Estimated Effects of Increased Coverage on Prescription Drug Expenditures among Seniors

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ABSTRACT

Access to prescription drugs is important to seniors with chronic conditions. In 2005, approximately one-third of seniors lacked prescription drug coverage. To examine the potential effects of gaining drug coverage, which many seniors achieved in 2006 with Medicare Part D, we estimate the relationship of prescription drug coverage and drug expenditures. We use econometric models and data from a nationally representative sample of elderly, non-institutionalized Medicare beneficiaries pooled for the years 2000 – 2003. Relative to no drug coverage, coverage from Medicare HMOs or employer-based plans is associated with increased prescription drug expenditures of approximately 15 and 20 percent respectively, and with a marginal increase of approximately one unique drug purchased per year. Medicaid and employer-based coverage are associated with greater purchases of newer analgesic agents. Findings from this paper can be used to inform Part D benefit design and formularies.

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INTRODUCTION

Prescribed medications play a critical role in treating and controlling many chronic conditions. Access to prescription drugs is therefore very important to the vast majority of seniors who have one or more chronic medical conditions. Until Medicare Part D was implemented in 2006, Medicare did not cover outpatient prescription drugs, and approximately one-third of non-institutionalized seniors lacked prescription drug coverage in 2005 (Neuman et al. 2007). Medicare Part D is expected to have an important positive impact on seniors' access to prescription drugs, but until individual level expenditure data are available for study in late 2008 or early 2009, we will not know its impact on the typical senior.[1] We use data from before the enactment of Medicare Part D to estimate how expanded insurance coverage for drugs will increase utilization and expenditures for individual enrollees, for all drugs and for specific therapeutic classes of drugs.

Neuman et al. (2007) describes the characteristics of Part D enrollees and their first year experiences, based on a national (but not nationally representative) survey of seniors. As expected, the study finds that enrollees reported increased access to drugs. For instance, compared with seniors without drug coverage in 2006, seniors with Part D reported that they were less likely to spend $300 or more per month out-of-pocket on prescription drugs, after controlling for socioeconomic characteristics, medication use, and health status. However, Neuman et al (2007) could not collect information on total expenditures validated by insurance claims or pharmacy reports, as is done in expenditure surveys like the Medicare Current Beneficiary Survey (MCBS) and Medical Expenditure Panel Survey (MEPS).

There are several other studies that examine the association of prescription drug coverage and drug use or spending in the Medicare population. However, most of these studies rely on older data and do not differentiate between types of insurance coverage. Further, all of the previous studies examine only aggregate drug use or expenditures. Using 1990 data that is not nationally representative, Lillard et al. (1999) estimated that adding prescription drug benefits to Medicare would increase the probability of any drug use by 8.8 percent for seniors without drug coverage, and 4.8 percent for all seniors. Other studies used nationally representative data from the MEPS or the Medicare Current Beneficiary Survey (MCBS) and found that expanded drug coverage would result in statistically significant increases in aggregate prescription drug expenditures or use. Curtis et. al. (2004) used data from the 1997 MEPS to estimate cross-sectional models with a single binary drug coverage variable, and found that prescription drug insurance would increase expenditures of those without drug insurance by about 40 percent.

Two recent papers use MCBS data and attempt to correct for the endogeneity of insurance status. Khan et. al. (2007) examine the effect of 4 types of drug coverage (HMO, Medigap, employer-sponsored, or public) estimating models first without, then with, individual fixed effects. Depending on the type of coverage, they estimated that drug use would increase by 15 to 47 percent before controlling for fixed effects, and 6 to 14 percent after controlling for fixed effects. They conclude that cross-sectional models are subject to substantial endogeneity bias which is corrected by fixed effects. Shea et. al. (2007) estimate models with a single binary drug coverage variable first using a cross-sectional specification, and then using a residual inclusion model to correct for potential endogeneity. The magnitudes of the estimates from the alternative specifications are nearly equivalent with each model showing that prescription drug coverage would increase drug use among Medicare beneficiaries by almost 50 percent.[2] Based

on these results, Shea et. al. conclude that selection into prescription drug coverage is predictable based on observable health.

Other studies examine the association of prescription drug coverage with use of drugs from one specific therapeutic class, such as antihypertensive drugs (Adams et al, 2001; Blustein, 2000) or cardiovascular drugs (Federman et al. 2001).

NEW CONTRIBUTION

This study estimates the association between four levels of prescription drug coverage and prescription drug use and expenditures. We improve upon previous studies by using more recent data, and we expand upon previous studies of aggregate drug use or spending by analyzing use of a wide range of therapeutic classes of drugs, focusing on the classes that account for the highest level of expenditures and use among seniors.[3] We estimate expenditures for 19 therapeutic drug classes and estimate which specific therapeutic classes of drugs will have higher expenditures in association with greater prescription drug coverage.

By including specific therapeutic classes, we are able to examine potential reasons for changes in aggregate expenditures. Unlike previous studies, we can estimate the extent to which increased drug coverage is associated with (1) purchasing more refills of drugs that seniors already purchase, (2) replacing previously purchased drugs for specific medical condition(s) with newer drugs that treat the same medical condition(s), or (3) purchasing drugs to treat a medical condition that was not previously treated with prescription drugs.

CONCEPTUAL MODEL

To examine the relationship between drug coverage and prescription drug expenditures, we use a conceptual model of the demand for health care, which is derived from the demand for health. The factors affecting patients' demand for health care include actual or perceived health status, sociodemographic characteristics, and economic factors (Feldstein 1979; Phelps 1992). Health status measures include self-rated health status and the presence of particular acute and chronic medical conditions. Greater use of health care is associated with lower levels of self-rated health and increases in the number and severity of medical conditions. Sociodemographic characteristics include age, gender, education, race/ethnicity, and geographic location. Age is positively associated with health care use. Higher levels of education may be reflected in greater knowledge about preventive care and treatment of specific medical conditions, different attitudes towards seeking care, and greater efficiency in purchasing care (Phelps, 1992). Race and ethnicity (Institute of Medicine, 2002) and geographic location (Welch et. al.1993) have been shown to be associated with different levels of treatment for specific conditions. Economic factors include income, prices and health insurance. People with higher levels of income tend to purchase more health care, all other factors equal. Health insurance lowers the price that patients pay for health care, and consumers purchase greater quantities of goods and services as their prices decline.

The models we estimate can be characterized by the following equation:

$$(1)\quad RX_{ist} = f(\text{health status}_{it}, \text{sociodemographic characteristics}_{it}, \text{income}_{it}, \text{insurance category}_{it}, \text{attitudes}_{it}).$$

Our measure of health care, (RX_{ist}), is annual drug use or expenditures by person i, for drug category s, in year t. Our primary model uses total expenditures for all types of outpatient prescription drugs. Next, we examine the number of unique drugs purchased. Then, we extend the analysis to separately examine 19 therapeutic classes and subclasses of drugs with high levels of expenditures by seniors. In our drug expenditure data, a non-trivial percent of persons have zero expenditures and the distribution of strictly positive expenditures is highly skewed. We accommodate these data issues by estimating two part models where the conditional expenditure model is estimated using Poisson models with log links (Buntin and Zaslavski, 2004; Manning and Mullahy, 2001). We estimate models of total purchases and the number of unique drugs using one part Poisson models that accommodate the distribution of these count data.

Our models control for health status, sociodemographic characteristics, income, insurance category, and patient attitudes about their health care. We include variables capturing patient attitudes about health care (described in more detail below) as a partial control for the potential endogeneity of insurance status and prescription drug expenditures.

DATA AND METHODS

Data

This study uses data from the Medical Expenditure Panel Survey (MEPS), an on-going survey that collects nationally representative data on health care use, expenditures, insurance coverage, health status, and socio-demographic characteristics for the U.S. civilian, non-institutionalized population. MEPS expenditure data combine household-reported information primarily associated with medical care events with information obtained from providers through

follow-back surveys to supplement household-reported data and to obtain more detailed data (Cohen, 2003).

In addition, MEPS collects detailed information on all prescription medication purchases reported by respondents, including the medication name and the condition for which the drug was prescribed. The prescription data collected from households are enhanced through surveys of pharmacies where the drugs were purchased. For every reported purchase of a prescription drug, pharmacies are asked to provide data on the medication name, national drug code (NDC), strength, quantity, total charge, and payment by source. In this study, each drug purchased was assigned a therapeutic class and subclass using the NDC to link the MEPS prescribed medicines files to the Multum Lexicon database, a product of Cerner Multum, Inc.

To increase sample sizes and statistical power, we pool data from MEPS for 4 years—2000 through 2003—and compute average annual estimates based on the pooled data. The study population includes people in the civilian, non-institutionalized population age 65 and older who were enrolled in Medicare during their first of 5 survey rounds in MEPS. Our total sample includes 7,036 individuals, representing an average of 33.4 million elderly Medicare beneficiaries per year between 2000 and 2003.

Measures

We examine three measures of total annual drug use and expenditures. Our primary model uses total expenditures for all types of outpatient prescription drugs. Next, we examine two measures of use: total purchases (e.g., number of prescriptions including refills) and the number of unique drugs purchased. In addition, we separately examine 19 therapeutic classes and subclasses of drugs with high levels of expenditures by seniors, including antihyperlipidemics, antidiabetic agents, proton pump inhibitors, antidepressants, analgesics, and

others. Drug expenditures for all years are adjusted to 2006 dollars using the Consumer Price Index (CPI) for Prescription Drugs and Medical Supplies.

The main variables of interest are binary variables that indicate 6 mutually exclusive drug coverage categories, hierarchically defined as:

1. Medicaid
2. Employer-based plan with prescription drug coverage (including TRICARE plans)
3. Medicare HMO
4. Individually-purchased Medigap plans with drug coverage
5. Prescription drug assistance from the Veterans' Administration (VA) or a State Pharmacy Assistance Program
6. No prescription drug coverage, which serves as the reference category.

Our insurance measures are based on the type of coverage beneficiaries reported during their first round in the survey, a "point-in-time" measure.[4] We distinguish beneficiaries in employer-based or Medigap plans that do not cover prescription drugs and assign them to the 'no drug coverage' category along with beneficiaries who have no supplemental insurance coverage.

The sociodemographic control variables include binary variables for age (3 categories), race/ethnicity, gender, education, region, year, death or entry into an institution, and health status reported by a household member. We control for 4 income categories relative to the federal poverty line: poor or near poor, low income, middle income, and high income, which are < 124 percent, 125 – 199 percent, 200 – 399 percent, and 400 or more percent of the federal poverty line, respectively. The health status measures include overall self-ratings of physical and mental health, as well as whether the beneficiary reported having limited physical functioning, limited cognition, difficulties in activities of daily living (ADL), or difficulties in instrumental activities

of daily living (IADL). Activities of daily living are activities related to personal care and include dressing and eating. Instrumental activities of daily living are activities related to independent living and include preparing meals and managing money (National Center for Health Statistics, 2007).

We also include two variables that measure beneficiary attitudes toward risk and health care that control for different propensities to purchase insurance and use medical care. These variables indicate whether each beneficiary agreed "strongly" or "somewhat" with the following statements: "I am more likely to take risks than the average person" and "I can overcome illness without help from a medically trained person."

Finally, we include a set of binary variables that indicate whether beneficiaries reported that a doctor had ever diagnosed them with diabetes, asthma, high blood pressure, heart disease, stroke, emphysema, or arthritis. Because of the potential for endogenous reporting of conditions (i.e., beneficiaries who use drugs are more likely to have received a diagnosis) we estimate models with and without these conditions variables.

Estimation Methods

Given the skewed distribution of drug expenditure data, along with a non-trivial percent of persons with zero expenditure, we estimate two-part econometric models. The first part is a logistic regression that estimates the probability of any drug use and the second part estimates the level of expenditures given use. To account for the characteristics of the conditional expenditure distribution, we estimate Poisson models with log links (Buntin and Zaslavski, 2004; Manning and Mullahy, 2001).[5] Total predicted expenditures are calculated by combining results from both parts of the two-part Poisson model. Models of the number of unique drugs are estimated using Poisson regressions to properly account for the distribution of these count data.

To estimate the marginal effects of drug coverage we use the method of recycled predictions. This method uses results from our models to calculate total predicted use and expenditures for the uninsured when they are uncovered and when they are simulated to have each of the 4 types of insurance. The marginal effect for each type of insurance is the difference between these estimates averaged across all uninsured persons. Standard errors for marginal effects are estimated using the method of balanced repeated replicates (BRR) (Wolter, 1985). BRR provides non-parametric estimates of standard errors that properly account for the complex survey design of MEPS. BRR is particularly useful in situations, such as the use of recycled predictions, where it is difficult, or impossible, to derive a closed-form solution of the Taylor Series standard error. In addition, BRR standard errors are known to be second order equivalent to bootstrap standard errors.

A second estimation issue is the potential endogeneity of insurance status since unobserved beneficiary characteristics may affect both a beneficiary's choice of insurance and their subsequent expenditures on prescription drugs. This may result in biased estimates of the impact of insurance on expenditures. However, previous studies found limited evidence of adverse selection in the Medicare supplemental market due to observable health status (Ettner, 1997; Wolfe and Goddeeris, 1991) and found that supplemental coverage appealed to both low and high health risk beneficiaries (Marquis, 1992). These findings mitigate concerns about endogeneity for Medigap and Medicare HMO plans. More recent evidence regarding endogeneity is mixed. Khan et. al. (2007) present evidence of selection bias in cross-sectional models while Shea et. al. (2007) conclude that selection into prescription drug coverage is predictable based on observable health. [6] Our models control for health status and other observable characteristics using a set of variables that are similar to those used in Shea et. al

(2007). In addition, we include variables that are typically unavailable in most data and that capture beneficiaries' attitudes towards risk-taking behavior and the necessity of consulting a medical provider to overcome illness.

RESULTS

Baseline Expenditures by Insurance Category

To provide a context for our estimates of how drug expenditures would potentially change when beneficiaries gain drug coverage, we show the distribution of insurance coverage among seniors and their associated spending patterns. As indicated in Table 1, we find that at any point in time between 2000 and 2003, an average of 12.9 million non-institutionalized elderly Medicare beneficiaries (or 38.6 percent) had no prescription drug insurance coverage. Among those with coverage, about 4.1 million beneficiaries were enrolled in a Medicare HMO and 1.5 million had a Medigap plan with a drug benefit. Taken together, this indicates an additional 5.6 million beneficiaries (or 16.5 percent) had limited drug coverage.

Beneficiaries with Medicaid and employer-based drug coverage had higher average drug expenditures ($2,174 and $1,712, respectively) than those without drug coverage ($1,456) and also had higher median and 95th percentile expenditures. In contrast, there were no statistically significant differences in mean or 95th percentile expenditures between beneficiaries covered by Medicare HMOs or Medigap plans and those without coverage. However, beneficiaries with Medigap coverage had higher median expenditures ($1,321) than those without drug coverage ($865).

Characteristics by Insurance Group

Differences in expenditures by insurance category may result from differential selection of beneficiaries into insurance categories as well as differences in the generosity of benefits. Table 2 describes the characteristics of our sample and presents means of the control variables by insurance group. Beneficiaries in Medicaid and employer-based plans are different from beneficiaries without drug coverage in virtually every aspect of self-rated health and for many of the chronic conditions. In general, beneficiaries covered by Medicaid are less healthy while beneficiaries with employer-based coverage are healthier than those without coverage. In contrast, there are fewer differences in reported health status between beneficiaries covered by Medicare HMOs or Medigap plans and persons who did not have drug coverage. This supports previous research that there is little selection into those plans based on observable health (Ettner, 1997; Wolfe and Goddeeris, 1991). In addition to health status, Table 2 shows a number of differences in other socio-economic characteristics between covered groups and those with no drug coverage.

Generosity of Coverage

Differences in expenditures by type of coverage are also affected by the generosity of benefits. Individuals with more generous coverage may be inclined to spend more than they would if benefits were less generous. The first row in Table 3 compares the average percent paid out of pocket across the existing categories of insurance coverage. Beneficiaries with Medicaid and employer-based plans have the most generous drug coverage and financed a relatively low percentage of their drug expenditures with out-of-pocket payments (25 percent and 33 percent, respectively). In contrast, beneficiaries with drug coverage from Medicare HMOs or Medigap

plans paid a higher percentage out-of-pocket (54 percent and 53 percent respectively), and those with no coverage had the highest percentage (88 percent). Out-of-pocket costs for seniors with no coverage are less than 100 percent because some seniors may have obtained drug coverage after our point-in-time measure of insurance coverage, or because some seniors received payment for prescription drugs from sources (e.g., automobile insurance) that we do not classify as prescription drug coverage. Similarly, out of pocket costs for seniors with Medicaid are higher than might be expected because some lack full year coverage or because they purchase some products that Medicaid does not cover.

The second row of Table 3 shows our estimates of what beneficiaries enrolled in each insurance category would pay out-of-pocket if they were instead enrolled in a Medicare Part D plan. For each insurance category, these estimates were produced by assuming that each beneficiary instead had prescription drug coverage from a standard Part D plan in 2006. In 2006, the standard Part D benefit package included a $250 deductible, 25 percent coinsurance until $2,250 in total drug expenditures, no coverage between $2,251 and $5,100, and 5 percent coinsurance after $5,100 in total prescription drug expenditures. We estimate that beneficiaries enrolled in each of our insurance categories would pay approximately half of their prescription drug expenditures out-of-pocket with Part D coverage.

Estimated Effects of Insurance on Total Expenditures and Utilization

The estimated coefficients for our two-part Poisson model of prescription drug expenditures (without the 7 chronic condition variables) are presented in Table 4. The results for the probability of use (part one) regression indicate that use of prescription drugs is positively associated with prescription drug coverage in employer-sponsored, Medigap, and Medicare

HMO plans, poor/fair general health, limited physical functioning, and older age. In addition, we find that males, seniors in the Midwest, and those who believe they can over come illness without a medical professional are less likely to use prescription drugs. There is no statistically significant association between prescription drug use and education, income or race/ethnicity.

Among seniors who use prescription drugs, we find that many of the same variables are also associated with greater prescription drug expenditures (Table 4). Prescription drug coverage from Medicaid or employer-based plans, poor/fair general health, limited physical functioning, difficulties with IADLs, and older age are associated with greater prescription drug expenditures. Males, seniors living in the West Census region, and those who believe they can over come illness without a medical professional spend less than those in their respective reference groups. Conditional upon prescription drug use, we find that greater drug expenditures are associated with enrollment in health plans with the most generous drug coverage—Medicaid and employer-sponsored plans. In contrast, our part one regression results indicate that Medicaid enrollment is not associated with an increased probability of prescription drug use.

Table 5 displays our predicted marginal increases in expenditures (first two rows) and number of unique drugs purchased (last two rows) computed using the estimated coefficients from our multivariate models. For our model without chronic condition variables, Medicaid ($480), employer-based ($288) and Medicare HMO ($217) coverage are all associated with statistically significant increases in prescription drug expenditures. Relative to the mean expenditure for beneficiaries with no drug coverage ($1,453), these estimates represent expenditure increases of 33, 20, and 15 percent, respectively. Inclusion of our 7 chronic condition variables result in smaller predicted increases in drug expenditures for all insurance

categories, as shown in the second row of Table 5. For instance, the alternate model predicts increases of $392 for Medicaid and $195 for employer-based plans relative to no drug coverage.

Our model without the 7 chronic conditions predicts that prescription drug coverage from Medicaid, employer-based plans, or Medicare HMOs is associated with a marginal increase of approximately one unique drug (unique active ingredient or combination) purchased during the year in addition to an increase in the number of refills of each drug, as shown in the third row of Table 5. On average, beneficiaries with no supplemental coverage purchased 4.7 unique drugs per year. Our simulation shows that when these beneficiaries gain prescription drug coverage from Medicaid, employer-based, or Medicare HMO plans they will subsequently purchase approximately 6 unique drugs per person. Across the different types of insurance coverage, the increase in unique drugs ranges from 0.9 (19%) to 1.2 (26%). In contrast, our model with the 7 chronic conditions results in predicted increases in the number of unique drugs purchases that are smaller, ranging from 0.6 (Medigap) to 1.0 (employer-based coverage).

Estimated Effects of Insurance by Therapeutic Class

Prescription drug coverage from Medicaid, employer-based plans, and Medicare HMOs is also associated with statistically significant increases in total expenditures for many therapeutic drug classes (Table 6). For example, our models predict that beneficiaries without drug coverage would increase their total expenditures for analgesics and gastrointestinal agents if they gained coverage through an employer-based plan. The greatest estimated increase in expenditures per person associated with employer-based coverage is for gastrointestinal agents ($69), largely due to an increase in spending on proton pump inhibitors ($57). We also estimate a $39 increase in analgesics, most of which would be spent on cyclo-oxygenase-2 (COX-2)

inhibitors ($26). In addition, employer-based coverage is associated with increased expenditures for sex hormones ($13).

We find that Medicare HMO coverage is associated with increases in spending on cardiovascular ($119) and hormone ($41) drugs. It is interesting that Medicare HMO coverage is not associated with any increase in spending on analgesics. This might be the result of HMO restrictions on the prescribing of COX-2 inhibitors. COX-2 inhibitors are more expensive but not clearly more effective in relieving pain than traditional nonsteroidal antiinflammatory drugs (NSAIDS) such as ibuprofen (Chou et al, 2006).

Finally, Medicaid coverage is associated with large increases in expenditures per user for cardiovascular drugs ($162), gastrointestinal drugs ($126), and analgesics ($79). Within the category of cardiovascular drugs, Medicaid coverage is associated with a large increase in antihyperlipidemics ($107).

DISCUSSION

The advent of Part D in 2006 increased access to prescription drugs for many Medicare beneficiaries. Early reports indicated that most seniors had prescription drug coverage as of 2006, including relatively generous coverage through employer-sponsored plans and low-income subsidy Part D plans, and less generous coverage from Medicare Advantage and standard Part D plans. Nonetheless, Neuman et al. (2007) estimated that 8.5 percent of seniors lacked drug coverage after the annual 2006 Part D enrollment period, and up to an additional 8 percent of seniors may not have had creditable drug coverage which meets or exceeds the actuarial value of the standard Part D benefit. In our study, we use data from prior to Part D to predict its effects on individual level expenditures and utilization of drugs. We estimate that the effect of coverage

through Medicare HMOs and employer-based coverage is associated with an increase in drug expenditures, on average, of approximately 15 to 20 percent, or roughly $217 to $288 per beneficiary (2006 dollars). We also estimate that increased coverage from Medicaid, employer-based, or Medicare HMO plans resulted in a 20 percent increase, from 5 to 6, in the number of unique drugs used by previously uncovered beneficiaries. Our estimates of the impact of drug coverage on aggregate use and expenditures fall in between two recent studies (higher than Khan et. al. (2007) but lower than Shea et. al. (2007).

We also find that Medicaid coverage is associated with much larger increases in marginal expenditures on prescription drugs. Our model estimates a marginal annual increase in total prescription drug expenditures of approximately $480 (33 percent) with Medicaid compared to having no coverage. This estimate may be relevant to beneficiaries who gained coverage through a Part D plan and received a low-income subsidy that covered premiums and copayments. As of January 2007, approximately 9.2 million enrollees (seniors and disabled) were receiving the low-income subsidy (Kaiser Family Foundation 2007). However, many seniors eligible for the low-income subsidy were instead enrolled in a standard (non-subsidized) Part D plan or they had no drug coverage at all (Government Accountability Office, 2007; Neuman et. al., 2007). Our results emphasize that access to prescriptions drugs could be substantially improved for the millions of seniors who were eligible for, but not enrolled in, the Part D low-income subsidy. The Government Accountability Office (2007) contains recommendations for improving outreach efforts for the Part D low-income subsidy program.

There are some limitations to this study. We assume that more generous coverage will result in higher drug expenditures, and address the likely endogenous relationship between insurance and prescription drug expenditures by including 2 variables that capture beneficiaries'

attitudes towards risk and use of health services and controlling for observed health status. However, differences in the effects of various drug insurance categories may also be due to unobserved differences among the beneficiaries in these categories that we are unable to control for. In addition, differences may also be due to formulary restrictions and other plan policies that are not reflected in our data. Finally, sample size limitations may explain why Medigap coverage was not associated with statistically significant increases in drug expenditures.

The 2 most generous forms of coverage—Medicaid and employer-based—are associated with increased purchases of prescription analgesics. Most of the estimated increase in analgesics is for COX-2 inhibitors, which are more expensive but not necessarily more effective than traditional NSAIDs (Chou et al., 2006). This finding is important because it illustrates that relatively generous coverage could result in some seniors replacing traditional drugs (for instance, traditional NSAIDs) with newer but not necessarily more effective drugs (COX-2 inhibitors) to treat the same medical conditions. For example, traditional analgesics and drugs for Type 2 diabetes have been shown to be as effective as newer, more expensive agents (Chou et al. 2006; Bolen et al. 2007). These findings may be used to inform Part D benefit design and formularies.

NOTES

1. Expenditure data from the Medical Expenditure Panel Survey (MEPS) for 2006 is scheduled for release on November 2008, according to the MEPS data release schedule available from the MEPS website (http://www.meps.ahrq.gov). The Medicare Current Beneficiary Survey Cost and Use file for 2006 is scheduled for release on or after March/April 2009, according to the Research Data Assistance Center (ResDAC).
2. The sample of Medicare beneficiaries in Shea et al. (2007) excluded people with prescription drug coverage for part of the year and people with drug coverage who were not enrolled in a Medicare supplemental insurance plan. Shea et al. (2007) did not indicate baseline prescription drug use for sample members without prescription drug coverage.
3. The 19 therapeutic drug classes were also selected based on sufficient sample size to estimate conditional expenditures.
4. The point-in-time measure of insurance coverage allowed us to include a measure of Medicare HMO coverage that benchmarks well to administrative enrollment data from the Center for Medicare & Medicaid Services.
5. We also estimated two-part gamma models. We present estimates from two-part Poisson models based on results from the specification tests (a variation of a Park test on the residuals) and sensitivity analyses we conducted. We also estimated one-part models, because more than 90 percent of elderly beneficiaries have positive drug expenditures. The one- and two-part Poisson models yield similar results, so for ease of exposition, we present estimates based on the two-part Poisson models.

6. Both approaches to correcting for endogeneity are useful, but neither is definitive. In the fixed effects model used by Khan et. al. (2007), the model is identified by within panel changes in insurance status and validity relies on the assumption (which Khan et. al. (2007) provide some evidence to support) that these changes are exogenous. Similarly, the validity of the residual inclusion model used by Shea et. al. (2007) relies on the quality of their instrumental variables.

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TABLE 1. Prescription drug expenditures by supplemental insurance status, Medicare beneficiaries age 65+

Type of supplemental insurance	Total population (millions)	Mean expenditure	Median expenditure	Expenditure at the 95th percentile
	Average annual estimates in 2006 U.S. dollars			
Medicaid	2.6 (0.2)	2,174** (102.0)	1,298** (83.7)	7,068** (324.1)
Employer-based with prescription drug coverage	9.2 (0.4)	1,712** (58.9)	1,115** (49.3)	5,448* (230.6)
Medicare HMO	4.1 (0.3)	1,556 (69.9)	1,038 (94.9)	4,775 (251.1)
Medigap with prescription drug coverage	1.5 (0.1)	1,619 (103)	1,321** (155.6)	4,724 (377.7)
Veterans' Administration or state/local program[1]	3.2 (0.2)	1,768** (102)	1,143** (81.7)	4,886 (394.4)
No prescription drug coverage[2]	12.9 (0.5)	1,456 (49.9)	865 (39.4)	4,937 (173.4)
All elderly Medicare	33.4 (1.0)	1,632** (32.6)	1,043** (24.9)	5,314** (117.9)
Sample size = 7,036				

Source: Authors' calculations from the 2000-2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes:
1. Beneficiaries are assigned to these categories using source of payment information.
2. Includes beneficiaries with no supplemental coverage and beneficiaries with employer-based or Medigap private supplemental insurance that does not include prescription drug coverage.

* Estimate is different from the estimate for beneficiaries with no drug coverage at $p < 0.05$.
** Estimate is different from the estimate for beneficiaries with no drug coverage at $p < 0.01$

TABLE 2. Demographic, socioeconomic, and health status characteristics by type of supplemental coverage, Medicare enrollees age 65+, 2000-2003

Characteristic	Medicaid	Employer based with prescription coverage	Medicare HMO	Medigap with prescription coverage	No prescription coverage
Age category					
65-74	49.1	62.8*	50.5	59.0*	47.7
75-84	31.9	27.0*	34.2	26.1*	34.0
85 and older	19.0	10.2*	15.3	14.9	18.3
Race/ethnicity					
Hispanic	20.0*	2.7*	8.8*	^	4.3
Black	20.8*	6.9	3.9*	4.5*	8.3
Asian/Other	10.0*	2.1	3.3	^	2.6
White	49.3*	88.3*	84.0	90.1*	84.8
Gender					
Male	31.8*	50.6*	38.9*	38.7*	27.2
Education					
Less than high school	63.2*	20.3*	31.5	26.1*	34.3
High school/Graduate Equivalency Degree	28.7*	50.5	51.4	52.0	49.4
College	6.4*	19.1*	12.4	17.0	12.3
Advanced degree	1.6*	10.0*	4.6	^	3.9
Income category (% poverty line)					
< 124%	47.2*	8.1*	15.3*	11.6*	20.1
125-199%	23.0	13.1*	25.7	25.5	25.3
200-399%	19.9*	35.9	36.9	36.0	33.0
≥ 400%	9.9*	42.9*	22.1	26.9	21.6
Died or entered institution during the year	8.8	2.8*	3.1*	^	7.2
Self-rated health					
Fair or poor physical health	45.1*	23.0	25.6	16.3*	24.1
Fair or poor mental health	19.9*	7.5*	8.6	5.2*	10.2
Activities of Daily Living (ADL) difficulties	16.1*	4.0*	4.5*	5.3	7.4
Instrumental Activities of Daily Living (IADL) difficulties	30.3*	8.3*	10.8	9.8	13.8
Limited physical functioning	53.7*	31.9*	33.9	34.1	36.8

Characteristic	Medicaid	Employer based with prescription coverage	Medicare HMO	Medigap with prescription coverage	No prescription coverage
Limited cognition	22.7*	8.0*	9.6	9.6	11.4
Attitudes towards risk					
Willing to take risks	14.0	10.7*	13.8	14.2	13.3
Can overcome illness without medical professional	10.1	9.3*	13.0	9.4	12.7
Geographic variables					
Northeast	22.2	23.8	23.4	21.6	19.7
Midwest	13.7*	25.1	13.9*	22.5	26.1
South	39.9	33.2*	24.4*	37.9	39.6
West	24.1*	17.8	38.3*	18.0	14.6
Metropolitan Statistical Area	76.3	80.3*	91.6*	73.0	71.6
Health conditions: has a doctor ever told you that you have:					
Diabetes	23.3*	14.8*	17.3*	11.6	12.3
Hypertension	57.5*	55.3*	57.4*	50.7	51.3
Heart disease	27.3	32.3*	28.5	27.0	26.2
Asthma	11.7*	8.6	8.0	7.6	7.8
Arthritis	42.3*	39.5	36.9	39.4	35.7
Stroke	11.8*	9.4	10.9	8.1	8.5
Emphysema	5.8	5.1	4.5	5.1	4.4
Sample size = 7,036					

Source: Authors' calculations from the 2000-2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes:
* Estimate is different from the estimate for beneficiaries with no drug coverage at $p < 0.05$, or better.
^ Unreliable estimate, relative standard error > 0.30.

TABLE 3. Out-of-pocket prescription drug expenditures by type of coverage
Medicare beneficiaries age 65+, 2000-2003.

	Medicaid	Employer-based with prescription drug coverage	Medicare HMO	Medigap with prescription drug coverage	No prescription drug coverage
Percentage paid out-of-pocket for drugs[1]					
With current coverage	24.5	33.4	53.8	52.9	87.9
With Part D coverage[2]	49.4	49.8	50.6	49.8	49.5

Source: Authors' calculations from the 2000-2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes

1. For each insurance category, the percentage of total expenditures paid out-of-pocket was calculated as:
   $\sum$(Out-of-pocket prescription expenditures) / $\sum$ (Total prescription expenditures)

2. The Part D coverage estimates were produced by assuming that beneficiaries in each insurance category instead had prescription drug coverage from a standard Part D plan.

3. Out-of-pocket costs for seniors with no coverage are less than 100 percent because some seniors may have obtained drug coverage after our point-in-time measure of insurance coverage, or because some seniors received payment for prescription drugs from sources (such as automobile insurance companies) that we do not classify as prescription drug coverage.

TABLE 4. Generalized Linear Model (Two-part Poisson Model with Log Link)
Regression Coefficients of Prescription Drug Expenditures, without chronic condition control variables

Characteristic	Logit Coefficient	Standard error	Poisson Coefficient	Standard error
	Probability of Use (Part 1)		Conditional Expenditures (Part 2)	
Type of supplemental insurance				
Medicaid	0.412	0.224	0.251**	0.062
Employer-based with drug coverage	0.925**	0.140	0.116*	0.048
Medicare HMO	0.872**	0.171	0.076	0.060
Medigap with drug coverage	0.685*	0.308	0.087	0.070
Age Category				
75 - 84	0.383**	0.128	0.010	0.041
85 and older	0.555**	0.163	-0.150**	0.042
Race/ethnicity				
Hispanic	-0.276	0.194	-0.092	0.061
Black	-0.355	0.186	-0.042	0.054
Asian/other	-0.372	0.290	-0.187	0.099
Education				
High school/Graduate Equivalency Degree	0.036	0.137	0.041	0.041
College	0.194	0.199	-0.016	0.053
Advanced degree	0.290	0.275	-0.090	0.067
Gender				
Male	-0.731**	0.117	-0.091*	0.037
Income category (% poverty line)				
125 - 199%	0.088	0.169	0.095	0.051
200 - 399%	-0.044	0.158	0.049	0.044
$\geq$ 400%	0.090	0.191	0.016	0.051
Self-rated health				
Fair or poor physical health	0.911**	0.173	0.365**	0.047
Fair or poor mental health	-0.134	0.246	0.047	0.063

Characteristic	Logit Coefficient	Standard error	Poisson Coefficient	Standard error
ADL difficulties	-0.258	0.320	0.127	0.067
IADL difficulties	0.311	0.275	0.121*	0.056
Limited physical functioning	0.982**	0.157	0.284**	0.041
Limited cognition	-0.340	0.233	0.034	0.054
Patient attitudes				
Willing to take risks	-0.024	0.150	0.035	0.050
Can overcome illness w/o medical professional	-0.921**	0.152	-0.254**	0.070
Geographic variables				
Midwest	-0.290*	0.136	0.086	0.058
South	-0.127	0.137	0.012**	0.052
West	-0.277	0.164	-0.211	0.055
Metropolitan Statistical Area	-0.245	0.125	-0.034	0.039
Panel				
Panel 6 (2001)	0.267	0.143	0.084	0.049
Panel 7 (2002)	0.492*	0.164	0.213**	0.054
Panel 8 (2003)	0.391*	0.162	0.287**	0.051
Died or entered an institution during the year	-1.502**	0.231	-0.594**	0.127
Missing value for attitude variable	-0.472**	0.154	-0.168**	0.053
Constant term	1.912**	0.253	7.090**	0.082
Sample size = 5,772				

Source: Authors' calculations from the 2000 – 2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes:

* (**) Significantly different from 0 at $p < .05$ ($p < .01$)

The coefficients and standard errors take into account sampling weights and the complex design of the MEPS to yield nationally representative estimates of the non-institutionalized Medicare population.

TABLE 5. Change in per capita annual drug expenditures associated with gaining drug coverage (2006 dollars)

Model specification	No drug Coverage (Baseline)	Medicaid	Employer- based with drug coverage	Medicare HMO	Medigap with drug coverage
Poisson with log link	Average expenditures	Marginal increase in expenditures[1]			
No chronic conditions[2]	$1,453	480*	288*	217*	219
		(124)	(81)	(94)	(120)
Chronic conditions	$1,453	392*	195*	115	204
		(108)	(72)	(92)	(113)
	Average number of purchases	Marginal increase in number of unique drugs[1]			
No chronic conditions[2]	4.7	1.0*	1.2*	0.9*	0.7*
Chronic conditions	4.7	0.8*	1.0*	0.7*	0.6*

Source: Authors' calculations from the 2000 – 2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes:

1. Simulated change in average expenditures (number of unique drugs) if persons with no prescription drug coverage gained coverage under each insurance category. To estimate the marginal effects of drug coverage, we use results from our models to calculate total

predicted use and expenditures for the uninsured when they are uncovered and when they are simulated to have each of the 4 types of insurance. The marginal effect for each type of insurance is the difference between these estimates averaged across all uninsured persons. The control variables are listed in Table 2.

2. The chronic conditions included in some simulations and not in others are: diabetes, hypertension, heart disease, asthma, arthritis, stroke, and emphysema.

*Statistically significant at $p < .05$, or better.
Standard errors (in parentheses) were estimated using the method of balanced repeated replicates (BRR).

TABLE 6. Changes in per capita annual prescription drug use and expenditures associated with gaining drug coverage, by therapeutic drug class (2006 dollars)

Therapeutic class	No drug coverage: Baseline: average expenditure	Medicaid: Marginal increase in expenditures	Employer-based with drug coverage: Marginal increase in expenditures	Medicare HMO: Marginal increase in expenditures	Medigap with drug coverage: Marginal increase in expenditures
Cardiovascular	580	162*	56	119*	31
Antihypertensives	331	54	45	71*	17
Antihyperlipidemics	186	107*	10	45	-5
Hormones	213	47	41	54	97
Antidiabetic	97	33	20	3	42
Sex hormones	32	17	13*	41*	13
Bisphosphonates	38	-7	6	-8	13
Thyroid drugs	23	-1	-1	1	11
Gastrointestinal	112	126*	69*	13	-11
Proton pump inhibitors	76	100*	57*	-5	-16
H2 antagonists	24	16	6	17	0
Psychotherapeutic	101	12	7	3	34
Antidepressants	57	13	7	0	23
Sedatives, anti-anxiety	31	1	0	-2	-2
Analgesics	97	79*	39*	18	34
Cyclo-oxygenase-2 (COX-2) inhibitors	53	53*	26*	0	33
Nonsteroidal anti-inflammatory drugs (NSAIDs)	16	16*	12*	11	0
Narcotic analgesics	17	17	7	15	2
Anti-infectives	34	7	15	-3	-8

Source: Authors' calculations from the 2000-2003 Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality.

Notes:
*Statistically significant at $p < .05$, or better.

Expenditures for therapeutic classes were estimated using two-part Poisson models that control for demographic, socioeconomic, self-rated health status and attitude variables.