiaries' transitions into MA plans can be interpreted as exogenous. While the first stages in these regressions are not as strong as those in the primary analysis, these two variables capture the transition of Medicare enrollees into Medicare Advantage (MA) plans, and thus estimate a different LATE.

MADV05 is the portion of the region covered by private Medicare in 2005, interacted with an indicator for the MMA years. Those regions with lower 2005 levels of private Medicare enrollment will see larger changes in their cost sharing. This is similar to the empirical strategy used by Amy Finkelstein in her assessment of the effects of Medicare's introduction (49). Time variation stems entirely from the MMA. Regional variation comes from a number of factors that determined private Medicare penetration before the MMA. The most important of these is the urban/rural composition of the region. Private options were less common in rural areas. Other important factors are the insurance market structure, state regulations, prior managed care history, beneficiary characteristics, supplemental coverage patterns, form of provider organization, practice patterns, care expectations, and other market characteristics (50, 51). While some of these factors are likely to be correlated with the outcomes, and may thus violate the exclusion restriction, this problem is addressed by including region fixed effects, as long as such factors are time-invariant.

The third and final instrument is the portion of the region covered by private Medicare in 2008, interacted with a dummy for the MMA years (MADV08). Rather than showing the potential for future plan transitions, as with the above 2005 figure, this variable shows the actual penetration of private Medicare two years after the MMA was enacted. Time variation again comes entirely from the MMA. Regional variation will also be similar to the 2005 version of this variable, as described above.

A potential problem exists with the robustness checks that use the two instruments based on MA penetration. It is conceivable that the same factors that determine whether or not people enroll in an MA plan also have an influence on the outcomes of my study. This problem would exist if, for example, people who enrolled in MA plans were differentially likely to use preventive care. Such a relationship would violate the exclusion restriction of an instrumental variables analysis, as the instruments would be affecting outcomes through the error term, rather than strictly through their association with prescription drug cost sharing. However, this problem is addressed with control variables, in the same way that was explained above. Regional fixed effects capture these other factors that could be affecting the outcome variables through the error term, as long as these factors are time-invariant. Additional support for the exclusion restriction is provided by Kulkarni et al 2012 (52), which showed a lack of association between Medicare Advantage penetration and hospital outcomes.

Individual-Level Analysis

One limitation of my empirical strategy is that aggregation of variables to the region-year level causes some portion of the identifying variation to be lost. In other words, it is possible that cost sharing has a significant relationship with individuals' health care utilization decisions, and in turn their health, but the aggregate measures of my main analysis are not precise enough to capture the relationship. Perhaps in the context of prescription drug cost sharing reductions from the MMA, care decisions and health effects are only affected in extreme cases that are not reflected in my aggregated variables. To address this issue, I performed analyses using an individual-level sample, restricted to the elderly respondents from MEPS panel 10, which spanned 2005-2006. These individuals were surveyed both before and after the Medicare Modernization Act (MMA) was enacted, and can be used as an interesting case study of the effects of the MMA's prescription drug cost sharing reductions.

These analyses follow a similar form to those in the base specifications reported earlier, with instrumental variables (2SLS) regressions, using standard errors clustered at the designated market area (DMA) level. The sample for these regressions is respondents aged 65 and higher, who had a prescription medicine event in both 2005 and 2006.

1^{st} Stage:

$$dSFCost_i = \alpha + \beta IV_i + \gamma MeanCost_i + \delta X_i + u_i$$

2^{nd} Stage:

$$Y_i = \alpha + \beta Predicted\ dSFCost_i + \gamma MeanCost_i + \delta X_i + \varepsilon_i$$

The key explanatory variable is $dSFCost_i$, which represents the change in individual i's share of prescription medicine costs paid by self or family, between 2005 and 2006. The dependent variables of interest, Y_i, are individual-level indicators for if the respondent was hospitalized for an ACSC in 2006, and for if they received a routine checkup in the 12 months prior to interview in 2006. Controls, represented by X_i above, are included for sex, age, race, income, education, and region fixed effects. $MeanCost_i$ is the mean total cost of prescription medicine events for the individual throughout 2005 and 2006.

The instruments, IV_i, reflect the individual's susceptibility to the prescription medicine cost sharing reductions that were instituted by the MMA. The three instruments are indictors for if in 2005, the individual had Medicaid (MCD05), any prescription drug insurance (RxIns05), and private insurance from an employer or union (EmpUn05). These analyses will therefore identify the effects of drug cost sharing reductions that were associated with these variables. The instruments are correlated with the change in cost sharing because they describe the individual's insurance situation prior to the MMA, and are thus correlated with its effects. As with the instruments in the aggregate analysis, these are also correlated with income and risk, and could therefore violate the exclusion restriction. Medicaid enrollees are the poorest individuals, those without prescription drug insurance tend to be low-middle income, and those with insurance from an employer or union tend to be higher income. The correlation between income, health risk, and the dependent variables of this analysis is a problem, but it is addressed by controlling for income.

Robustness Checks

To test the robustness of the results, analyses of alternate specifications were performed. Earlier in this section, I explained additional instruments that were tested, and the use of an individual-level analysis for respondents in the 2005-2006 panel. Further sensitivity analyses include estimating the impact of changes in cost sharing on hospitalizations for each of the individual ACSCs listed in the methods section, and the 15 hospitalization diagnoses most common among the US elderly. I also test alternate lists of conditions classified as ACSCs, and within conditions, I test different diagnosis definition codes (CCC and ICD). In addition to recent routine checkups, I test other outcome variables that capture the utilization of preventive and outpatient care. To further assess the influence of the financial responsibility arrangements, I test explanatory variables for portions of medical expenses paid by Medicare, and by private insurance. Additionally, I adjust my sample in order to run analyses with variables that include aggregate variables calculated among all events in a region-year, rather than just the first time events, as is used in the base specification. I also break up the sample into the four census regions, in case relationships vary geographically throughout the US. For details on these other specifications, please see the Robustness Checks section within the Results section.

V. RESULTS

Table 3 shows the results from the OLS and IV regression specifications, of ACSC hospitalizations and routine checkups on the explanatory variable for percent of prescription medicine expenses paid by self or family. Columns 1 and 3 show the OLS results, and 2 and 4 report the results from IV regressions. The table also reports the first stage F-stats, to show instrument strength. As expected, the instruments, based on the Medicare Modernization Act (MMA), are correlated with the prescription drug cost sharing, which is the independent variable of interest.

Specification 1 shows that the association between percent of total medical expenses paid by self or family and ACSC hospitalizations under OLS is not significantly different from zero. When the same variables are tested in an IV regression, we see that the effect is still not significantly different from zero. Column 2 uses MRX08 (percent of region with Medicare prescription drug coverage in 2008, interacted with the years of the MMA) as an instrument, and thus removes any endogeneity inherent in the OLS result. The coefficient on drug spending self/family share, of 0.0036, implies that a one percentage point increase in the region-year mean percent of prescription medicine spending by self or family is insignificantly associated with a 0.36 percentage point increase in the share of region-year hospitalizations for which the primary diagnosis was an ACSC. This specification shows a first stage F-stat of 15.53, indicating that the instruments are strongly associated with the instrumented variables.

Table 3 also reports the results from regressions using the portion of the region-year that had a routine checkup in the past year as their dependent variable. Column 3 shows that in OLS, prescription drug cost sharing's association with recent routine checkups is not significantly different from zero. Specification 4, with the IV regression results for the effects of self or family share of prescription drug spending, also shows no significant effect. The coefficient in specification 4 is 0.0004, implying that a one percentage point increase in the region-year mean share of prescription medicine expenses paid by self or family is insignificantly associated with a 0.04 percentage point increase in the portion of the region-year that has received a routine checkup in the last year.

In summary, the results show no statistical significance for the coefficients of the key explanatory variable. This demonstrates that in the context of this study, the effects of prescription drug cost sharing on ambulatory care sensitive conditions, and on utilization of routine checkups, are not significantly different from zero (Table 3). Both dependent variables are regressed on the self/family share of prescription drug spending, which is instrumented with the percent of the region with Medicare prescription drug coverage in 2008, interacted with the years of the MMA. Table A-1 in the appendix reports the full regression results, with all control variable coefficients.

Other instruments

As mentioned in the Method section, I use additional instrumental variables regressions to assess the sensitivity of the above results to specification modification. Specifically, since IV regressions identify a local average treatment effect (LATE), I use other instruments to see if the effect is different for populations that were differentially affected by the MMA. These regressions use instruments that are associated with the transition of Medicare enrollees into Medicare Advantage (MA) plans, which became more popular after the MMA was enacted. The instruments are the percentage of the region enrolled in an MA plan in 2005 (MADV05), and in 2008 (MADV08).

These results are reported in Table A-1 of the appendix, with the full set of controls. As with the primary results reported above, there was no significant association between prescription drug cost sharing and either of the major dependent variables (ACSC hospitalizations and routine checkups). The coefficients were not significantly different from zero, as was found in the main results.

A potential limitation of the specifications that use MADV05 and MADV08 as instruments is that they are not as strongly associated with prescription drug cost sharing as is MRX08. This is evidenced by the first stage F-statistics, which are not as high as those in the main results. These F-tests use the null hypothesis that the instruments are weak; in other words, that there is no significant association between the instruments and the instrumented variables. The most commonly used rule for rejecting this null is that the F-statistics must be at least 10 (53). MADV05 has an F-statistic of 5.66 (p-value 0.0185) when ACSC hospitalizations is the dependent variable, and 4.94 (p-value 0.0276) with routine checkups. MADV08 has a first stage F-statistic of 8.74 (p-value 0.0036) with ACSC hospitalizations, and 6.82 (p-value 0.0098) with routine checkups.

These specifications, even with only moderately high first stage F-statistics, are valuable. In these regressions, there is only one instrument, and one instrumented variable; in this just-identified case, even with weak instruments, a two-stage least squares estimator is median-unbiased (54). Furthermore, the lower degree of freedom in this test allows an easier rejection of the weak instrument null hypothesis, as evidenced by the p-values, which all show rejections of the weak instrument null at significance levels greater than 95 percent.

To provide further evidence that the results are not driven by the weakness of the instruments, I have provided the results from the weak instrument robust Anderson-Rubin (AR) test (55). This tests the null hypothesis that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero, and, in addition, that the over-identifying restrictions are valid (56). Thus, a failure to reject the AR null confirms the non-rejections of the IV analysis null, that the coefficients on the cost sharing variables are equal to zero. Table A-1 shows the AR Wald test (Chi-squared (1)) for each IV specification. Every test fails to reject the null.

Reduced form

The results from the reduced form regressions, of the dependent variables on the instruments, are reported in Table 4. These results show no significant association between the dependent variables and any of the instruments used in this study. Given the lack of significant association seen in the IV results (see Table 3), these results fit with expectations regarding any correlation between the instruments and dependent variables. As with a randomized experiment in which half the sample is given a treatment that has no effect, the randomized variable (the IV) should have no association with the outcomes.

Individual-Level Analysis

As mentioned earlier, a limitation of my empirical strategy is that the aggregation of variables to the region-year level causes some portion of the identifying variation to be lost. As such, there is a chance that in spite of the results reported above, cost sharing does in fact affect individuals' care utilization decisions and health, but the aggregate measures are not precise enough to capture these effects. To address this possibility, I performed an individual-level analysis of respondents from MEPS panel 10, which spanned 2005-2006, allowing observations before and after the enactment of the Medicare Modernization Act (MMA).

The results of the individual-level analysis are reported in Table 5. This table shows the effects of changes in prescription drug cost sharing on both ACSC hospitalizations and routine checkups. The key explanatory variable is the change in the share of drug spending by self or family between 2005 and 2006, and the results show that this has no significant effect on either dependent variable. As such, these results confirm those from the region-year level analysis, failing to reject the hypotheses that effects of prescription drug cost sharing on ACSC hospitalizations and routine checkups are not significantly different from zero. Columns 1 and 5 report OLS results, and columns 2-4 and 6-8 report IV results, with the instruments noted in the last row. All the OLS and IV specifications show coefficients that are not significantly different from zero.

Additional robustness checks

Given the results above, I fail to reject the null hypothesis that prescription drug cost sharing has no effect among the elderly on ambulatory care sensitive condition (ACSC) hospitalizations, or on the utilization of routine checkups. In order to confirm the validity of these conclusions, I have conducted a series of robustness checks with different dependent and independent variables, as well as different sample restrictions.

The list of hospitalizations defined as sensitive to ambulatory care varies across different sources. In the base specification used above, the conditions were those specified in Bindman et al (47), and are listed in the methods section. Levinton et al (57) uses a stricter definition of ACSCs, which only includes angina, asthma, congestive heart failure, chronic obstructive pulmonary disease (COPD), diabetes, epilepsy, and hypertension. Using this alternate list of ACSCs did not change any results. The results from regressions with alternative definitions of ACSCs are reported in Table A-3 of the appendix.

In addition to using these aggregate lists of conditions, I also checked each condition individually for sensitivity to cost sharing. Again, there was no significant association between these outcomes and the explanatory variable of interest. The results from regressions with dependent variables for individual conditions can be found in Table A-2 of the appendix. Finally, to ensure that the classification of the diagnoses that define ACSC hospitalizations did not affect my results, I varied the diagnosis definitions between ICD-9 codes and Clinical Classification Codes (CCC), which are also included in the MEPS data. This caused no change in the results, which are reported in Table A-3 of the appendix.

Given my consistent finding of no causal effect of prescription drug cost sharing on hospitalizations, I pursued other outcomes that could be susceptible to cost sharing. Specifically, I sought other hospitalizations that could be directly affected by variation in prescription drug cost sharing (the primary source of identifying variation in my analysis), rather than relying on ACSC hospitalizations, which require an effect through outpatient care utilization. Among the elderly population, a wide variety of conditions can be affected by drug use. As such, I tested the most common sources of elderly hospitalizations. As listed in Russo and Elixhauser (58), the following 15 conditions were the most frequent conditions causing hospitalizations among the elderly in 2003: congestive heart failure; pneumonia; coronary atherosclerosis; cardiac dysrhythmias; acute myocardial infarction; COPD; stroke; osteoarthritis; rehabilitation care, fitting of prostheses, and adjustment of devices; fluid and electrolyte disorders; chest pain; urinary tract infections; hip fracture; complication of medical device, implant, or graft; and septicemia. The ICD-9 and CCC codes used to define these hospitalizations are listed in the appendix. Among these sources of hospitalizations, the only conditions that are unlikely to be preventable with prescription drugs are rehabilitation care, fitting of prostheses, adjustment of devices, and hip fractures (59).

The results of regressions with dependent variables for common hospitalizations among the elderly can be found in Tables A-2 and A-3 of the appendix. These results show no evidence of an effect on hospitalizations from common conditions, except for those stemming from chest pain. A higher portion of prescription drug costs paid out-of-pocket resulted in a slightly decreased portion of hospitalizations in a region-year stemming from chest pain, but no other events showed an effect. The precise interpretation of the implied effect on chest pain hospitalizations shows that the effect is minor: a one percentage point increase in the mean Medicare portion of prescription drug payments in a region-year yields a 0.4 percentage point increase in the share of hospitalizations in a region-year related to chest pain. Why would chest pain hospitalizations react to prescription drug cost sharing, when all other evidence showed no effect? It is unclear. It is possible that this result arose due to chance; I am examining many relationships, and five percent of them will be statistically significant, regardless of causality. This seems to be the most likely explanation, due to the lack of significance in every other relationship.

In order to test the robustness of my result of no causal effect of cost sharing on the utilization of routine checkups, I also evaluated the effects of cost sharing on other outcomes related to preventive and outpatient care. Specifically, I ran IV regressions with dependent variables for the portion of the sample in the region-year who (1) recently received a flu shot, (2) recently received a cholesterol check, and (3) reported that they receive preventive care at their usual source of care. I also used the same IV specification to examine dependent variables for the portion of outpatient visits in the region-year that (1) were classified as a checkup, (2) included an immunization, and (3) were with a general practitioner. The results of these regressions can be found in Table A-4 of the appendix. These other outcomes largely confirmed the lack of effect by the share of prescription drug spending by self or family. The only exception was mixed evidence that increased out-of-pocket spending for prescription drugs may have caused a slight reduction in the portion of a region-year that reported receiving preventive care at their usual source of care. The implied effect can be interpreted to mean that a one percentage point increase in the share of prescription drug costs paid by self or family causes a 0.46 reduction in the consumption of preventive care at usual sources of care. While this result fits with the negative cross-price elasticity of demand among complements, the evidence is weak. All the other outcome measures of preventive care use show no effect, and there is a possibility that the statistical significance with this outcome arose due to chance.

In evaluating whether or not the share of medical expenses borne by the patient influences their health care decisions and health, I am effectively testing if the source of payment is influential. To further validate this approach, I used similar instrumental variables regressions to test for effects by Medicare payment portions, and payment portions from private insurance. These explanatory variables were examined in analyses that used all of the dependent variables described above. The results of these analyses can be found in Table A-5 of the appendix. The share of spending from private insurance did not show strong first stages with any instruments, and thus provide no support on either side of hypothesis rejection. Medicare spending, however, had sufficiently strong first stages, and showed no significant association with the key outcome variables. This implies that I cannot reject the hypothesis that Medicare drug spending does not affect ACSC hospitalizations, or routine checkup utilization. Such a result fits with those from the main analyses reported above, which also suggested that the source of payment is not an important determinant of these dependent variables.

I performed a final robustness check by varying the sample restrictions. As mentioned in the methods section, my variables that used event-based outcomes (hospitalizations, outpatient visits, and prescription medicines) were restricted to those events that were an individual's first of the year. In the presence of non-linear financial responsibility schemes (eg: deductibles or maximum expenditure limits), such events are the most likely to be influenced by the demand-side consumer cost-sharing that is the focus of this paper. Subsequent analyses were performed with a sample that included all events, and these results showed no meaningful variation from their counterparts in the main results above. These results can be found in Table A-6 of the appendix.

VI. DISCUSSION

The results show that the effect of prescription drug cost sharing on certain types of health care utilization and health among the elderly in the United States is not significantly different from zero. Specifically, it was shown that when these costs were reduced, there was no effect on the utilization of routine checkups, indicating that in this case, cross-price demand between these two types of service is inelastic. Furthermore, reduced prescription drug cost sharing among older adults did not make individuals any more or less likely to be hospitalized for ACSCs, which can result from lack of proper outpatient care and disease management. In summary, the prescription drug cost sharing reductions from the Medicare Modernization Act (MMA) resulted in no cross-price effect on at least one important complement service. And, any utilization alterations that did occur did not have an offset effect on one indicator of ambulatory care quality.

These results conflict with theoretical predictions, and with some existing literature. Looking first at the cross-price effect, theory predicts that quantity demanded for a product should increase when the price of a complement product drops. For example, since routine checkups and prescription drug care are complements (at least among initial purchases), it is possible that patients would choose not to see a doctor because they worry that they are not covered for the treatments that are likely to be prescribed. Existing evidence on this topic is scarce – most studies on the effects of cost sharing focus on own-price elasticity. For example, the RAND Health Insurance Experiment (HIE) found that increased cost sharing reduced utilization of all types of services, including preventive care such as annual checkups, but this was not a cross-price effect (13). While some evidence indicates that drug cost sharing affects doctor visits (38), this and other studies on cross-price effects exist in different settings, and lack comparability to the introduction of Medicare Part D for the elderly of the United States.

The fact remains that the cross-price effect has been seen in other settings (15, 38), and fits with theory, but my analysis fails to reject the hypothesis that the effect of prescription drug cost sharing on routine checkups is not significantly different from zero. The possible explanations for my differential results can be grouped into two broad categories. The first has to do with the fact that my IV analysis identifies a local average treatment effect (LATE), and the second is that my analysis could have made a type II error. Looking first at the former, the precise LATE identified in this study is the effect of United States Medicare beneficiary cost sharing variations that stemmed from the Medicare Modernization Act of 2003 (MMA). This was a particular group of people, responding to a specific policy change, and the effect in this situation may not be generalizable to other populations, time periods, or cost sharing margins.

The MMA introduced Medicare Part D (prescription drug coverage), meaning that my identification strategy, and any implied LATE, relies on this variation. It is possible that due to good insurance coverage of primary care both before and after the policy change, prescription drug cost sharing did not influence people's use of preventive care. It should be noted that most Medicare enrollees had good coverage of primary care throughout the study period. Both before and after the policy change, beneficiaries were covered for an annual flu shot, an annual routine checkup, and a cholesterol check every five years. Thus, it is possible that good coverage of preventive care ensured that prescription drug cost sharing reductions had minimal effect.

Another possible explanation for why I found the LATE to be insignificantly different from zero is that the presence of limited drug coverage prior to the MMA, either from Medicare Part B, or from supplemental insurance, could have reduced the effect of Part D's introduction in 2006. In the pre-MMA years, certain drugs, associated with physician services, were covered by Medicare Part B (60). Also, many beneficiaries transitioned into Part D from supplemental insurance plans, which may have covered some of their prescription drug needs. As of 1999, 75 percent of Medicare beneficiaries received drug coverage from a number of sources, including Medicaid, employment-based plans, Medigap, other public sources, and other HMOs (43). Therefore, a possible explanation for the lack of effect in my results is that relatively few patients would have been in a position where an inability to pay for subsequent prescribed drug treatment would dissuade them from using primary care. Such an explanation would imply that net variations in drug coverage benefits from the MMA were small, and thus had minimal effect. Table 1 shows that the average coinsurance rate for drugs dropped by 11.77 percentage points from 2005 to 2006; perhaps this change was insufficient to induce a significant cross-price effect.

The cross-price effect relies on the complementarity of prescription drugs and routine checkups. It is possible that despite the obvious role of primary care in acquiring these drugs, the nature of routine checkups, and the people that use them, make demand insensitive to changes in drug prices. For example, regular checkups may be a part of an individual's long term care regimen, making demand unresponsive to complement service price changes. People who get routine checkups may be healthier to begin with, and less likely to need prescription drugs. Furthermore, it is possible that these types of people may be especially likely to receive lifestyle advice as treatment, rather than drugs.

The second broad explanation for the lack of a cross-price effect in my results is that a limitation of the analytic strategy caused a type II error. While the strategy seeks to identify the effects of cost sharing on certain types of care utilization and health, it is possible that the outcome and exposure measures do not vary enough for an effect to be seen. This could be the case if the aggregation of variables to the region-year level removed key identifying variation. The aggregation was an important part of my strategy to create a decade-long panel, and thereby exploit exogenous variation in cost sharing from the MMA, but it also caused some portion of the identifying variation to be lost. This lost variation could cause a type II error if cost sharing does affect individuals' health care utilization decisions, and in turn their health, but the aggregate measures used in this study are not precise enough to capture effects. Indeed, it is possible that in the context of prescription drug cost sharing reductions from the MMA, care decisions and health effects were only affected in extreme cases that were not reflected in my aggregated variables. This problem was addressed, however, with the individual-level analysis that was conducted in MEPS panel 10, spanning 2005 and 2006. These instrumental variables regressions featured individual-level variables for MEPS respondents aged 65 and higher, who were surveyed both before and after the MMA was enacted. As was the case in the aggregate regressions, the prescription drug cost sharing reductions associated with the MMA were not associated with the utilization of routine checkups, or with ACSC hospitalizations. This suggests that if there was a type II error, it was not caused by aggregation.

In addition to a lack of cross-price effect, my analyses also failed to identify an offset effect on ACSC hospitalizations of any utilization changes that may have accompanied the Medicare

Modernization Act (MMA). The offset effect could occur through own-price effects on drug utilization, or through cross-price effects on other services. As was discussed above, there was no cross-price effect on routine checkups, which would be a likely candidate to affect ACSC hospitalizations, because they are influenced by outpatient care and proper disease management (1). But, the utilization of routine checkups does not capture everything that can cause an ACSC hospitalization. Perhaps a more perfect measure of the services performed with primary care, and chronic disease management, would be more likely to have an offset effect in this context. Indeed, any service utilization alteration induced by the drug price changes could induce an offset effect. But, as with routine checkups, my analysis found no cross-price effect on a number of care outcomes – cholesterol checks, flu shots, or general preventive care. With a distinct lack of cross-price effects on these services, it is unsurprising that no offset effect was found.

There remains the possibility that the offset effect could operate through the own-price effect of drug price changes on drug utilization. There is evidence that these drug price reductions that accompanied the MMA caused people to consume more drugs (7-10); why did these utilization alterations not have an offset effect? Past evidence has shown that drug utilization changes affect health outcomes, and four papers from the literature review explicitly analyze the effects of prescription drug cost sharing for the elderly on hospitalization outcomes (12, 15-17). Of these, three find offset effects, with hospitalizations sensitive to cost sharing (12, 15, 16). The exception is the work of Culler, Parchman, and Przybylski (17), which is the only one of the four to use ACSC hospitalizations as an outcome; it found no effect of higher prescription drug cost sharing. It should also be noted that the RAND Health Insurance Experiment (HIE) found no evidence that outpatient cost sharing in the nonelderly increases expenditures later on (for example, by inducing hospitalization) (29). The sources of the differential results in the three studies that found offset effects are uncertain, but most likely involve a lack of comparability across study designs. Chandra, Gruber, and McKnight (12) found effects of a policy change that altered outpatient cost sharing, in addition to prescription drug cost sharing, which was the sole cost sharing change featured in my study design. Tamblyn et al (15) used a Quebec policy change in the mid-1990s; the Canadian health care system, and differential drug usage patterns during this time period may explain the offset effects that were found. Finally, Hsu et al (16) found offset effects while exclusively looking at effects of a cap in drug benefits for Medicare beneficiaries. It is plausible that caps have different effects than net coinsurance, and furthermore, it is possible that selection bias may have affected the results of that study.

One reason for the lack of offset effect in this context is that drug consumption was not altered enough for major health effects (like hospitalizations) to be realized. The evidence on the effects of Part D's implementation shows that while the costs of drugs decreased substantially for enrollees, the actual increase in prescription drug utilization was modest. Ketchum and Simon (7) found that despite out-of-pocket costs being reduced by 21.7 percent, the use of drugs (days of medication supplied per capita) increased by only 4.7 percent. Yin et al (8) found that drug therapy-days increased by 1.1 percent in the first five months after Part D' implementation, and by 5.9 percent in the year after that. These relatively small adjustments in prescription drug utilization may have been too small to affect ACSC hospital admissions, which represent a major decline in health. It is likely that these changes in drug use did affect health, but at a magnitude insufficient to have a significant association with hospitalizations.

The hospitalizations most likely to detect a relatively minor offset effect from modest drug alterations would be those that are caused by conditions typically treated by drugs alone, rather than those that could also potentially be treated with lifestyle changes. Even when I look at the conditions that should be most affected by drug usage alterations, there is still no significant association. Those conditions are bacterial pneumonia, cardiac dysrhythmias, cellulitis, congenital syphilis, grand mal seizure disorders, kidney/urinary tract infection, pelvic inflammatory disease, septicemia, and severe ENT infection (59). As noted in the results section, hospitalizations from none of these conditions showed a significant association with prescription drug cost sharing. This further suggests that any offset effects of prescription drug cost sharing were minimal, and not strong enough to result in an admission.

To summarize, it seems that a number of factors specific to the context of this study combined to mute the health effects of drug use alterations. First, these drug use changes were modest, and health effects may have been too subtle to be detected in hospitalizations. Second, good coverage of other health services, both before and after the MMA was enacted, reduced cross-price effects. The consistent presence of primary care may have reduced the influence of the minor drug changes that did occur. These results do not imply that drug use does not affect ACSCs. Rather, they imply that drug cost sharing does not affect ACSC hospitalizations. More specifically, the drug cost sharing reductions induced by the Medicare Modernization Act (MMA) do not affect ACSC hospitalizations for the elderly of the United States. It is possible that this legislation had effects on health outcomes not tested in this study. Moreover, the large reductions in out-of-pocket drug spending could have provided an income effect that improved the health and overall utility of the target population through other channels.

VII. CONCLUSION

This study assesses the effect of prescription drug insurance cost sharing on health care utilization decisions, and on health outcomes. For the elderly in the United States, I found that variation in point-of-service out-of-pocket spending for prescription drug services does not affect the use of certain preventive services. Moreover, it does not affect the likelihood that a patient is hospitalized because of an Ambulatory Care Sensitive Condition (ACSC), which are known to be responsive to proper outpatient care and disease management. These findings are especially relevant, given the large and increasing share of health expenditures that are spent on the elderly, and on their use of prescription drugs. The study addresses problems of selection and reverse causality by exploiting a 2006 policy change that exogenously shocked cost sharing arrangements for millions of United States Medicare enrollees.

The findings imply that for the Medicare population, demand-side cost sharing with certain conditions does not affect preventive care use and preventable hospitalizations. Routine checkups, in particular, appear to be highly entrenched in the service utilization patterns of the elderly, and thus insensitive to price reductions in complement services. These conditions may include good insurance coverage of preventive care, which ensures that patients receive the ambulatory care that is necessary to avoid costly hospitalizations. Understanding how care usage and health outcomes react to prescription drug cost sharing changes is important, because these costs can be an effective tool in an insurance plan that reduces moral hazard consumption, while maintaining appropriate protection against risk.

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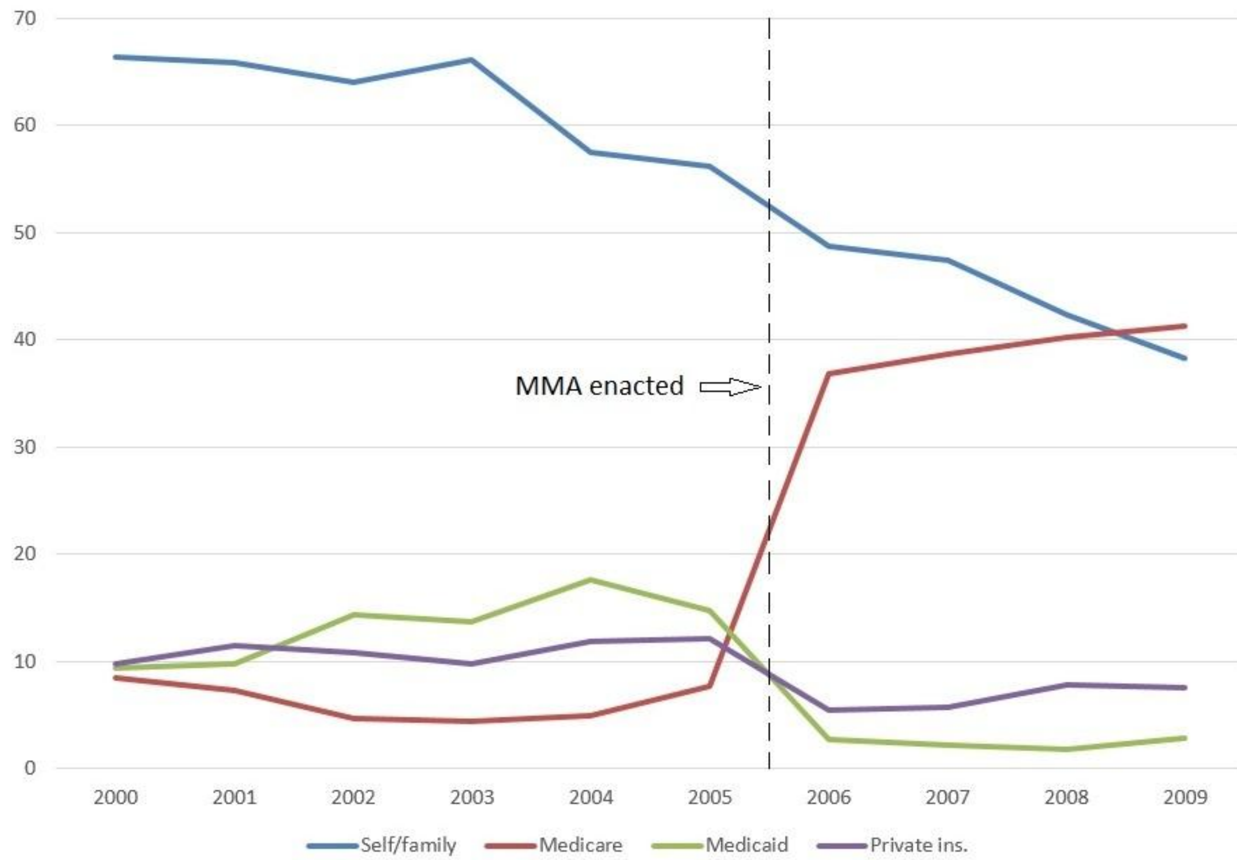
TABLES AND FIGURES

Figure 1: 2006 Standard Benefit Structure for Medicare Part D plans (61)

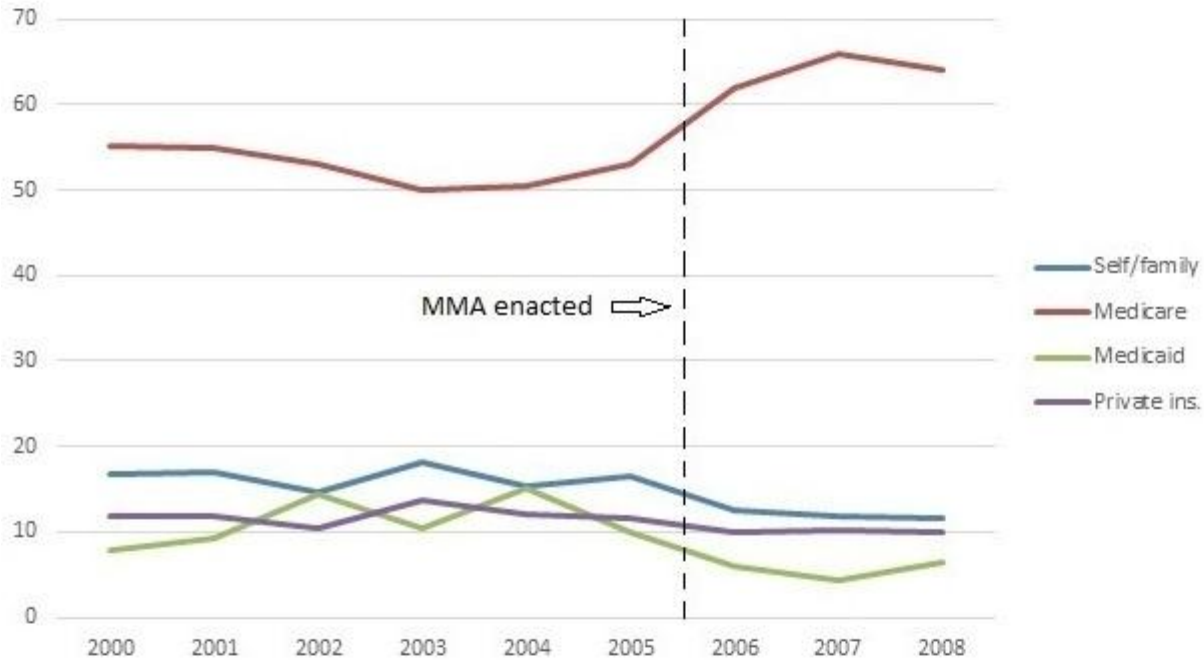
Total Cost	Out of Pocket Cost
$0 - $250	100% ($250 deductible)
$251 - $2250	25% coinsurance
$2251 - $5100	100% ("donut hole")
> $5100	5% coinsurance, or copays ($2 generics, $5 non-generics)

Figure 2: Shares of Prescription Drug Spending (%), Medicare Beneficiaries



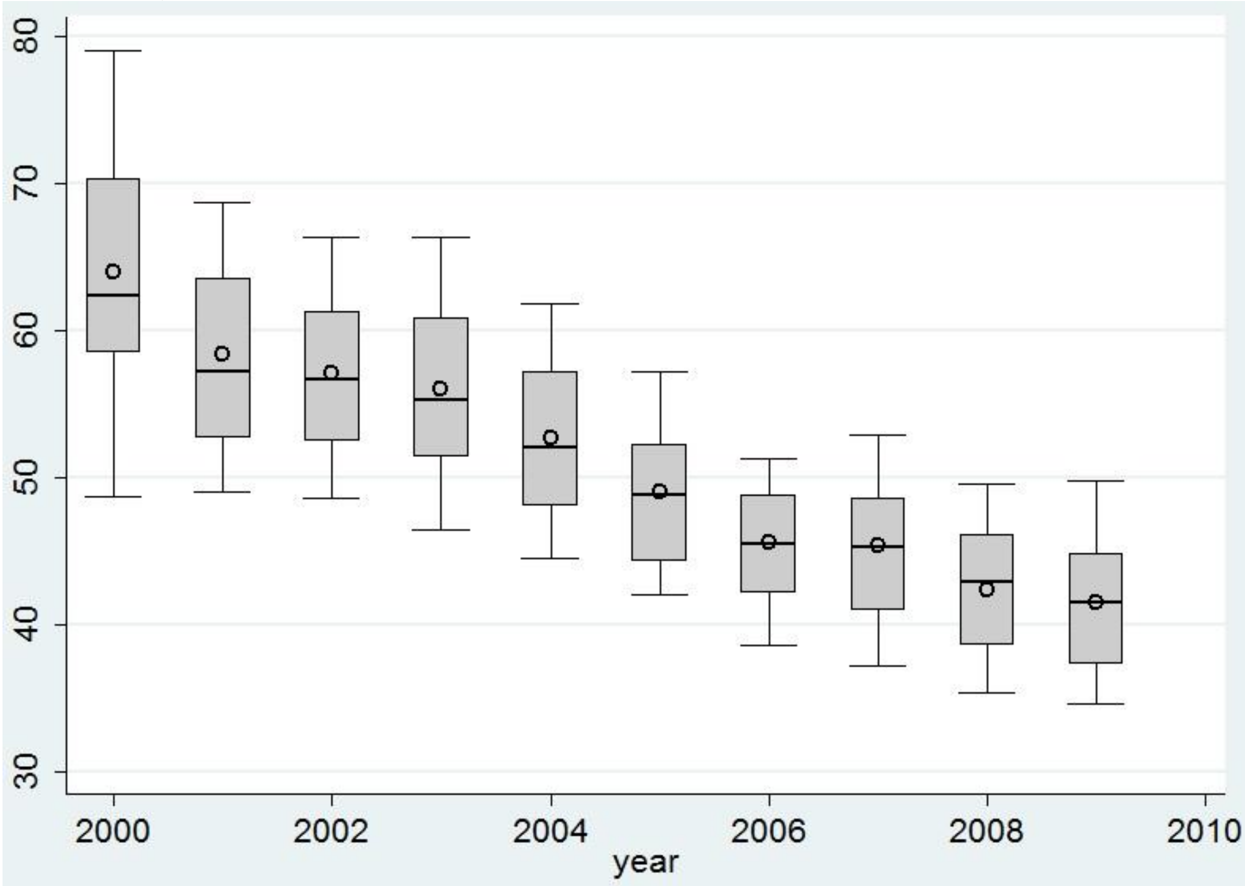
Notes: Data source is the Medical Expenditure Panel Survey (MEPS). Graph depicts the mean percent of a prescription medicine event paid by each source in each year.

Figure 3: Shares of Total Medical Expenses (%), Medicare Beneficiaries



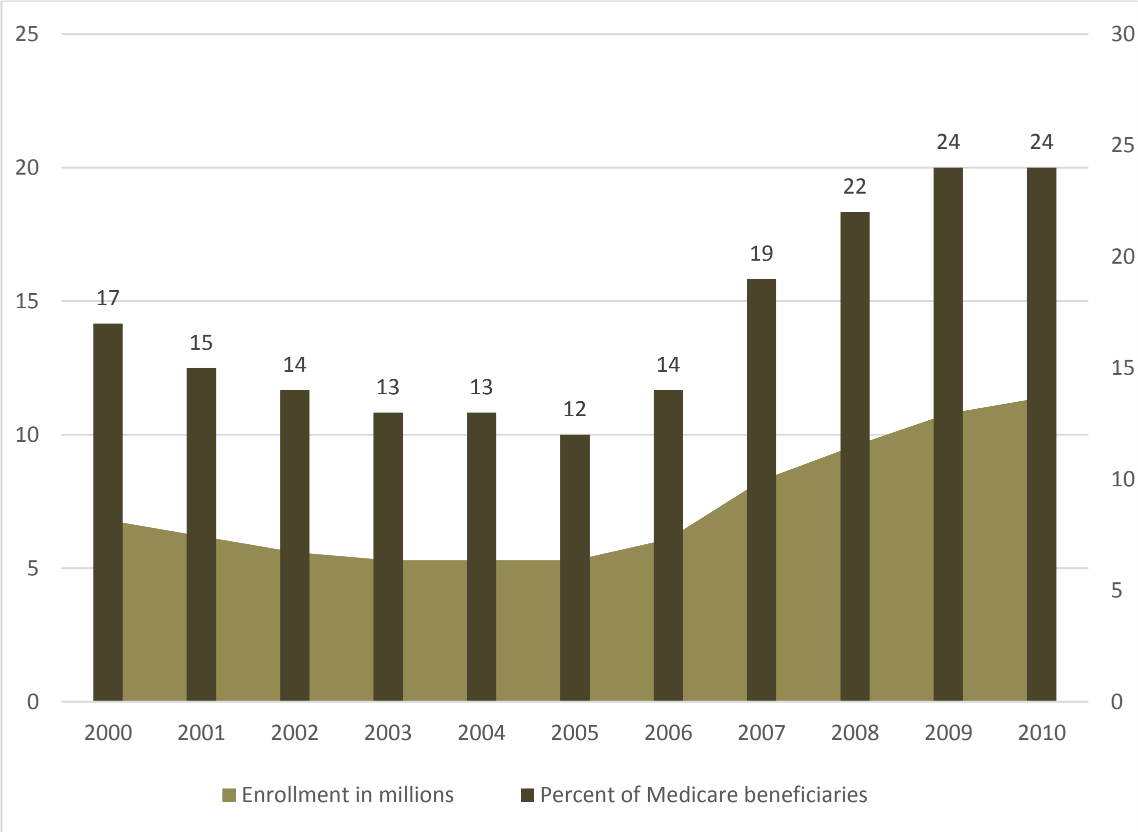
Notes: Data source is the Medical Expenditure Panel Survey (MEPS). Graph depicts the mean percent of total medical expenses for Medicare beneficiaries paid by each source in each year.

Figure 4: Interquartile range of regional percentages of prescription medicine expenses paid by self or family



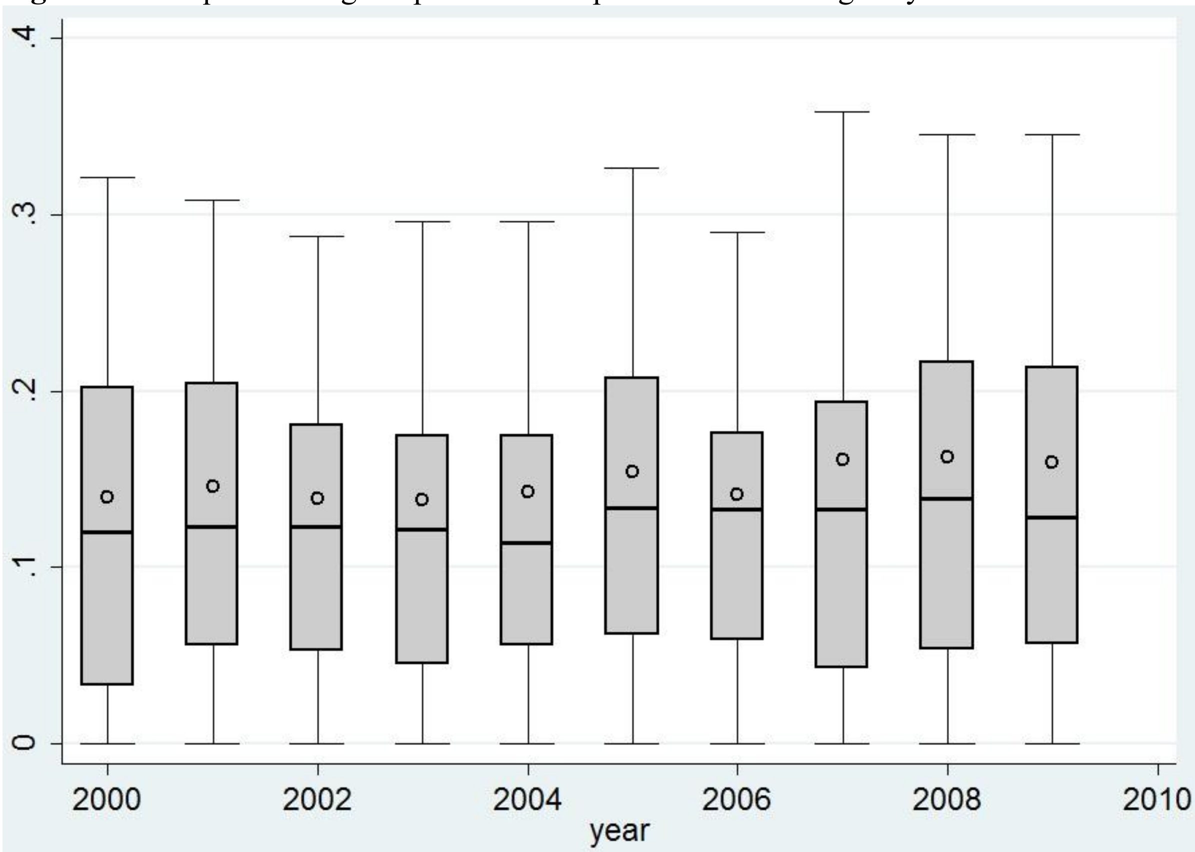
Notes: The vertical axis is the percent of prescription medicine expenses paid by self or family in a region-year, among United States individuals aged 65 and higher. Regions are designated market areas (DMA). Gray boxes show interquartile range above and below the median. The lines show the 90-10 spread. The circles show the means. Data source is the Medical Expenditure Panel Survey (MEPS).

Figure 5: Total Private Medicare Enrollment, 2000-2010



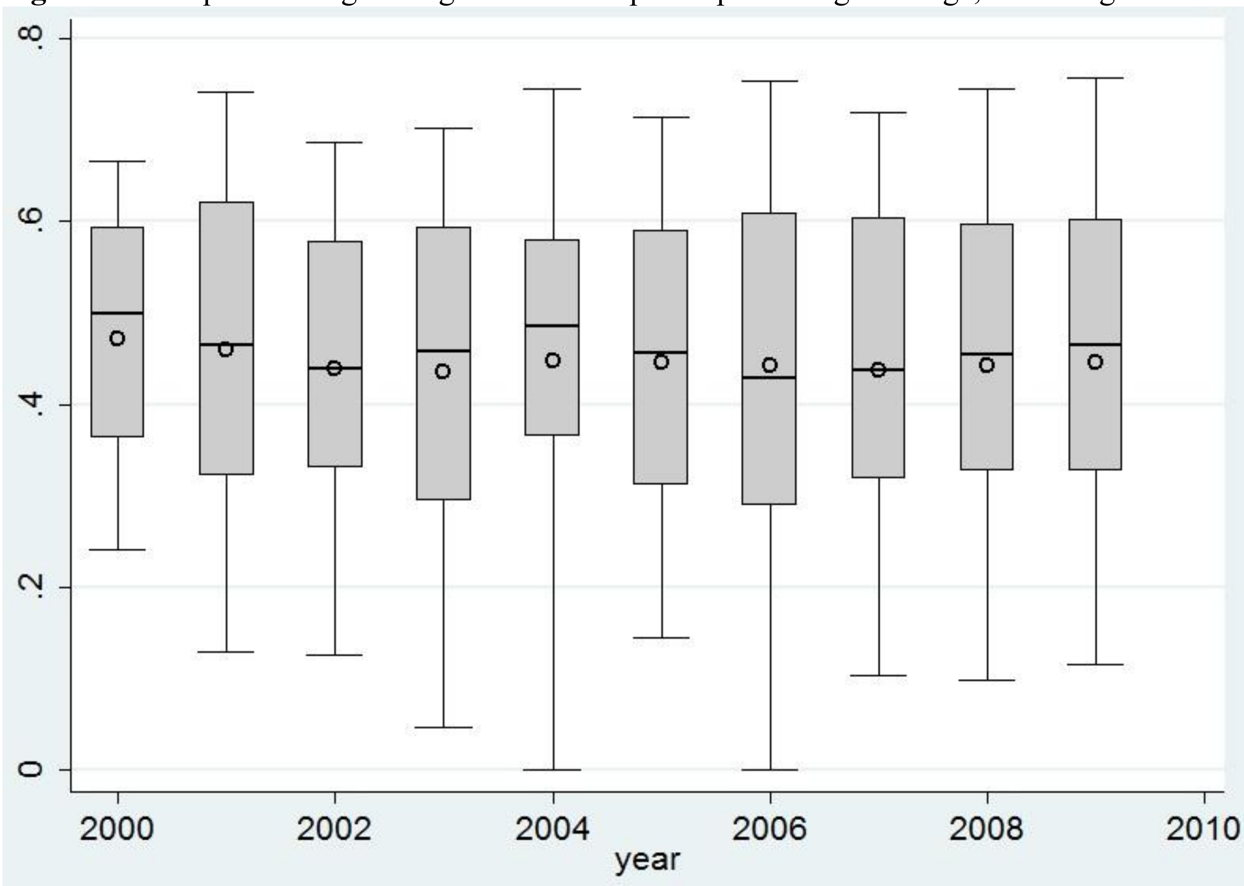
Notes: Enrollment in millions on left side axis; percent of Medicare beneficiaries on right side axis. Includes HMOs, PSOs, PPOs; regional PPOs; PFFS plans; 1876 cost plans; demos; HCPP; and PACE plans. Source: Kaiser Family Foundation (45).

Figure 6: Interquartile range of portion of hospitalizations in a region-year linked to an ACSC



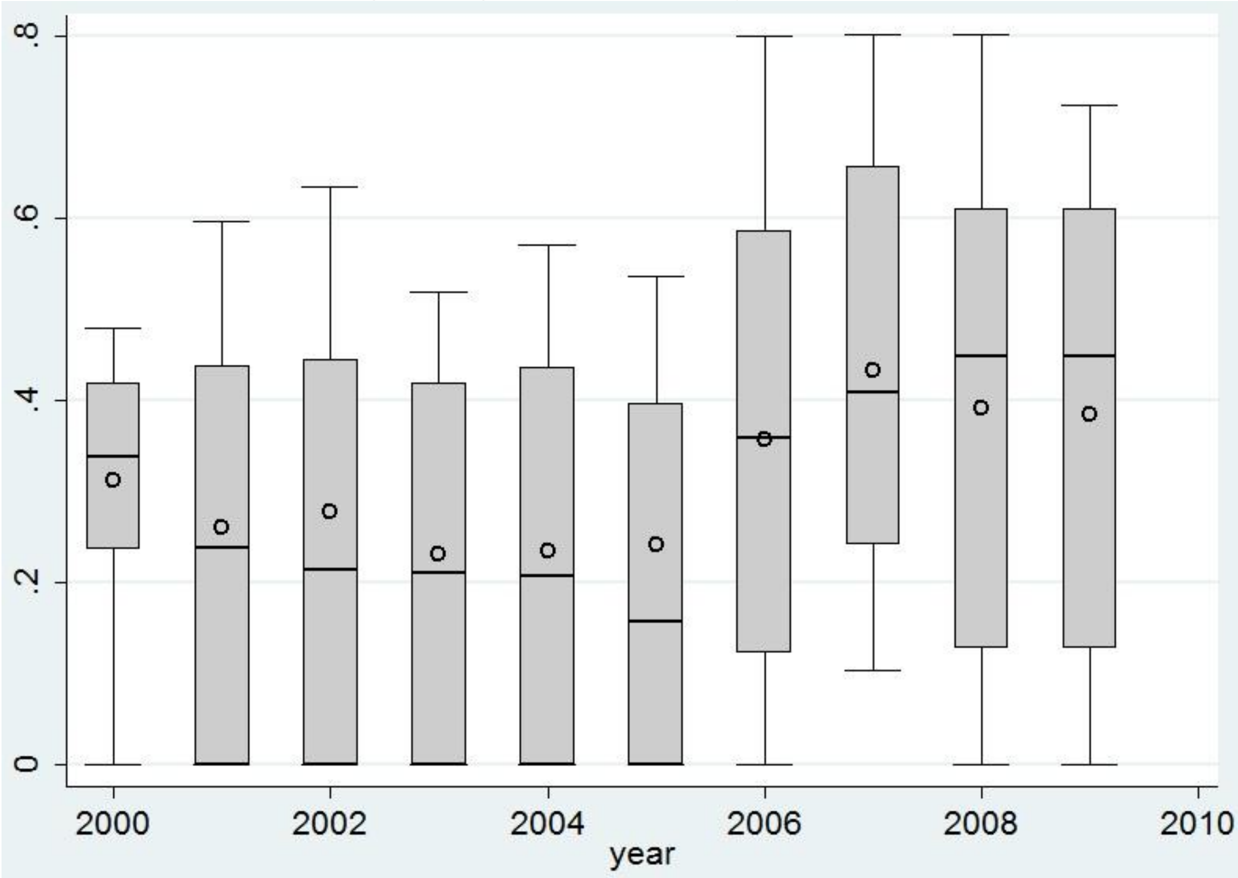
Notes: The vertical axis is the portion [0, 1] of hospitalizations in region-year for which the primary diagnosis was an ACSC, among United States individuals aged 65 and higher. Regions are designated market areas (DMA). Gray boxes show interquartile range above and below the median. The lines show the 90-10 spread. The circles show the means. Data source is the Medical Expenditure Panel Survey (MEPS).

Figure 7: Interquartile range of regional rates of prescription drug coverage, for all regions



Notes: The vertical axis is the portion [0, 1] of people aged 65 and higher in a region that had prescription drug coverage in each year. Regions are designated market areas (DMA). Gray boxes show interquartile range above and below the median. The lines show the 90-10 spread. The circles show the means. Data source is the Medical Expenditure Panel Survey (MEPS).

Figure 8: Interquartile range of regional rates of prescription drug coverage, for those regions in the bottom 20 percent of drug coverage in the pre-MMA years



Notes: The vertical axis is the portion [0, 1] of people aged 65 and higher in a region that had prescription drug coverage in each year, for those regions in the bottom 20 percent of drug coverage in the pre-MMA years. Regions are designated market areas (DMA). Gray boxes show interquartile range above and below the median. The lines show the 90-10 spread. The circles show the means. Data source is the Medical Expenditure Panel Survey (MEPS).

TABLE 1: Mean prescription drug coinsurance rate for MEPS respondents aged 65+, 2005 and 2006

	2005	2006	Change	Observations
All	56.65	44.88	-11.77	1566
	(31.34)	(25.95)		
Any drug insurance, 2005	47.02	46.52	-0.50	489
	(20.94)	(21.94)		
No drug insurance, 2005	61.02	44.14	-16.89	1077
	(34.18)	(27.56)		
Medicare, 2005	56.56	44.57	-11.99	1474
	(31.43)	(25.81)		
Non-Medicare, 2005	58.03	49.87	-8.16	92
	(29.97)	(27.77)		
Medicaid, 2005	26.78	27.64	0.86	222
	(21.89)	(20.64)		
Non-Medicaid, 2005	61.58	47.73	-13.86	1344
	(29.89)	(25.64)		
Private insurance from employer or union, 2005	49.52	48.29	-1.22	498
	(23.66)	(23.47)		
No private insurance from employer or union, 2005	59.97	43.29	-16.69	1068
	(33.83)	(26.90)		

Standard deviations in parentheses. Sample is Medical Expenditure Panel Survey (MEPS) respondents aged 65 and higher who had at least one prescription medicine event in both 2005 and 2006, and had sufficient survey responsiveness to be used in analyses.

TABLE 2: Mean prescription drug out-of-pocket amount ($) for MEPS respondents aged 65+, 2005 and 2006

	2005	2006	Change	Observations
All	31.64	23.05	-8.60	1566
	(32.41)	(23.44)		
Any drug insurance, 2005	23.74	23.80	0.06	489
	(17.33)	(22.22)		
No drug insurance, 2005	35.24	22.71	-12.53	1077
	(36.75)	(23.97)		
Medicare, 2005	31.68	22.85	-8.83	1474
	(32.76)	(23.02)		
Non-Medicare, 2005	31.11	26.25	-4.86	92
	(26.45)	(29.30)		
Medicaid, 2005	13.34	11.86	-1.47	222
	(17.52)	(14.00)		
Non-Medicaid, 2005	34.67	24.89	-9.78	1344
	(33.30)	(24.16)		
Private insurance from employer or union, 2005	25.38	24.91	-0.47	498
	(19.75)	(23.01)		
No private insurance from employer or union, 2005	34.57	22.18	-12.39	1068
	(36.50)	(23.59)		

Standard deviations in parentheses. Sample is Medical Expenditure Panel Survey (MEPS) respondents aged 65 and higher who had at least one prescription medicine event in both 2005 and 2006, and had sufficient survey responsiveness to be used in analyses.

TABLE 3: Effects of prescription drug cost sharing on ambulatory care sensitive condition (ACSC) hospitalizations and recent routine checkups (RRCU)

	ACSC		RRCU	
	1	2	3	4
Rx spending:	-0.0002	0.0036	-0.0007	0.0004
Self/family share (%)	(0.0006)	(0.0066)	(0.0006)	(0.0073)
1st stage F-stat		15.53		13.56
p-value		0.0001		0.0003
Observations	14,127	14,125	14,320	14,319
Instrument	OLS	MRX08	OLS	MRX08

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year that were caused by an ambulatory care sensitive condition (ACSC), and the portion of respondents in the region-year that had a routine checkup in the past year (RRCU). All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

TABLE 4: Reduced form regression results

	ACSC			RRCU		
	1	2	3	4	5	6
MRX08	-0.0009			-0.0003		
	(0.0013)			(0.0015)		
MADV08		-0.0003			0.0010	
		(0.0009)			(0.0009)	
MADV05			0.0000			0.0006
			(0.0008)			(0.0009)
Observations	14,124	14,124	14,124	14,321	14,321	14,321

Output for OLS regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year that were caused by an ambulatory care sensitive condition (ACSC), and portion of the respondents in that region-year who received routine checkups (RRCU) in the last year. MRX08 is the portion of the region-year that had Medicare prescription drug coverage in 2008, interacted with an indicator for the years of the MMA (2006-2009). MADV 05 and 08 are the portions of the region-year that had Medicare Advantage in 2005 and 2008, respectively, interacted with an indicator for the years of the MMA (2006-2009). All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, and unemployment. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. Robust clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

TABLE 5: Effects of prescription drug cost sharing, in 2005-2006 panel of individuals

	ACSC				RRCU			
	1	2	3	4	5	6	7	8
Rx Spending:	0.0000	0.0011	0.0004	-0.0006	0.0001	0.0023	0.0016	0.0022
06 minus 05 shr	(0.0001)	(0.0009)	(0.0008)	(0.0007)	(0.0003)	(0.0015)	(0.0018)	(0.0016)
First stg F-stat		105.84	45.72	50.54		86.29	44.3	48.16
p-value		0	0	0		0	0	0
Observations	1,575	1,554	1,554	1,554	1,484	1,466	1,466	1,466
Instrument	OLS	MCD05	RxIns05	EmpUn05	OLS	MCD05	RxIns05	EmpUn05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the indicators, for if the respondent was hospitalized for an ambulatory care sensitive condition (ACSC), and for if the respondent received a routine checkup in the past year (RRCU). The key independent variable is the difference between the share of drug expenses paid by self or family in 2006 and in 2005. All regressions feature region fixed effects, as well as controls for age, gender, race, marital status, education, income, and total level of drug spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2005-2006 (Panel 10), restricted to respondents aged 65 and higher. Instruments are indicators for if in 2005, the individual had Medicaid (MCD05), any prescription drug insurance (RxIns05), and private insurance from an employer or union (EmpUn05). Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX

Ambulatory care sensitive condition (ACSC) hospitalization definitions

Hospitalizations for each condition were defined as those for which the primary diagnosis had one of the following International Statistical Classification of Diseases and Related Health Problems codes (ICD-9), or Clinical Classification Codes (CCC). For each condition, I note the preferred definition, which is the code that fits most closely with the condition descriptions listed in existing literature on preventable hospitalizations (47). In situations where both the ICD-9 and CCC were equally well suited, the ICD-9 definition was used. In addition to the 20 conditions listed here, Bindman et al (47) also listed immunization preventable conditions and iron deficiency anemia as ACSCs, but only for young children (aged one to five, and aged less than five, respectively). Dehydration, failure to thrive, and skin graft with cellulitis were also listed as ACSCs, but I did not include them because they cannot be well-defined with the three digit codes available in MEPS.

1. Angina
    - ICD-9: 413 (preferred definition)
    - CCC: 101
2. Asthma
    - ICD-9: 493 (preferred)
    - CCC: 128
3. Bacterial pneumonia
    - ICD-9: 481, 482, 483, 485, 486 (preferred definition)
    - CCC: 122
4. Bronchitis
    - ICD-9: 466 if secondary diagnosis is 491, 492, 494, 496 (preferred definition)
    - CCC: 125
5. Cellulitis
    - ICD-9: 681, 682, 683, 686 (preferred definition)
    - CCC: 197
6. Congenital syphilis
    - ICD-9: 090 (preferred definition)
    - CCC: 009
7. Congestive heart failure
    - ICD-9: 428
    - CCC: 108 (preferred definition)
8. Chronic obstructive pulmonary disorder (COPD)
    - ICD-9: 491, 492, 494, 496 (preferred definition)
    - CCC: 127
9. Dental condition
    - ICD-9: 521, 522, 523, 525, 528 (preferred definition)
    - CCC: 136
10. Diabetes
    - ICD-9: 250 (preferred definition)
    - CCC: 049, 050
11. Gastroenteritis

- ICD-9: 558
- CCC: 154 (preferred definition)

12. Grand mal seizure disorders
    - ICD-9: 345
    - CCC: 083 (preferred definition)
13. Hypertension
    - ICD-9: 401, 402 (preferred definition)
    - CCC: 098, 099
14. Hypoglycemia
    - ICD-9: 251 (preferred definition)
    - CCC: 051
15. Kidney and urinary tract infection
    - ICD-9: 560, 599
    - CCC: 159 (preferred definition)
16. Nutritional deficiency
    - ICD-9: 260, 261, 262, 268 (preferred definition)
    - CCC: 052
17. Pelvic inflammatory disease (women only)
    - ICD-9: 614 (preferred definition)
    - CCC: 168
18. Ruptured appendix
    - ICD-9: 540 (preferred definition)
    - CCC: 142
19. Severe ear, nose, or throat infection
    - ICD-9: 382, 462, 463, 465, 472 (preferred definition)
    - CCC: 126, 094
20. Tuberculosis
    - ICD-9: 011, 012, 013, 014, 015, 016, 017, 018 (preferred definition)
    - CCC: 001

Most frequent causes of hospitalization among the elderly in 2003

These are the hospitalization diagnosis codes used to define the fifteen conditions that most frequently cause hospitalizations among the elderly of the United States, as listed in Russo and Elixhauser (58).

1. Acute myocardial infarction
    - ICD-9: 410 (preferred definition)
    - CCC: 100
2. Cardiac dysrhythmias
    - ICD-9: 427 (preferred definition)
    - CCC: 106
3. Chest pain
    - ICD-9: 786
    - CCC: 102 (preferred definition)
4. Chronic obstructive pulmonary disorder (COPD)
    - ICD-9: 491, 492, 494, 496 (preferred definition)

- CCC: 127

5. Complication of medical device, implant, or graft.
   - ICD-9: 996
   - CCC: 237 (preferred definition)
6. Congestive heart failure
   - ICD-9: 428
   - CCC: 108 (preferred definition)
7. Coronary atherosclerosis
   - ICD-9: 414
   - CCC: 101 (preferred definition)
8. Fluid and electrolyte disorders
   - ICD-9: 276
   - CCC: 055 (preferred definition)
9. Hip fracture
   - ICD-9: 820 (preferred definition)
   - CCC: 230
10. Osteoarthritis
    - ICD-9: 715
    - CCC: 203 (preferred definition)
11. Pneumonia
    - ICD-9: 480, 481, 482, 483, 485, 486 (preferred definition)
    - CCC: 122
12. Rehabilitation care, prosthesis fitting, device adjustment
    - ICD-9: V52, V53, V57
    - CCC: 254 (preferred definition)
13. Septicemia
    - ICD-9: 038
    - CCC: 002 (preferred definition)
14. Stroke
    - ICD-9: 434 (preferred definition)
    - CCC: 110
15. Urinary tract infections
    - ICD-9: 590, 599
    - CCC: 159

TABLE A-1: IV regression results with control coefficients

	ACSC Hospitalizations				Recent Routine Checkups			
	1	2	3	4	5	6	7	8
Rx spending:	-0.0002	0.0036	-0.0035	-0.0008	-0.0007	0.0004	0.0088	0.0074
Self/family %	(0.0006)	(0.0066)	(0.0086)	(0.0103)	(0.0006)	(0.0073)	(0.0099)	(0.0132)
Rx spending:	-0.0002	0.0001	-0.0004	-0.0002	0.0000	0.0001	0.0006	0.0005
Total amount	(0.0003)	(0.0005)	(0.0006)	(0.0007)	(0.0002)	(0.0005)	(0.0007)	(0.0009)
Female	-0.0027	-0.0032	-0.0022	-0.0026	0.0009	0.0008	-0.0002	-0.0001
	(0.0022)	(0.0023)	(0.0022)	(0.0023)	(0.0018)	(0.0020)	(0.0022)	(0.0025)
Age	0.0000	-0.0001	0.0000	0.0000	-0.0002	-0.0002	-0.0003	-0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Black	-0.0003	0.0014	-0.0018	-0.0006	-0.0014	-0.0009	0.0031	0.0025
	(0.0043)	(0.0055)	(0.0055)	(0.0060)	(0.0043)	(0.0052)	(0.0060)	(0.0072)
Hispanic	-0.0070*	-0.0052	-0.0086	-0.0073	0.0018	0.0024	0.0065	0.0058
	(0.0037)	(0.0045)	(0.0060)	(0.0067)	(0.0040)	(0.0050)	(0.0060)	(0.0073)
Married	-0.0029	-0.0033	-0.0026	-0.0029	0.0013	0.0012	0.0006	0.0007
	(0.0022)	(0.0023)	(0.0021)	(0.0022)	(0.0026)	(0.0027)	(0.0031)	(0.0031)
Inc. quin. 1		0.0016	0.0016	0.0016		0.0024	0.0019	0.0020
		(0.0051)	(0.0053)	(0.0052)		(0.0055)	(0.0060)	(0.0059)
Inc. quin. 2	0.0070	0.0080*	0.0091*	0.0087*	-0.0076	-0.0054	-0.0072	-0.0069
	(0.0045)	(0.0045)	(0.0049)	(0.0049)	(0.0059)	(0.0047)	(0.0055)	(0.0055)
Inc. quin. 3	0.0018	0.0029	0.0038	0.0034	-0.0076	-0.0054	-0.0068	-0.0066
	(0.0040)	(0.0040)	(0.0042)	(0.0042)	(0.0056)	(0.0051)	(0.0057)	(0.0058)
Inc. quin. 4	-0.0042	-0.0027	-0.0026	-0.0026	-0.0052	-0.0028	-0.0030	-0.0029
	(0.0045)	(0.0039)	(0.0039)	(0.0038)	(0.0056)	(0.0043)	(0.0049)	(0.0047)
Inc. quin. 5	-0.0016				-0.0024			
	(0.0052)				(0.0055)			
Unemp. rate					-6.562***	-6.984**	-10.03***	-9.528**
					(0.7160)	(2.7640)	(3.6420)	(4.7980)
% of region	-0.106***	-0.116***	-0.0979***	-0.105***	0.1040***	0.1090***	0.1460***	0.1400**
< high sch.	(0.0086)	(0.0187)	(0.0235)	(0.0273)	(0.0174)	(0.0370)	(0.0471)	(0.0601)
2001		-0.0064	0.0774	0.0458		-0.0296	-0.1270	-0.1110
		(0.0932)	(0.1190)	(0.1330)		(0.0962)	(0.1270)	(0.1630)
2002	-0.0819	-0.0942	0.0006	-0.0351	-0.0072	-0.0386	-0.1480	-0.1300
	(0.0584)	(0.0826)	(0.1130)	(0.1340)	(0.0430)	(0.0977)	(0.1310)	(0.1730)
2003	-0.0741	-0.0833	0.0057	-0.0278	-0.0108	-0.0413	-0.1450	-0.1280
	(0.0578)	(0.0782)	(0.1050)	(0.1250)	(0.0431)	(0.0932)	(0.1240)	(0.1630)
2004	-0.0583	-0.0651	0.0194	-0.0124	-0.0190	-0.0487	-0.1470	-0.1310
	(0.0575)	(0.0749)	(0.1010)	(0.1200)	(0.0398)	(0.0873)	(0.1180)	(0.1560)
2005	-0.0463	-0.0426	0.0224	-0.0021	-0.0021	-0.0288	-0.1050	-0.0928
	(0.0597)	(0.0563)	(0.0783)	(0.0928)	(0.0430)	(0.0663)	(0.0886)	(0.1180)
2006	-0.0587	-0.0394	-0.0033	-0.0169	-0.0071	-0.0290	-0.0710	-0.0641
	(0.0601)	(0.0319)	(0.0438)	(0.0511)	(0.0453)	(0.0399)	(0.0508)	(0.0670)
2007	-0.0462	-0.0187	0.0021	-0.0058	-0.0040	-0.0234	-0.0473	-0.0434
	(0.0598)	(0.0222)	(0.0325)	(0.0356)	(0.0442)	(0.0250)	(0.0316)	(0.0393)
2008	-0.0421	-0.0077	0.0002	-0.0028	0.0094	-0.0078	-0.0160	-0.0146
	(0.0608)	(0.0134)	(0.0177)	(0.0180)	(0.0453)	(0.0094)	(0.0117)	(0.0146)
2009	-0.0403				0.0137			
	(0.0609)				(0.0465)			

Constant	1.978***				27.83***			
	(0.0841)				(2.8610)			
1st stg F-stat		15.53	8.74	5.66		13.56	6.82	4.94
p-value		0.0001	0.0036	0.0185		0.0003	0.0098	0.0276
AR Wald Test		0.32	0.17	0.01		0	0.81	0.31
p-value		0.5741	0.6774	0.9367		0.9555	0.3669	0.5763
Observations	14,127	14,125	14,125	14,125	14,320	14,319	14,319	14,319
R-squared	0.015	-0.016	-0.008	0.014	0.014	0.011	-0.175	-0.125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. These results correspond to Table 3 in the main text of the paper. Dependent variables are the portion of hospitalizations in the region-year that were caused by an ambulatory care sensitive condition (ACSC), and the portion of the region-year that received a routine check-up in the past year. All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. AR Wald Test is the Anderson-Rubin Wald test, distributed as chi-squared (1). The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE A-2: Effects of prescription drug cost sharing on hosptilizations from specific conditions among U.S. elderly

	Angina				Asthma			
	1	2	3	4	5	6	7	8
Rx spending:	0.0000	-0.0008	0.0009	0.0016	0.0001	0.0015	0.0025	0.0032
Self/fam shr (%)	(0.0000)	(0.0011)	(0.0012)	(0.0019)	(0.0001)	(0.0012)	(0.0020)	(0.0025)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Bacterial pneumonia				**Cellulitis**			
	9	10	11	12	13	14	15	16
Rx spending:	-0.0004	-0.0016	-0.0089*	-0.0133*	0.0000	0.0030	0.0043	0.0061
Self/fam shr (%)	(0.0003)	(0.0029)	(0.0050)	(0.0077)	(0.0001)	(0.0020)	(0.0031)	(0.0046)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Congestive heart failure				**COPD**			
	17	18	19	20	21	22	23	24
Rx spending:	-0.0003	-0.0002	0.0000	-0.0010	-0.0001	-0.0009	-0.0026	-0.0010
Self/fam shr (%)	(0.0002)	(0.0024)	(0.0038)	(0.0052)	(0.0002)	(0.0022)	(0.0029)	(0.0038)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Dental condition				**Diabetes**			
	25	26	27	28	29	30	31	32
Rx spending:	-0.0001	-0.0004	-0.0001	0.0000	0.0000	-0.0011	-0.0046	-0.0053
Self/fam shr (%)	(0.0000)	(0.0004)	(0.0009)	(0.0013)	(0.0002)	(0.0023)	(0.0041)	(0.0044)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Gastroenteritis				**Epilepsy**			
	33	34	35	36	37	38	39	40
Rx spending:	0.0000	0.0000	-0.0004	-0.0006	-0.0001	-0.0018	0.0001	0.0014
Self/fam shr (%)	(0.0000)	(0.0002)	(0.0003)	(0.0005)	(0.0001)	(0.0016)	(0.0025)	(0.0037)

First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Hypertension				**Hypoglycemia**			
	41	42	43	44	45	46	47	48
Rx spending:	0.0001	0.0013	0.0024	0.0048	0.0000	-0.0001	-0.0002	-0.0002
Self/fam shr (%)	(0.0002)	(0.0023)	(0.0039)	(0.0061)	(0.0000)	(0.0001)	(0.0002)	(0.0002)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Urinary tract infection				**Pelvic inflammatory disease**			
	49	50	51	52	53	54	55	56
Rx spending:	0.0002	0.0031	0.0005	0.0003	0.0000	0.0002	-0.0004	-0.0008
Self/fam shr (%)	(0.0002)	(0.0024)	(0.0019)	(0.0025)	(0.0000)	(0.0003)	(0.0004)	(0.0007)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Ruptured appendix				**Severe ear/nose/throat infection**			
	57	58	59	60	61	62	63	64
Rx spending:	0.0001	0.0005	0.0014	0.0020	0.0001	0.0007	0.0006	0.0005
Self/fam shr (%)	(0.0001)	(0.0008)	(0.0017)	(0.0024)	(0.0001)	(0.0010)	(0.0013)	(0.0017)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Tuberculosis				**Acute myocardial infarction**			
	65	66	67	68	69	70	71	72
Rx spending:	0.0000	-0.0001	0.0000	-0.0001	0.0003	0.0032	0.0053	0.0085
Self/fam shr (%)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0002)	(0.0034)	(0.0050)	(0.0068)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

	Cardiac dysrhythmias				Chest pain			
	73	74	75	76	77	78	79	80
Rx spending:	0.0002	0.0004	0.0014	0.0020	-0.0001	-0.0040**	-0.0034	-0.0010
Self/fam shr (%)	(0.0002)	(0.0018)	(0.0023)	(0.0028)	(0.0002)	(0.0017)	(0.0023)	(0.0031)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

	Complication of device, implant, or graft				Coronary atherosclerosis			
	81	82	83	84	85	86	87	88
Rx spending:	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0002	0.0010	-0.0015
Self/fam shr (%)	(0.0000)	(0.0005)	(0.0005)	(0.0007)	(0.0002)	(0.0029)	(0.0032)	(0.0046)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

	Fluid and electrolyte disorder				Hip fracture			
	89	90	91	92	93	94	95	96
Rx spending:	0.0002**	0.0017	0.0005	-0.0004	-0.0001	-0.0015	-0.0028	-0.0051
Self/fam shr (%)	(0.0001)	(0.0011)	(0.0016)	(0.0021)	(0.0002)	(0.0018)	(0.0027)	(0.0036)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

	Osteoarthritis				Pneumonia			
	97	98	99	100	101	102	103	104
Rx spending:	0.0001	0.0004	0.0013	0.0016	-0.0004	-0.0010	-0.0075	-0.0108
Self/fam shr (%)	(0.0001)	(0.0013)	(0.0023)	(0.0032)	(0.0003)	(0.0029)	(0.0046)	(0.0070)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

	Septicemia				Stroke			
	105	106	107	108	109	110	111	112
Rx spending:	0.0002	0.0002	-0.0018	-0.0021	0.0000	0.0001	-0.0007	-0.0016
Self/fam shr (%)	(0.0002)	(0.0014)	(0.0030)	(0.0044)	(0.0001)	(0.0004)	(0.0008)	(0.0017)

First stg F-stat		13.67	6.97	4.91		15.53	8.74	5.66
p-value		0.0003	0.0091	0.028		0.0001	0.0036	0.0185
Observations	14,324	14,323	14,323	14,323	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year that were caused by the condition listed. Output for four types of hospitalizations was omitted because of insufficient observations: bronchitis, congenital syphilis, nutritional deficiency, and rehabilitation care, prosthesis fitting, and device adjustment. All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE A-3: Effects of prescription drugs on other groups of hospitalizations

	Common hospitalizations				Restricted group of ACSC hosps			
	1	2	3	4	5	6	7	8
Rx spending:	0.0002	0.0013	-0.0064	-0.0102	-0.0005	-0.0028	-0.0076	-0.0087
Self/fam shr (%)	(0.0007)	(0.0083)	(0.0094)	(0.0120)	(0.0005)	(0.0056)	(0.0088)	(0.0122)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX 08	MADV 08	MADV 05	OLS	MRX 08	MADV 08	MADV 05

	CCC defined ACSC hosps				ICD defined ACSC hosps			
	9	10	11	12	13	14	15	16
Rx spending:	-0.0006	0.0050	-0.0034	-0.0073	-0.0002	0.0034	-0.0023	0.0016
Self/fam shr (%)	(0.0007)	(0.0079)	(0.0101)	(0.0140)	(0.0006)	(0.0072)	(0.0088)	(0.0102)
First stg F-stat		15.53	8.74	5.66		15.53	8.74	5.66
p-value		0.0001	0.0036	0.0185		0.0001	0.0036	0.0185
Observations	14,127	14,125	14,125	14,125	14,127	14,125	14,125	14,125
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year for which the diagnosis was in the group noted, which are fully explained with the Robustness Checks in the Results section of the main paper. Common hospitalizations are the 13 most frequent conditions causing hospitalizations among the elderly (Russo and Elixhauser, 2003). The restricted group of ACSC hospitalizations are seven conditions listed in Levinton et al 2006, rather than the full group of 20 conditions from Bindman et al 2005. CCC defined ACSC hospitalizations are the 20 conditions, as defined by Clinical Classification Codes. ICD defined ACSC hospitalizations are the 23 conditions, as defined by the International Classification of Diseases codes. All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE A-4: Effects of prescription drug cost sharing on other utilization outcomes

	Recent flu shot				Recent cholesterol check			
	1	2	3	4	5	6	7	8
Rx spending:	0.0000	0.0037	0.0067	0.0049	-0.0011**	-0.0035	0.0046	0.0045
Self/fam shr (%)	(0.0007)	(0.0087)	(0.0128)	(0.0174)	(0.0005)	(0.0060)	(0.0080)	(0.0108)
First stg F-stat		13.71	6.97	4.91		13.71	6.97	4.91
p-value		0.0003	0.009	0.0281		0.0003	0.009	0.0281
Observations	14,321	14,320	14,320	14,320	14,319	14,318	14,318	14,318
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	Preventive care at usual source of care				**OP visits classified as checkups**			
	9	10	11	12	13	14	15	16
Rx spending:	-0.0001	-0.0046**	-0.0003	0.0011	0.0008	-0.0039	-0.0117	-0.0142
Self/fam shr (%)	(0.0001)	(0.0023)	(0.0030)	(0.0043)	(0.0006)	(0.0063)	(0.0086)	(0.0109)
First stg F-stat		13.71	6.97	4.91		14.15	7.53	5.44
p-value		0.0003	0.009	0.0281		0.0002	0.0067	0.0208
Observations	14,318	14,318	14,318	14,318	14,255	14,254	14,254	14,254
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	OP visits with immunization				**OP visits with a GP**			
	17	18	19	20	21	22	23	24
Rx spending:	-0.0001	-0.0006	0.0004	0.0013	0.0001	-0.0020	-0.0015	-0.0022
Self/fam shr (%)	(0.0001)	(0.0014)	(0.0014)	(0.0020)	(0.0003)	(0.0024)	(0.0034)	(0.0043)
First stg F-stat		14.15	7.53	5.44		14.15	7.53	5.44
p-value		0.0002	0.0067	0.0208		0.0002	0.0067	0.0208
Observations	14,255	14,254	14,254	14,254	14,255	14,254	14,254	14,254
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are at the region-year level, with specifications 1-12 as a portion of individuals in a region-year, and specifications 13-24 as a portion of outpatient visits in a region-year. All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE A-5: Effects of Medicare and private insurance drug spending on ambulatory care sensitive conditions (ACSC) hospitalizations and recent routine check-ups (RRCU)

	ACSC				RRCU			
	1	2	3	4	9	10	11	12
Rx spending:	0.0001	-0.0031	0.0027	-0.0009	0.0001	-0.0008	-0.0112	-0.0066
Medicare shr (%)	(0.0005)	(0.0051)	(0.0097)	(0.0090)	(0.0005)	(0.0056)	(0.0139)	(0.0129)
First stg F-stat		17.43	3.3	3.24		13.52	2.09	2.45
p-value		0	0.071	0.0738		0.0003	0.1498	0.1195
Observations	14,123	14,120	14,120	14,120	14,319	14,318	14,318	14,318
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05
	ACSC				RRCU			
	5	6	7	8	13	14	15	16
Rx spending:	-0.0002	-0.0379	-0.0053	0.0009	-0.0003	-0.0062	0.0248	0.0069
Priv ins shr (%)	(0.0006)	(0.1260)	(0.0197)	(0.0090)	(0.0007)	(0.0455)	(0.0471)	(0.0144)
First stg F-stat		0.12	0.97	3.75		0.27	0.51	2.58
p-value		0.7274	0.3252	0.0546		0.6034	0.4759	0.1102
Observations	14,123	14,120	14,120	14,120	14,319	14,318	14,318	14,318
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year that were caused by an ambulatory care sensitive condition (ACSC), and the portion of the region-year that received a routine check-up in the past year (RRCU). All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE A-6: Effects of prescription medicine spending, in unrestricted sample

	ACSC				RRCU			
	1	2	3	4	5	6	7	8
Rx spending:	0.0001	0.0043	0.0032	0.0082	-0.0006	0.0010	0.0098	0.0089
Self/fam shr (%)	(0.0006)	(0.0067)	(0.0088)	(0.0123)	(0.0006)	(0.0070)	(0.0099)	(0.0140)
First stg F-stat		17.44	9.17	5.56		15.55	7.16	4.59
p-value		0	0.0028	0.0195		0.0001	0.0082	0.0336
Observations	14,128	14,126	14,126	14,126	14,319	14,318	14,318	14,318
Instrument	OLS	MRX08	MADV08	MADV05	OLS	MRX08	MADV08	MADV05

Output for instrumental variables (2SLS) regressions, with standard errors clustered at the designated market area (DMA) level. Dependent variables are the portion of hospitalizations in the region-year that were caused by an ambulatory care sensitive condition (ACSC), and the portion of the region-year that received a routine check-up in the past year (RRCU). These regressions are the same as Table 3 in the main text, except instead of restricting the sample to events that were an individual's first of the year, the results shown here used all events. All regressions feature year and region fixed effects, as well as controls for age, gender, race, marital status, education, income, unemployment, and total level of spending. The data source is the Medical Expenditure Panel Survey (MEPS), 2000-2009, restricted to respondents aged 65 and higher. MRX08 is Medicare prescription drug penetration in 2008, interacted with the years of the MMA. MADV05 is Medicare Advantage penetration in 2005, interacted with the years of the MMA. MADV08 is Medicare Advantage penetration in 2008, interacted with the years of the MMA. Instrument details are in the Methods section. Robust clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1