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PROFILE

- Health services researcher with extensive economics training and applied research experience spanning the federal government, pharmaceutical industry, and non-profit organizations.
- Highly effective research communication skills: Wrote federal grant proposal and successfully received independent funding. Published multiple manuscripts in peer-reviewed healthcare journals. Prepared and presented research at several professional meetings.
- Skilled in data programing and statistical modeling using SAS 9.2 and STATA 11.
- Works productively in teams and independently to effectively manage multiple projects.
- Coursework in Econometrics I & II, Research Methods I & II, Advanced Microeconomic Theory, Survival Analysis, Health Economics, Benefit-Cost Analysis, Statistical Methods I & II, Pharmaceutical Economics, Pharmacoepidemiology, Epidemiology, Health Behavior, Health Care Policy

EDUCATION

Ph.D. (Pharmaceutical Health Services Research), University of Maryland 2012
D*issertation Title:* Topics in Medicare Part D: Eligibility, Participation, Impacts
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RESEARCH EXPERIENCE (UNIVERSITY OF MARYLAND)

***Topics in Medicare Part D: Eligibility, Participation, and Impacts*.**
Principal Investigator: J Samantha Shoemaker 2011-2012
Sponsor: Agency for Healthcare Research and Quality, Health Services Research Dissertation Grant- R36
Proposal development, literature review, study design, analysis (i.e., data check, analytic file construction, and final analysis), table preparation, descriptive analyses, and manuscript preparation.

Impact of Benefit Design, Cost Sharing & Utilization Management within the Medicare Part D Benefit.
Principal Investigator: Bruce Stuart 2010-2011
Sponsor: GlaxoSmithKline
Provided statistical analysis; contributed to development of study protocol, analytic decisions, and manuscript preparation.

***Supplemental Medical and Drug Insurance and Cancer Related Spending*.**
Principal Investigator: Amy Davidoff 2010-2011
Sponsor: American Cancer Society

Constructed analytic dataset, conducted statistical analysis; contributed to analytic decisions and manuscript preparation.

***The Impact of Part D on Previously Uninsured Medicare Beneficiaries with Hypertension*.**
Principal Investigator: Bruce Stuart 2009-2012
Sponsor: Novartis Pharmaceuticals
Study design, analytic file construction, statistical analysis, table preparation, descriptive analyses, and manuscript preparation

***The Impact of Part D on Previously Uninsured Medicare Beneficiaries*.**
Principal Investigator: Amy Davidoff 2009-2010
Sponsor: Novartis Pharmaceuticals
Contributed to analytic file construction, statistical analysis, and manuscript preparation.

***Achieving Maximum Value from Prescription Drug Coverage of Medicare Beneficiaries with Chronic Disease*.**
Principal Investigator: Bruce Stuart 2008-2011
Sponsor: Commonwealth Fund.
Contributed to analytic file construction, statistical analysis, and manuscript preparation.

***Medicare Spending, Disparities, and Returns to Healthy Behaviors*.**
Principal Investigator: Bruce Stuart 2008-2010
Sponsor: Robert Wood Johnson Foundation
Analytic file construction, statistical analysis; contributed to analytic decisions and manuscript preparation.

LEADERSHIP AND PROFESSIONAL SERVICE

International Society of Pharmacoeconomics and Outcomes Research (ISPOR)

Chair, Student Network Meeting Planning Committee 2009 – 2011
Organize and manage student events at annual meetings
Interact with leaders and professionals in the organization

President, University of Maryland Student Chapter 2009 – 2011
Coordinate events and invite external seminar speakers
Delegate officer responsibility to encourage chapter activity

University of Maryland School of Pharmacy, Baltimore, MD

Committee Member, Graduate Studies and Research Committee 2010 – 2011
Formulation of policies concerning graduate education and research, and visiting lecturers
Review of graduate education curricula, approval of changes in curricula

Graduate Teaching Assistant*, *Study Design in Epidemiology 2010 – 2011
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Prepare student exams/assignments and maintain student grades

AWARDS

AcademyHealth Student Panel Presentation- 2012
John M. Eisenberg Article-of-the-Year in Health Services Research- 2011
Agency for Healthcare Research and Quality (AHRQ) Dissertation Fellowship- 2011
Arthur Schwartz Annual Memorial Research Award, University of Maryland- 2011
Distinguished Service Award, Student Network Meeting Planning Chair, ISPOR- 2011
Travel Grant Award, ISPOR, 13th Annual European Congress, Prague, Czech Republic- 2010
Distinguished Service Award, Student Network Meeting Planning Chair, ISPOR- 2010
Scholar Award, University of Maryland College Park, Department of Economics - 2006

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American Society of Health Economists
AcademyHealth
International Society of Pharmacoeconomics and Outcomes Research

PUBLICATIONS

Shoemaker JS, Davidoff A, Stuart B, Zuckerman I, Onukwugha E, Powers C "Eligibility and Participation in the Medicare Part D Low Income Subsidy" *Inquiry* (in press).

Erten M, Davidoff A, Stuart B, **Shoemaker JS**, Bryant-Comstock L, Shenolikar R." How Does Drug Treatment for Diabetes Compare between MAPD and PDP Plans?" *Health Services Research* (in press).

Davidoff A, Shaffer T, Erten M, **Shoemaker JS**, Zuckerman I, Pandya N, Stuart B, Bryant-Comstock L, Shenolikar R "Out-of-pocket Healthcare Expenditure Burden for Medicare Beneficiaries with Cancer" *Cancer* (in press).

Davidoff A, Shaffer T, Erten M, **Shoemaker JS**, Zuckerman I, Pandya N, Stuart B, Bryant-Comstock L, Shenolikar R "Use and Spending on Antineoplastic Therapy for Medicare Beneficiaries with Cancer" *Medical Care* (in press).

Stuart B, Yin X, Davidoff A, Simoni-Wastila L, Zuckerman I, Doshi J, **Shoemaker JS**. "Impact of Part D Low Income Subsidies on Medication Patterns for Medicare Beneficiaries with Diabetes" *Medical Care* (in press).

Stuart B, **Shoemaker JS**, Dai M, Davidoff A. "Geographic Variation in Drug Spending and Adherence Patterns for Medicare Beneficiaries with Diabetes". *Health Affairs* (under revise and resubmit).

Shoemaker JS, Davidoff A, Stuart B, Zuckerman I, Onukwugha E, Powers C "Impact of the Medicare Part D Low Income Subsidy on Eligible Part D Enrollees" *Medicare and Medicaid Research Review* (under revise and resubmit).

Lopert R, **Shoemaker JS**, Stuart B, Davidoff A, Shaffer T, Lloyd J. (2012) "Impact of Medication Adherence on Medicare Expenditure Among Beneficiaries with Heart Failure" *Value in Health,* 18(5), 556-563.

Davidoff A, Stuart B, Lopert R, Lloyd J, **Shoemaker JS** (2012) "Simulated Value Based Insurance Design Applied to Statin Use by Medicare Beneficiaries with Diabetes" *Value in Health,* 15(3), 404-411.

Shoemaker JS, Stuart B, Davidoff A, Zacker C (2012) "The Impact of Part D on Previously Uninsured Medicare Beneficiaries with Hypertension" *Journal of Pharmaceutical Health Services Research*, 3(3), 141-148.

Stuart B, Davidoff A, Lopert R, Shaffer T, **Shoemaker JS**, Lloyd J. (2011) "Does Medication Adherence Lower Medicare Spending among Beneficiaries with Diabetes?" *Health Services Research.* 46(10), 1475-6773).

Davidoff A, Stuart B, Shaffer T, **Shoemaker JS**, Kim M, Zacker C (2010) Lessons Learned: Who Didn't Enroll in Medicare Drug Coverage in 2006, and Why? *Health Affairs*, 29(6),1255-63.

Stuart B, Davidoff A, Lloyd J, Shaffer T, **Shoemaker JS**, Kemner J (2010) Does Influenza Vaccination of Older Adult Medicare Beneficiaries Lower Treatment Costs for Acute and Chronic Respiratory Disease? *American Journal of Geriatric Pharmacotherapy*, 8(3), 201-214.

PARTICIPATION IN PROFESSIONAL MEETINGS

ORAL PRESENTATIONS:

Shoemaker JS, Davidoff A, Stuart B, Zuckerman I, Onukwugha E, Powers C. "Impact of the Medicare Part D Low Income Subsidy on Eligible Part D Enrollees" *AcademyHealth Annual Research Meeting*, Orlando, FL, June 2012

Davidoff A, Lopert R, **Shoemaker JS**, Stuart B, Shaffer T, Lloyd J. "Impact of Medication Adherence on Medicare Expenditure among Beneficiaries with Heart Failure *AcademyHealth Annual Research Meeting*, Orlando, FL, June 2012

Stuart B, **Shoemaker JS**, Dai M, Davidoff A. "Geographic Variation in Drug Spending and Adherence Patterns for Medicare Beneficiaries with Diabetes". *AcademyHealth Annual Research Meeting*, Seattle, WA, June 2011

Shaffer T, Davidoff A, **Shoemaker JS**, Simoni-Wastila L, Zuckerman I, Bryant-Comstock L, Shenolikar R, Stuart B. Medicare Part D Growth: Coverage of the Previously Uninsured or Crowd Out from Other Forms of Rx Coverage? *AcademyHealth Annual Research Meeting*, Seattle, WA, June 2011

Shoemaker JS, Stuart B, Davidoff A. "Predicting Enrollment into the Medicare Part D Low Income Subsidy Program Using Enhanced Financial Indicators". *American Society of Health Economists Bicentennial Conference,* Ithaca NY, June 2010

Davidoff A, Lopert R, Stuart B, Shaffer T, Lloyd J, **Shoemaker JS**. "Will Value Based Benefit Design Work for Medicare Beneficiaries with Diabetes?" *American Society of Health Economists Bicentennial Conference,* Ithaca NY, June 2010

Shoemaker JS, Stuart B, Davidoff A. "Estimating Eligibility of the Medicare Part D Low Income Subsidy Program Using Enhanced Financial Indicators". *Gerontological Society of America Annual Scientific Meeting,* Atlanta GA, November 2009

POSTER PRESENTATIONS:

Shoemaker JS, Davidoff A, Stuart B, Zuckerman I, Onukwugha E, Powers C "Eligibility and Participation in the Medicare Part D Low Income Subsidy" *AcademyHealth Annual Research Meeting,* Orlando, FL, June 2012

Shoemaker JS, Erten M, Stuart B, Davidoff A. "How Does Drug Treatment for Diabetes Compare between MAPD and PDP Plans?*". AcademyHealth Annual Research Meeting,* Seattle, WA, June 2011

Erten M, Davidoff A, **Shoemaker JS**, Stuart B. "Can Contextual Measures Compensate for Data Limitations Inherent in the Medicare CCW Data?*". AcademyHealth Annual Research Meeting*, Seattle, WA, June 2011

Shoemaker JS, Stuart B, Dai M, Davidoff A. "Geographic Variation in Drug Spending and Adherence Patterns for Medicare Beneficiaries with Diabetes". *International Society of Pharmacoeconomics and Outcomes Research Annual International Meeting,* Baltimore, MD, May 2011

Shoemaker JS, Lopert R, Stuart B, Davidoff A, Shaffer T, Lloyd J. "Does Persistency in Medication Lower Medicare Spending among Beneficiaries with Heart Failure?*". International Society of Pharmacoeconomics and Outcomes Research European Congress,* Prague, Czech Republic, November 2010

Lloyd J, Davidoff A, Stuart, B, **Shoemaker JS**, Shaffer, T. "Predictors of Any Drug Use, Persistent Use, and Level of Medication Use among Medicare Beneficiaries with Diabetes". *AcademyHealth Annual Research Meeting,* Boston, MA, July 2010

Shoemaker JS, Davidoff A, Stuart B, Zacker C. "Short-Term Impacts of Medicare Part D Enrollment on Health and Activities of Daily Living for Beneficiaries with No Prior Prescription Drug Coverage". *AcademyHealth Annual Research Meeting,* Boston, MA, July 2010

Stuart B, Yin X, **Shoemaker JS**, Davidoff A, Zuckerman I, Simoni-Wastila L. "Timeliness in Initiating Medication Use is Cost Saving for Medicare Beneficiaries with Diabetes". *AcademyHealth Annual Research Meeting*, Boston, MA, July 2010

Stuart B, Davidoff A, Pradel F, Lopert R, Zhao L, Shaffer T, Onukwugha E, Fedder D, Hendrick F, Lloyd J, **Shoemaker JS**. "Persistency in Health Behaviors among Medicare Beneficiaries". *AcademyHealth Annual Research Meeting*, Boston, MA, July 2010

Shoemaker JS, Stuart B, Davidoff A, Zacker C. "The Impact of Part D on Previously Uninsured Medicare Beneficiaries with Hypertension". *Novartis Pharmaceuticals, Inc.*, East Hanover, NJ, July 2009

Shoemaker JS, Davidoff A, Stuart B, Zacker C. "Factors Associated with Participation in Medicare Part D Among Previously Uninsured Beneficiaries". *AcademyHealth Annual Research Meeting*, Chicago, Il, July 2009

Abstract

Title of Dissertation: Topics in Medicare Part D: Eligibility, Participation, and Impacts

Julia Samantha Shoemaker, Doctor of Philosophy, 2012

Dissertation Directed by: Amy Davidoff

Part D expanded Medicare in 2006 by creating a prescription drug benefit offered through private insurance plans. Key features of this benefit include the Low Income Subsidy (LIS), which provides discounts for plan premium and cost sharing for qualifying beneficiaries, and enrollment regulations, which provide economic incentives to encourage enrollment regardless of health status. Enrollment is voluntary among non-Medicaid duals; consequently, enrollment decisions are critical to program efficiency. This study addresses fundamental aspects of participation in Part D to inform policy design related to insurance access and impacts.

Low LIS participation is a major policy concern; however, published estimates of eligibility and take-up are unreliable due to the lack of unified data capturing both dimensions. The objective of Aim 1 was to develop better estimates of whom, among likely eligible beneficiaries, enrolled, and to identify characteristics of non-enrollees. I used an unpublished supplement to the Medicare Current Beneficiary Survey in conjunction with an income imputation procedure, to determine eligibility. Findings suggest that published literature may misrepresent the population unreached by the LIS. In particular, this study brings attention to the high rate of likely LIS eligible beneficiaries obtaining unsubsidized Part D. Aim 2 expanded upon this to estimate the impact of the LIS on drug spending among eligible Part D enrollees using generalized

linear regression models. Results indicated that LIS was associated with $534 greater Part D spending compared to non-LIS enrollees. Greater spending was associated with more drug fills and use of higher cost fills. Aim 3 assessed the efficiency of Part D design in offering incentives for timely enrollment by examining the role of health shocks on late enrollment among non-duals. The study focused on beneficiaries who did not obtain Part D or have other creditable coverage following their initial enrollment opportunity using a 5% sample of the Medicare population. Results indicated that a health shock was associated with a greater likelihood of late Part D enrollment suggesting that policy mechanisms alone were not effective in inducing participation. Most beneficiaries remained without coverage, thus penalizing the initial decision to decline Part D may deter later enrollment.

Topics in Medicare Part D: Eligibility, Participation, and Impacts

by

Julia Samantha Shoemaker

Dissertation submitted to the faculty of the Graduate School

of the University of Maryland, Baltimore in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

2012

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The completion of this dissertation signifies the end of this journey. Because of all of you, I am now ready to take the next step into my future.

Table of Contents

Chapter 1: Introduction

In a major change in Medicare policy, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 established a publicly-subsidized prescription drug benefit under Part D. The goal of this program, fully implemented in 2006, was to fill a critical gap in health care for the elderly and disabled by ensuring affordable access to drug coverage. Prior to the introduction of Part D, approximately 30% of Medicare beneficiaries lacked a drug benefit [1].

Part D generated an exogenous change in the determinants of demand for drug insurance and has been largely successful in expanding drug coverage in the Medicare population. By 2010, the proportion of beneficiaries with drug coverage reached 90%, and almost 10 million beneficiaries, or 40% of Part D enrollees, were receiving financial aid through the newly created Part D Low Income Subsidy (LIS) program[2]. The LIS supplements the Part D benefit by providing discounts in plan premiums and cost-sharing for beneficiaries with limited income and assets. Beneficiaries who are dual-enrolled in other means-tested federal programs are auto-enrolled into Part D plans with the LIS. Other qualifying beneficiaries must actively apply for the subsidy and enroll in Part D.

To date, the literature surrounding Part D focuses on program participation and impacts in its early years. Findings suggest that Part D was associated with significant increases in drug utilization and reductions in out-of-pocket spending [3-18]. Fewer studies have focused on enrollment in the LIS, due to the fact that reliable eligibility and take-up estimates are not available and a majority of LIS recipients were auto-enrolled because of dual-eligibility. However, the few published studies suggest that many

beneficiaries who would benefit from this subsidy are not enrolling [19-22]. Current literature also lacks a longitudinal perspective to consider changes in enrollment decisions.

1. A. Study Motivation

The first few years of the Part D program provide a unique opportunity to study the effects of a new insurance benefit on insurance choices and the impact of those choices on prescription drug utilization. Understanding participation decisions in Part D and the LIS is critical to inform policy regarding program objectives and overall impacts. Evaluating policies implemented under Part D serve as lessons in the design of other public insurance programs. Understanding the implications of economic incentives on individual behavior offers an important perspective for the effectiveness of program design and evaluation.

Since 2006, Part D has been a focal interest for many health services researchers; however, the first year of the program involved significant transitions for patients and insurers. Hence, an understanding of the program over a longer term perspective is needed. Now that several years of Part D data are available to researchers, a more in-depth look at selected issues is possible. An effective examination of this extensive program requires a longitudinal look at enrollment decisions, in addition to a more intensive assessment of its subsidy program, the LIS. This dissertation addresses these issues in focusing on three fundamental issues related to Part D participation decisions and impacts. Specifically, I assess the effectiveness of the program in (1.) enrollment of beneficiaries eligible to receive the LIS, (2.) the impact on drug utilization among LIS

participants, (3.) the subsequent enrollment among beneficiaries who failed to enroll at their first opportunity and the role of health shocks. The study aims are presented in the next section.

1. B. Research Questions and Aims

Research Question 1: Who is eligible for the Part D LIS and what characteristics are associated with take-up among those who are not auto-enrolled?

Aim 1: To use enhanced financial indicators to examine determinants of enrollment in the Part D LIS among eligible beneficiaries who are not auto-enrolled.

Research Question 2: What is the impact of the Part D LIS on prescription drug spending?

Aim 2: To examine the impact of LIS participation on prescription drug spending among LIS eligible Part D enrollees who are not auto-enrolled.

Research Question 3: What is the impact of a health shock on a change in demand for Part D coverage?

Aim 3: To examine the impact of a hospital admission resulting in a diagnosis of a drug-intensive condition on late Part D enrollment among Medicare beneficiaries who declined coverage at the first opportunity to enroll.

The rest of the text is structured as follows. Chapter 2 provides an introduction to the Medicare Part D and the LIS program. Chapter 3 discusses economic theory surrounding insurance demand. Chapter 4 presents a broad review of the literature surrounding insurance selection and Part D enrollment. Chapters 5 to 7 include

manuscripts corresponding to the three study aims. Implications of study findings and new directions in research are presented in Chapter 8.

Chapter 2: Background

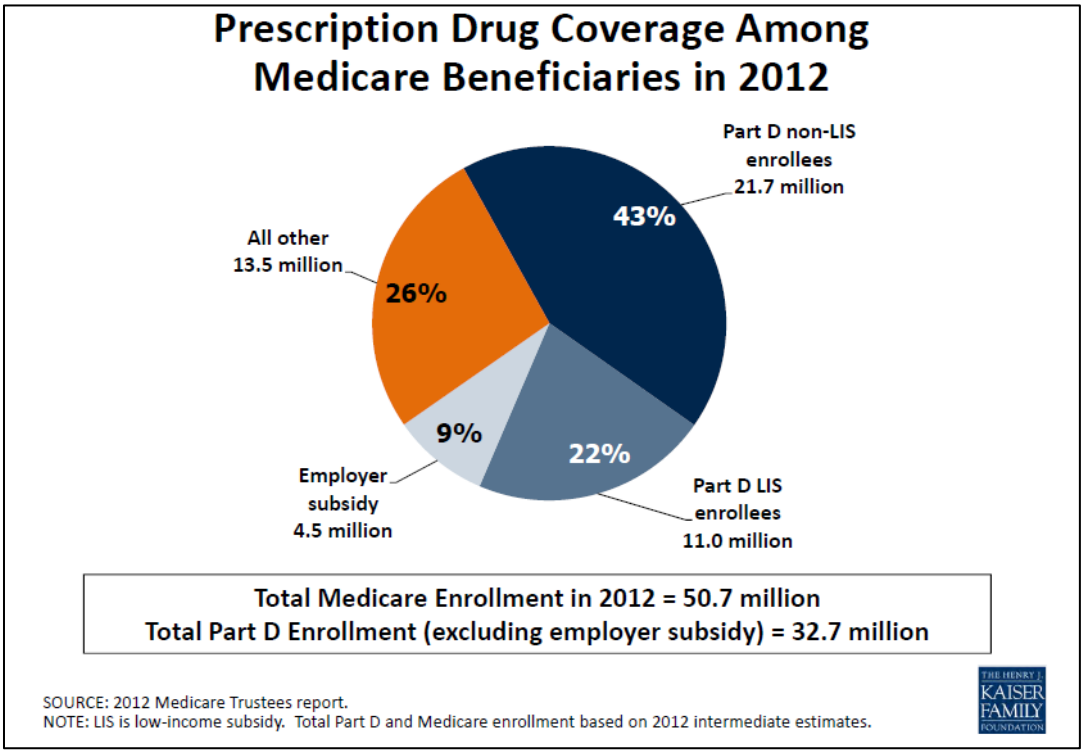
This dissertation examined three topics surrounding eligibility, participation, and impacts of Part D prescription drug insurance. I assessed key elements of the Part D benefit including the LIS and incentives in place to encourage enrollment. Specifically, I evaluated the extent to which the LIS reaches beneficiaries eligible to receive the subsidy and the impact of LIS participation on drug utilization. In addition, I explored patterns in Part D enrollment 2006 to 2008 and determined whether healthy beneficiaries delay enrollment until an unexpected decline in health status. The following sections present background information of the Part D and LIS programs.

2. A. Overview of Medicare Part D and the Low Income Subsidy

Overview of Part D

Drug coverage under Part D is offered through private insurance plans. Part D benefits are available through stand-alone plans (PDPs) or bundled with Medicare Advantage plans (MA-PDs). In 2012, 32.7 million (65%) Medicare beneficiaries were enrolled in a Part D drug plan. Figure 1 below displays the distribution of sources of drug coverage in the Medicare population[23].

Figure 1 Prescription Drug Coverage among Medicare Beneficiaries, 2012



The initial Part D enrollment period, during which all beneficiaries had the first opportunity to enroll, took place from November 15, 2005 to May 15, 2006. Each year beneficiaries are able to newly enroll or change Part D plans during the open enrollment period which, up until 2011, took place each year from November 15 to December 31st for coverage to begin January 1 of the following year[1][24]. In addition, new beneficiaries are able to enroll during the three months before and after their month of Medicare entitlement. If a beneficiary does not enroll in a Part D plan during the enrollment period and does not have another source of creditable drug coverage then a penalty is imposed for the delay in enrollment. This penalty is permanent and takes the form of an added 1% to the plan premium for each month of delayed enrollment[24]. For example, if a

[1] Beginning in 2011, the Part D open enrollment period takes place October 15 to December 7.

beneficiary declined Part D coverage and had no other source of creditable coverage for one year then their penalty would cost them an additional 12% once enrolled[25]. The average monthly PDP plan premium (weighted by enrollment) in 2012 is $37.96[26].

Certain groups are exempt from the restricted enrollment periods and late enrollment penalty. LIS recipients are exempt from both policies [27]. Some non-LIS eligible beneficiaries are granted Special Enrollment Periods (SEP). SEP duration varies by eligibility criteria. Beneficiaries who involuntarily lose drug coverage from another creditable source are granted a 2-month window to enroll in Part D without penalty. Other eligibility criteria include being impacted by particular severe hurricanes, transitioning in or out of a long term care facility (for the duration in the institution and for two months following discharge), loss of Medicaid eligibility, change of residence, and involvement with a State Pharmaceutical Assistance Program (SPAP) or Special Needs Plan (SNP) [27].

Overview of the Low Income Subsidy

A key feature of Part D is the LIS, which provides financial assistance to beneficiaries with low incomes and limited assets. The LIS subsidizes the cost of plan premiums and cost-sharing for eligible beneficiaries. The subsidy is designed with a sliding scale in which beneficiaries with less financial resources receive greater benefits. Some qualifying beneficiaries are required to apply for LIS through the Social Security Administration (SSA) or Medicaid office. Certain populations are “deemed eligible” for the LIS and are automatically enrolled in the subsidy by the Centers for Medicare and Medicaid Services (CMS). Deemed eligible beneficiaries include those who are also

enrolled in Medicaid, a Medicare Savings Program (MSP), or are receiving Supplemental Security Income (SSI)[28].

SSI is a federal program that provides financial assistance to low income individuals who are elderly, disabled, or blind. In most states, SSI recipients are also automatically enrolled in Medicaid which provides health coverage for low income individuals and is jointly funded by the states[29]. Income and asset thresholds for Medicaid and SSI eligibility are lower than that of the LIS. The MSP consists of three programs with varying levels of eligibility and benefits. These include the Qualified Medicare Beneficiary program (QMB), Specified Low Income Medicare Beneficiary program (SLMB), and Qualified Individual program (QI). Medicare beneficiaries who qualify for MSPs receive discounts in Medicare Part A and/or B premiums, deductible, or cost sharing. Eligibility levels for these programs are slightly higher than Medicaid[30].

LIS Eligibility Requirements and Benefits

Beneficiaries may qualify for either the full or partial LIS based on their family income and assets. Family members considered in the financial determinations include the applicant's spouse if living with them, and any other dependents living with them[28, 31]. In 2012, eligibility for the full subsidy requires beneficiaries to have income below 135% of federal poverty level (FPL) and assets below $8,440 for an individual (or $13,410 for a couple). Beneficiaries who qualify for the full subsidy are able to receive prescription medications at no cost in premiums or deductibles, and face copayments between $0 and $7 with no gap in coverage. Dual-eligible beneficiaries are auto-enrolled and receive the full subsidy.

Partial subsidies are also available for beneficiaries with limited, but somewhat higher income below 150% of FPL and assets less than $13,070 for an individual (or $26,120 for a couple). The partial subsidy uses a sliding scale for premiums along with substantial discounts to cover cost sharing and the annual deductible[28, 31]. Eligibility thresholds are updated annually based on the Consumer Price Index[21]. Table 1 below summarizes the 2010 LIS eligibility levels and associated benefits[32].

Table 1 Benefits under the Part D Low Income Subsidy, 2010

Low-Income Subsidy Level	Monthly Premium	Annual Deductible	Copayments
Individuals with Medicare and Medicaid	$0	$0	$1.10-$2.50/generic
			$3.20-$6.30/brand-name; no copayments after total drug spending reaches $6,440
Individuals with Medicare and Medicaid in nursing homes	$0	$0	No copayments
Individuals with income <135% of poverty and resources <$8,100/individual; $12,910/couple	$0	$0	$2.50/generic $6.30/brand-name;
			no copayments after total drug spending reaches $6,440
Individuals with income 135%-150% of poverty and resources <$12,510/individual; $25,010/couple	sliding scale up to $31.94*	$60	15% of total costs up to $6,440; $2.50/generic $6.30/brand-name thereafter

BORROWED FROM: Kaiser Family Foundation Medicare Chartbook, Fourth edition, 2010
NOTES: The 2010 poverty level is $10,800/individual and $14,600/couple. Resources include $1,500/individual and $3,000/couple for funeral or burial expenses. *$31.94 is the national monthly Part D base beneficiary premium for 2010.
SOURCE: Kaiser Family Foundation summary of Medicare drug benefit low-income subsidies in 2010.

LIS Enrollment

In 2010, approximately 40% of all Part D enrollees were receiving the LIS[2]. Over 80% of LIS recipients are enrolled in PDP plans. According to CMS, approximately 12.5 million Medicare beneficiaries are eligible for the LIS[22]. More than half (57%) of those eligible were auto-enrolled. The majority of non-dual beneficiaries who are presumed to qualify for the LIS are not receiving it. Some eligible beneficiaries are thought to be enrolled in Part D without the LIS or other forms of drug coverage[22, 33].

Low participation among eligible individuals is a common concern in welfare programs and encouraging LIS enrollment is of particular policy interest.

Chapter 3: Economic Theory and Related Literature

The theoretical framework used to study demand for health insurance has developed significantly over the past several decades. This work is relevant to the design of, and participation in Medicare Part D. This chapter will provide a brief discussion of the classic framework and newer developments in the economic theory used to explain demand for insurance and how it relates to Part D and the LIS.

3. A. Insurance Demand Theory

Economic theory can be used to explain why individuals purchase health insurance. This chapter discusses central theories used to explain demand for health insurance and the relevance of theory to Part D design and participation. First, I discuss traditional economic theory based on the expected utility framework. Then, alternative theories will be briefly presented followed by relevance in the context of Part D.

Expected utility theory is the classic framework for understanding consumer demand for health insurance. This theory was the basis for a seminal paper by Kenneth Arrow in 1963 which stated that insurance choices are based on the assumptions that individuals are risk averse and chose to maximize their utility. He argues that the social gain from expanding insurance to the uninsured is "overwhelming"[34]. This paper had substantial influence on the 1965 legislation which established Medicare and Medicaid. Many of these assumptions are relevant today in understanding demand for prescription drug coverage under Medicare Part D.

Expected Utility Theory Framework

Expected utility theory is founded on the assumption that individuals derive utility (or satisfaction) from income, or more generally, from wealth. The utility function developed by Von Neumann-Morgenstern provides the basis for this theory. The utility function provides an indirect approach to measure an individual's utility[35]. A fundamental assumption of this theory is that the utility function exhibits diminishing marginal utility of income, or more specifically, that utility increases with income but at a decreasing rate[36]. This is the basis for the key assumption that individuals are averse to risk[34, 37].

The expected utility theory explains the decision to purchase insurance based on the probability distribution and magnitude of future losses. In most insurance markets, insurance is designed to compensate a person for an exogenous loss. In health care, insurance is designed to help pay for goods and services that are intended to bring the person back to a prior state of health. Therefore, loss represents payment for medical care needed to restore health in the case an individual falls ill. At any point in time an individual faces various possible states of health at different probabilities. The decision to purchase insurance, which provides a payoff in case of a loss, depends on the expected utility with and without the insurance. In this model the price of insurance, or premium, is actuarially fair so that it is equal to the expected loss [38].

In a simplified model, the utility function can be used to assume that there are two states of the world, poor health with probability (p) and good health with probability ($1-p$). Poor health is associated with a need for healthcare services costing L to be paid

out of income (W) and, if purchased, insurance compensates for the loss with payoff (I). Under full insurance the compensation is equivalent to the loss ($I = L$). The expected utility (U) is a function of the weighted sum across the two health states[39]. The expected utility when the person is uninsured ($E[U_u]$) is:

$$E[U_u] = pU(W - L) + (1 - p)U(W)$$

The expected utility when insurance is purchased ($E[U_i]$) is:

$$E[U_i] = pU(W - pL - L + I) + (1 - p)U(W - pL)$$

$$= U(W - pL)$$

With insurance, utility and income are certain $E[U_i] = U(W - pL)$. Insurance is purchased for an actuarially fair premium which is equal to the expected loss incurred under poor health (pL). Therefore, under the expected utility theory an individual faces the decision between not purchasing insurance for an uncertain outcome and utility; or purchasing insurance for a premium with a certain outcome and utility. The individual will purchase insurance if the expected utility with insurance is greater than without $E[U_u] < E[U_i]$. Therefore, if the individual does purchase insurance, and thus prefers certainty over uncertainty, then that individual is said to be risk averse[38, 39]. Accordingly, an individual who is risk averse will maximize expected utility by purchasing actuarially fair insurance.

So far, this model exemplifies a scenario under which the insurance premium is actuarially fair. Outside of the simple model, insurance companies impose administrative costs and profits known as "loading fees" to the premium price. Loading fees increase the

premium faced to be higher than the actuarially fair value. However, it is also assumed that there is a maximum additional amount that an individual is willing to pay for insurance, known as the risk premium. The risk premium is a function of the level of aversion to risk and income. Individuals will purchase insurance if the premium faced is valued less than the sum of the actuarially fair amount plus their risk premium[38].

Developments in Insurance Demand Theory

The expected utility theory provides the foundation for other developments in explaining demand for health insurance. Expansions on this theory include the contingent state dependent theory and prospect theory.

Contingent State Dependent Utility Theory

In contingent state dependent utility theory separate utility functions are derived for different states of health. This theory suggests that a change in health changes the perceived value of insurance. This theory centers on the notion that in a state of poor health the demand for an income payoff is more important than certainty or avoidance of risk. Health insurance provides access to healthcare in a state of poor health that might otherwise be unaffordable. Therefore, individuals purchase insurance to obtain access. With insurance, enrollees can transfer income to the state of poor health where the utility of income is higher. However, separate utility functions must be derived for each state of health[40, 41].

Prospect Theory Framework

Expected utility theory assumes that the preference for certain losses is of the same expected magnitude as uncertain ones[42]. In many cases, this does not accurately explain individual behavior and preferences. There is substantial empirical evidence which suggests that uncertain losses may be preferred over the same losses that are certain. This behavior deviates from the classic theory centered on risk aversion and preference for certainty[43]. An alternative explanation is prospect theory [44-47]. Prospect theory states that individuals prefer certainty when gains are at stake, but prefer uncertainty when losses are at stake. In other words, the expected value from an uncertain loss is greater than the value of an actuarially-equivalent smaller certain loss[43].

Other Determinants of Insurance Choice

Theory provides a framework to understand consumer demand for insurance and can be used to identify factors that influence insurance participation. This section discusses various determinants of insurance choice that are founded in theory.

Socio-demographic Factors

Income plays a significant role in insurance demand. Assuming that insurance is a normal good, demand for insurance will increase with increasing income. Insurance is also purchased to protect wealth from losses of a large magnitude.

Other socio-demographic factors are also influential. Gender, marital status, household or family size, age, race/ethnicity, and education may be associated with health status and risk aversion. These factors may also affect assessment of the likelihood

of future potential health states. On the other hand, employment, income, and household structure often are determinants of the options that may be available in health insurance choices.

Risk and Health Preferences

Unobserved factors include risk aversion and preferences for healthcare. Again, aversion to risk and uncertainty in future expenses influence insurance choice. Individuals have different preferences for health and healthcare. Those who place a greater value on health will be more likely to obtain more insurance to cover that healthcare.

Market Supply

Market supply conditions also affect insurance choice. The demand for insurance is a function of the price as reflected in plan premiums and cost-sharing. Theoretically, a greater price to obtain insurance will reduce demand.

Insurance coverage reduces the price of healthcare. The value of insurance is greater when the price of healthcare increases. Similarly, the price of complements and substitutes for healthcare covered by the insurance are factors. For example, demand for prescription drug insurance may be influenced by the availability of free drug samples or price of outpatient or inpatient care.

3. B. Why Health Insurance is Not Purchased

A focus of this dissertation research is populations without prescription drug coverage. In order to examine the impact of a new drug benefit available under Part D it

is important to first understand why individuals may choose not to obtain coverage. Using theoretical foundations, the rest of this section offers explanations for why individuals do not purchase insurance.

Risk Neutral or Risk Seeking

Assuming that insurance is actuarially fair, the decision to purchase depends on the individual's preference for risk and certainty[38]. If an individual is risk averse or the loading fees are less than the risk premium then the individual will purchase insurance. If an individual is risk neutral and there are loading fees incorporated in the premium then they will not purchase insurance. An individual who is risk-seeking will not purchase insurance.

State Probability Assessment

The person's ability to assess the range of possible future health states and assign realistic probabilities to those states is also a factor in insurance purchase. For example, an individual who is presently healthy may underweight the probability of a future illness. Therefore, the perceived probability weighted loss is under-estimated. As a result, there is less incentive to enroll.

Market Failure

Expected utility theory states that, given an actuarially fair premium, insurance is desired depending on the preference for certainty over uncertainty. An individual's risk premium may be less than the loading fees that add to the premium faced. As a result,

there may not be an insurance policy that offers the amount of protection desired at a price below what a consumer is willing to pay and insurance will not be purchased.

Rate of Time Preference

The value that an individual places on their future and future health will affect their insurance decision in the present. An individual who discounts the future, or has a high rate of time preference, will receive greater utility from immediate benefit than waiting for a future benefit. In the case of insurance, this relates to a higher perceived value from not paying an insurance premium compared to the future payoff from insurance to cover a loss from medical care expenditure. Income level may affect an individual's rate of time preference as individuals with less wealth place a higher value on current consumption. This is similar to the concept of myopia in which decisions are made in the present with little consideration for future consequences.

Lack of Income

Insurance protects against loss of income, but theory assumes that there is income to lose. For those with low incomes, the insurance decision is between purchasing insurance in the event of illness or taking a chance on not having access to medical care if ill. Taking the chance is often preferred in that the dollars saved from not having an insurance premium can be used to pay for food, shelter, and goods for themselves or their family.

Insurance benefits would appear to be particularly beneficial for individuals with lower initial income; although it is this population that tends to be less insured[48].

However, unlike individuals with median income levels who purchase insurance out of disposable income, the premium payment reflects that which otherwise would be used to purchase basic necessities[38].

3. C. Part D Late Enrollment Penalty and Enrollment

Design of the Part D program distorts the expected utility associated with purchasing insurance under conventional theory. In the inauguration of Part D, individuals without creditable drug coverage were presented with the opportunity to either enroll or to not. A key element of the program design is a financial penalty for late enrollment.

The penalty is in place to encourage healthy beneficiaries to enroll even if they do not otherwise see an immediate benefit from doing so. If healthy beneficiaries decline Part D and later realize the need to take prescription drugs then they must wait until the following open enrollment period and face a higher premium. This complicates the enrollment decision. Beneficiaries must consider whether paying the premium with no immediate benefit is worth the savings from avoiding a penalty in the future.

Empirical evidence suggests that given the imposition of the financial penalty for late enrollment, the most cost-effective choice for all beneficiaries was to immediately enroll. Atherly and Dowd simulated lifetime out-of-pocket drug expenditures for healthy beneficiaries under two scenarios: one in which they enrolled in Part D if eligible and another in which enrollment was postponed until the beneficiary acquired a drug-intensive condition. They found that total out-of-pocket drug costs were 6.5-10% higher

over a lifetime if beneficiaries delayed enrollment than if they had enrolled immediately upon being eligible[49].

In general, the decision to purchase insurance is a function of the probability of needing that insurance over the course of one year (until the following open enrollment period). The penalty forces a beneficiary to look forward and consider their longer term probability of needing drug coverage. This is because each year that they do not enroll in Part D the premium they would potentially face increases by an additional 12%. The probability of loss is therefore not considered over one year, but must be extended over their lifetime. Consequently, the probability of poor health is higher when assessed long term. In addition, perceived future loss is greater than loss associated with the cost of medical care if uninsured. If a beneficiary transitions into a state of poor health and would benefit from drug insurance, they face a much higher premium upon enrolling.

Given the potential increases in costs, beneficiaries who are risk adverse will perceive a substantially greater benefit in immediate enrollment regardless of current health status. However, those who are not risk averse, highly discount the future, or who lacked the disposable income may still choose not to enroll in Part D. A study conducted by Vetter and colleagues (2012) used 2006 national survey data of Medicare beneficiaries to assess the relationship between risk aversion and the Part D enrollment decision. Risk aversion was measured using hypothetical lottery questions. Findings suggested that beneficiaries determined to be risk tolerant were less likely to enroll in Part D [50].

The Role of Health Shocks

One of the critical assumptions of conventional insurance demand theory is that individuals purchase insurance to protect from the uncertainty of loss due to an exogenously determined negative health event, or a "health shock".

An individual may decide in one period to not purchase insurance; however, a change in their perceived probability of various health states can change how the individual assesses choices in the next period. Additionally, if an individual who previously perceived a low probability of loss later experiences a health shock, then they are likely to reassess the relative probabilities of future health. A health shock will cause the individual to re-weight future loss with a greater probability. Reevaluating expected utility from this new perspective will likely increase the demand for insurance. Similarly, contingent state dependent theory suggests that the individual will demand immediate access to care and insurance coverage after a health shock.

Obtaining insurance is often not possible at the time of health shock. Insurance plans may require that an individual waits to enroll in insurance until the next enrollment period. As a result, events occurring from the time of the health shock to the opportunity to enroll may also influence whether an individual will enroll. It may be that a health shock is quickly resolved and the immediate loss in income due to not being insured is absorbed.

Health Shocks and Late Part D Enrollment

Theory suggests that non-enrollees are not threatened by uncertain risk. They may view themselves as healthy with a very low probability of experiencing a health shock. The Part D premium payment may be greater than the cost of uncertain loss. In other words, the risk premium is less than the plan premium. Even the possibility of facing a greater premium upon late enrollment does not increase the relative perceived benefit of enrollment.

All individuals are susceptible to a future health shock. A beneficiary who did not initially enroll in Part D and experiences a health shock is faced with a new decision. They must decide to enroll in Part D and incur the higher premium or to continue to remain without drug coverage. The experience is likely to have an effect on ones assessment of the likelihood of a future health shock. They may now place a higher weight on future potential loss which effectively increases the expected utility associated with purchasing insurance. Similarly, the experience of a health shock may lower an individual's rate of time preference or raise their maximum willingness to pay for insurance or risk premium.

If they choose to remain without coverage they must then either decide to absorb the full cost of prescription drugs or forgo them. Both options are now more costly to the beneficiary than in the first decision. As a result, the severity of the condition may become relevant. A health shock that is chronic, requires costly drug therapy, or is life threatening increases the perceived benefit of enrollment than the cost and likely lead the

beneficiary to enroll in Part D. A health shock that is transitory, requires cheaper drug therapy, and is not as severe may lessen the relative perceived value of enrollment.

3. D. Insurance Demand and the Insurance Market

In an examination of demand for insurance it is also important to understand the critical role that it plays in the insurance market. This section briefly describes this relationship and relevance to Part D.

Risk Selection

Theory suggests that individuals in poorer health will disproportionately purchase more health insurance and incur greater costs than individuals in good health. Under observable heterogeneity in preferences, markets can price and allocate products efficiently. However, complete information on consumer profiles and health risk is unobserved to insurers. As a result, a central issue affecting insurance markets is systematic selection into insurance plans in which consumers maximize their net benefits by switching or dropping plans based on their expected spending.

The asymmetry of information associated with risk selection into insurance coverage can lead to market inefficiencies, and ultimately cause inequities in prices faced and the type and extent of coverage offered by providers[51, 52]. In the presence of significant risk selection, plans with generous benefits may cover beneficiaries who are disproportionately more costly. Consequently, the plans are forced to raise prices, which, in turn, drive less costly enrollees to drop the plan and enroll into less expensive and less

generous plans. The fallout leads the selected plans to raise prices even more or leave the market and the result is inefficiency in the market and inequitable access to coverage.

The ideal way to avoid this failure in the market would be to price plan premiums and cost sharing based on risk, i.e. charging more to enrollees that are expected to incur greater costs. In this scenario, competitive underwriting would price insurance contracts on their actuarial value and be used to attract sufficient risk profiles under perfect market conditions[53]. In theory, insurance plans and prices are sorted and determined by consumer demand. In other words, products are matched accordingly and optimal resource allocation is achieved.

There are two reasons why the above scenario is unrealistic. First, perfect information is not available and shared between insurance buyers and sellers. As a result, adverse selection is common in health insurance markets in that more costly individuals select into more generous plans. This is evident in individual plans where premiums are higher and coverage is more limited than for employer-based plans where selection is regulated[53]. Second, greater financial risk is generally associated with lower health status and income. From a societal perspective, competition in the private market and systematic pricing can lead to inequities and reduced social welfare. Often public policy will subsidize coverage or create mechanisms to protect against market failure including community rating, guaranteed issue, high risk pools, and reinsurance. The government can play a role in preventing or mitigating selection effects with sufficient information about the characteristics of potential participants and an understanding of the reasons individuals self-select into insurance.

Risk Selection in the Part D Market

Health risk, self- selection, and social equity played significant roles in the formation of Part D policy. Part D included several strategies to reduce risk selection. Payment to insurance plans is determined based on a risk adjustment system to calculate the expected variation in drug spending. This risk adjustment takes into account enrollee demographic and health risk characteristics. Health risk is identified based on a claims-based count of chronic conditions. The calculation also considers age, gender, LIS status, and residential status (facility)[25]. The government subsidy to insurers is based on this risk adjustment, but the enrollee premium is not. The Part D premium is based on the average beneficiary risk. Therefore, low risk beneficiaries receive a lower average subsidy and plans are subsidized for covering high risk enrollees. On the other hand, beneficiaries do face the full difference in cost of selecting a plan more or less generous than the standard. Of course, this risk adjustment does not perfectly predict the variation in expected spending and ignores unobserved factors influencing enrollee spending[25].

Other policies in place to minimize risk selection in Part D are the imposition of a financial penalty for delayed enrollment and restricted enrollment periods. This design encourages enrollment of healthy beneficiaries to offset the cost of more expensive enrollees in order to maintain the solvency of the program. These policies appear to be a mostly effective incentive mechanism in expanding drug coverage to about 90%. An alternative approach is to mandate enrollment, in which non-enrollment is penalized rather than late enrollment. The relative effectiveness of both policies in motivating enrollment is unknown and can be politically controversial[54].

Current literature suggests that there is minimal evidence of adverse selection in the Part D market. Again, insurance selection based on unobserved risk can lead plans to raise prices or leave the market entirely. Now, in current Part D market there remains a relatively broad set of insurance sponsor choices and premiums have remained lower than anticipated while enrollment of healthy beneficiaries is high [25, 53, 55-57]. However, many beneficiaries remain not enrolled, and given the breadth of plans varying by design and premiums, there is more potential for adverse selection within plan types[58]. In fact, since 2006 the variety and levels of plan generosity have decreased over time and the most comprehensive plans are disappearing[18, 53].

3. E. Rationale for Studying Insurance Demand

Understanding non-random insurance selection is critical for two reasons. First, it is necessary to identify the scale and source of market inefficiencies in order to establish mechanisms to correct or prevent them. Second, systematic differences in enrolled and non-enrolled populations affect the ability to make simple causal inferences when studying insurance effects. Endogenous insurance participation confounds the relationship with healthcare utilization, spending and outcomes. Additionally, self-selection in insurance plans affects the financial viability. Adverse selection can lead to increased premiums or dropping of plans which have negative effects on consumer welfare and efficiency.

Chapter 4: Theory and Evidence in Part D Enrollment and Impacts

Part D provides a recent and relevant example to study insurance participation. Theory suggests that individuals will enroll in Part D to maximize expected utility. However, program rules and the LIS complicate participation decisions as suggested by conventional insurance theory. The financial penalty and restricted enrollment periods forced healthy beneficiaries to consider the tradeoff in the savings from premiums not expended and subsequent delays in coverage and financial penalties from enrolling late. Participation in the LIS is available at no cost. As a result, there is no monetary cost to weigh against the benefits of enrollment as suggested in insurance demand theory. On the other hand, the costs are reflected in transaction costs, lack of information, and other barriers to enrollment. Recently published research begins to offer empirical evidence to explore these issues with respect to Part D and the LIS. This chapter describes the literature related to these concepts.

4. A. Part D Participation

Who Enrolled in Part D?

A key question of interest to researchers and policy makers is who enrolled in Part D and why. While many Part D enrollees had coverage before 2006 through private sources, the population of particular policy interest is those beneficiaries who did not. In 2006, almost two-thirds of beneficiaries without prior coverage enrolled in Part D. Several studies suggest that previously uninsured beneficiaries with comparatively higher drug use and spending were more likely to enroll into Part D [20, 53, 59, 60]. Enrollees were more likely to have supplemental medical coverage, a greater number of chronic

conditions, and report prior cost-related non-adherence [19, 53, 56, 60, 61]. In general, beneficiaries appear to have made rational choices related to current health expense in their decisions whether or not to enroll into Part D[53]. However, less rational choices were in made in sorting through the numerous plans available [62-64].

Who Did Not Enroll in Part D?

When open enrollment closed in the May 2006, nearly 5 million beneficiaries remained without drug coverage[19, 24]. Studies suggest that many beneficiaries who declined Part D in 2006 generally reported good health and low demand for prescription drugs [19, 56, 61, 65].

Consistency with Theory

This literature suggests that most beneficiaries without prior coverage who expected to benefit from drug coverage did enroll in Part D. On the other hand, non-enrollees were healthier and thus, likely expected no need for prescription drugs and perceived little benefit from enrolling. Although beneficiaries with a greater aversion to risk may have been more motivated to enroll in Part D to avoid the financial penalty, many did not. This calls into question the effectiveness of the financial penalty design in encouraging healthy beneficiaries to enroll.

4. B. Part D LIS Participation

The LIS offers substantial benefits to low income beneficiaries and there is no monetary cost to participate; however, most eligible beneficiaries that were not auto-enrolled do not participate. Low participation is a concern that is common to most public

insurance programs. This section discusses the literature related to estimation of eligibility and enrollment in public programs and the evidence specific to the LIS.

Public Insurance Program Eligibility and Participation

Both the federal and state governments offer public insurance programs to ensure access to health care and basic necessities for vulnerable populations. Participation in such programs among those who are eligible to participate, also termed "take-up", is generally low and a source of policy concern. Take-up of means-tested entitlement programs, such as Medicaid, MSPs, and SSI, range from one to two-thirds of the eligible elderly population[66]. Specifically, studies suggest that about 13-33% of individuals eligible for MSPs are enrolled and 54-60% for SSI and Medicaid [67-70]. For years researchers have attempted to understand why participation in these programs is low. An understanding of this can help to not only increase participation, but to inform future policy regarding program design and expansions.

Insurance demand theory suggests that an individual will enroll in an insurance program to maximize expected utility. In other words, they will chose to participation if the expected benefit of doing so is greater than the cost. The expected benefit reflects the value of the insurance to the individual. The value of health insurance depends on the value of one's own health and their expected need for access to healthcare. There is, however, no cost to participate. Consequently, it would seem that there would be a clear benefit to enroll for all eligible individuals. Consistently low take-up of these programs suggests that there are other non-cost barriers to participation. Over time a literature has developed that helps to identify these barriers and their role in limiting participation

choices in public programs. The following section describes these constructs with supporting evidence that can be used to help explain enrollment in the LIS in a conceptual framework.

Barriers to Enrollment in Public Insurance Programs

Time and Search Costs

The time spent and effort required to enroll create disincentives to participate. These include the time to learn about the program and how to apply for it. A study by Stuber and colleagues (2004) found that the hassle and length of time associated with applying was associated with 70-80% lower probability of Medicaid take-up[71]. Long lines are also common disincentives to enroll[72, 73]. Efforts to learn about and understand the program and application process is particularly difficult for elderly and vulnerable populations who may not have access to helpful resources such as information technology.

Application Burden and Complexity

The process and forms required to apply for welfare benefits can be complex, cumbersome, and time consuming which creates additional barriers to enrollment. A panel study found that two-thirds of MSP enrollees needed assistance with the enrollment application[74]. Another study found that even many staff members complained that the guidelines for Medicaid enrollment were too complicated and that they were undertrained to aid clients[71]. In an effort to understand low participation in Medicare QMB and SLMB programs a government initiative interviewed low income Medicare beneficiaries.

Respondents cited lengthy enrollment applications and difficult or long eligibility verification requirements discouraged enrollment[75].

The information required to be provided in applications for welfare programs can also be considered intrusive. Disclosure of private financial information makes many people uncomfortable. Additionally, asset qualification in particular is more difficult to determine. The level of assets required to qualify is restrictive, and may lead many to believe that they do not quantify. Simplifying program eligibility requirements and enrollment guidelines would greatly improve access to welfare programs.

Linked Benefits/Automatic Enrollment

Automatic enrollment can significantly improve participation rates as evident by studies related to linked assistance programs. Several studies have found that severing the link between public programs reduces participation. This was evident during Medicaid expansions for children in the mid-1990s which cut the link with a federal cash assistance welfare program[76, 77]. The reform policies were associated with a 20% decline in Medicaid participation[77, 78]. Similarly, studies have found that those who leave welfare programs also appear to leave Food Stamp Programs[79].

Lack of Information

Not being aware of the program is an obvious barrier to enrollment. The dissemination and availability of information about a program is essential in outreach to individuals eligible for a public program. Information promotes awareness and

knowledge of the program without which an eligible individual cannot seek out the program.

A study by Neumann and colleagues (1995) found that awareness of the QMB program was associated with a 20 percentage point increase in participation[80]. A survey of MSP eligible beneficiaries found that insufficient knowledge of the program, benefits, and eligibility criteria was a common problem[75]. Another survey found that 79% of beneficiaries eligible for MSPs but not enrolled had never heard of the program[74].

CMS has waged extensive outreach campaigns to increase awareness of the LIS, although with little success[81]. Prior to the inauguration of the LIS program substantial efforts were aimed at promoting awareness of the subsidy and motivating participation among low income beneficiaries. There were 76,000 events nationwide, informational letters mailed to 18 million potentially eligible beneficiaries and even follow-up calls to 9 million[82]. Despite these efforts to disseminate information, awareness remains low. One study based on the Health and Retirement Study found that 36% of Medicare beneficiaries estimated to be eligible for LIS reported that they did not apply because they did not know about it[59]. Similarly, several small survey-based studies have cited a lack of awareness or confusion surrounding the subsidy and how to apply [61, 83, 84]. On the other hand, a study by Butler and colleagues (2012) found that the likelihood of beneficiaries seeking out information regarding Part D was associated with stating a need for information. It is probable that many beneficiaries did not actively seek out information for the program in misperceiving the value of the benefit [85].

Stigma

"Welfare stigma" is a common barrier to program participation and reflects negative attitudes or shame that society associates with means-tested programs[86]. Stigma is often cited as a reason for low participation in government welfare programs. Sources of stigma stem from perceptions that welfare recipients are lazy, worthless, or weak[71, 87]. Welfare recipients have cited being treated poorly in welfare offices by case managers and receiving negative attitudes which worsen perceptions of stigma[88]. Individuals sometimes associate other assistance programs such as MSPs or the LIS with welfare. Beneficiaries are able to apply for the LIS through either the state Medicaid office or the SSA office[28]. The option for applying outside of welfare offices reduce barriers associated with stigma.

Social Networks

Individuals often find themselves in distinct social networks. These networks may be based on ethnicity, immigration status, or income level and are the basis of cultural or social norms. Cultural norms influence behavior, such as the decision to participate in a welfare program, when an individual does not want to deviate from the norm[89].

Perceived Ineligibility

Another common reason that eligible individuals do not apply is that they believe themselves not to be eligible, when in fact they are. As stated previously, this is often due to the asset test. Many individuals do not understand the included and excluded resources for eligibility and assume that they have too many assets[90]. For example, it is common

for people to believe that they are ineligible due to owning their home even though primary residence is not counted towards eligibility. This has been reported to be the case for many potentially LIS eligible beneficiaries[22, 83]. Another common misperception is that individuals fear that they will lose their estate[91].

Accessibility

Transportation and distance to enrollment offices can be very burdensome for potential enrollees. Some beneficiaries eligible for MSPs but do not enroll are reportedly more likely to be homebound or live in isolated rural areas[92].

Personal Contacts

An individual's personal relationships including friends and family can substantially aid in learning about public programs. A personal contact may be more aware of programs available or have greater access to helpful resources. One's living situation or household composition may proxy for a person's interactions with other people and exposure to news and information. One study found that individuals who live alone are less likely to be familiar with MSPs[91]. Personal contact can also help to directly motivate or facilitate enrollment applications.

Cognitive Ability

Cognitive ability includes the ability to process information and be aware of surroundings. Cognitive impairment exacerbates issues of information, program awareness, and understanding the application requirements and process. Consequently,

lower cognitive ability may have a negative effect on the likelihood of enrollment. This is important in understanding the benefit of participation and the ability to apply for it.

Literacy Problems

Limitations in language, literacy, or vision/hearing problems also are likely to affect knowledge of how to apply for the programs. Many outreach programs are inadequately prepared to potential enrollees with limited English language skills[74, 75].

Who Does Enroll in Public Programs?

Despite the many obstacles in public insurance participation, a portion of those eligible does enroll. Theory would suggest that those who actively seek out and enroll in these programs do so because they perceive a large benefit from enrolling in a full information setting. In other words, they expect to use much of the goods and services that are subsidized and perceive that the potential benefits of enrollment outweigh the non-cost barriers, which drive them to apply.

Consistency with theory is evident in a study conducted using the MCBS which found that enrollment in MSPs is highest among the most vulnerable beneficiaries. Those in poor health, who were disabled, or reported low functional status were more likely to enroll in QMB or SLMB program if eligible[75]. Similarly, Sears and colleagues (2001) found that among Medicare beneficiaries eligible for MSPs, the non-enrollees were less likely to be SSI recipients, disabled, non-white, in poor health, and live alone[93]. In fact, the most common initial reasons beneficiaries cite for enrolling in a MSP is hospitalization or moving to subsidized housing[74].

Few studies have begun to shed some light on the characteristics of the LIS enrolled population. The results of these studies are consistent with the goals of the program in that more vulnerable beneficiaries did appear to enroll in LIS. LIS enrollees tended to be of lower socio-economic status, less educated, of poorer health, and to report financial hardship [20, 61, 94].

Methodology for Estimating Eligibility in Public Programs

There is an extensive literature surrounding the use of household survey data to estimate eligibility and participation in other public or subsidized health insurance programs. Much of this work has focused on estimating child eligibility for Medicaid and State Children's Health Insurance Program (SCHIP) expansions [76, 95-100]. A more limited literature focuses on programs for the elderly, including MSPs, Medicaid, SSI, and more recently, Part D LIS[20, 68, 101-104]. Many of these studies address issues fundamental to the methodology used to measure eligibility and enrollment. These issues include complicated income disregards (i.e. specific categories that are excluded from eligibility determination criteria), income underreporting, lack of asset data, and under-reporting of program participation.

Income and Asset Exclusion Criteria

A challenge in eligibility estimation includes accounting for various exclusions in eligibility criteria. An important note is that most federal means-tested programs base income eligibility on only "countable income" which includes defined sources of income. The same rules to determine income and asset eligibility apply for Medicaid, SSI, and the

LIS (although at different thresholds). Countable income is calculated by the following formula:

$$Countable\ income = (Unearned\ monthly\ income - \$20) + 0.5(Earned\ monthly\ income - \$65)$$

Along the same line, asset criteria for eligibility generally include liquid resources that can be converted into cash within 20 days and real property that is not the primary residence. Most studies attempt to address these issues using simple calculations, but the ability to calculate these measures depends on the availability of data.

Approaches to determining eligibility include algorithms using earned income. To study Medicaid expansions a study by Selden et al. estimated Medicaid eligibility using the 1996 Medical Expenditure Panel Survey data. The authors converted earned income to a net income measure by subtracting a simulated amount of disregarded work-related expense and child care expense. The resulting income amounts were matched to eligibility guidelines for various welfare programs which have eligibility thresholds that closely parallel the Medicaid expansions [69, 70]. Briesacher and colleagues (2010) also applied exclusions using the Health and Retirement Study (HRS) to study LIS take-up[105]. A number of studies have also incorporated algorithms for deductions when determining eligibility for other public programs [76, 106-109].

Underreporting of Income

Underreporting of income is a common problem in survey data [95, 110, 111]. A comprehensive review of literature on survey income shows that specific types of income are most commonly underreported including self-employment, transfers between friends

and family, and government transfers[112]. Underreporting of income yields overestimates of the size of the eligible population and underestimates of take-up.

Most studies make no adjustment to self-reported income or asset data [19, 59, 61, 101, 105, 113-115]. To address this problem, simple aggregate factor adjustments can be used to correct for underreporting survey income data [116]. Instrumental variable techniques are also used to correct measurement error[117].

Lack of Asset Information

Asset information is not commonly available in survey data. An alternative is to calculate asset holdings based on asset income flows or match survey data to SSA records. Moon and colleagues (1998) examined MSP asset eligibility in assuming a 5% return on interest, dividend, and rental income. A major weakness is the crude approach to simulating an estimate for assets based on incomplete data[118]. Another study used 1997 data from the MCBS Income and Assets Supplement to estimate eligibility for QMB and SLMB programs. This single source approach is attractive because the data file contains administrative enrollment information linked to detailed income information. However, a weakness of the MCBS income data is underreporting which is likely to overestimate the population eligible[119].

Certain survey datasets do include asset information such as the Survey of Income and Program Participation (SIPP). To estimate eligibility for MSPs, Rupp and Sears (2000) used SIPP data matched to SSA administrative records. The SIPP contains detailed information to determine major sources of income and assets. Countable income was based on values from SIPP supplemented with monthly SSA data. Using SSA data

improves the ability to match program eligibility definitions by deducting simple exclusion criteria, however use of self-report for other sources of income and assets and lack of valid enrollment records are weaknesses of the study [68].

Unreliable Program Participation Information

Most household survey sources include self-reported information on program enrollment, but lack administrative confirmation. Self-reported participation in means-tested programs tends to be underreported in survey data. This has been the focus of a number of studies relating to Medicaid, SSI, or food stamps [103, 120-124]. Underreporting of enrollment information yields underestimates of program take-up.

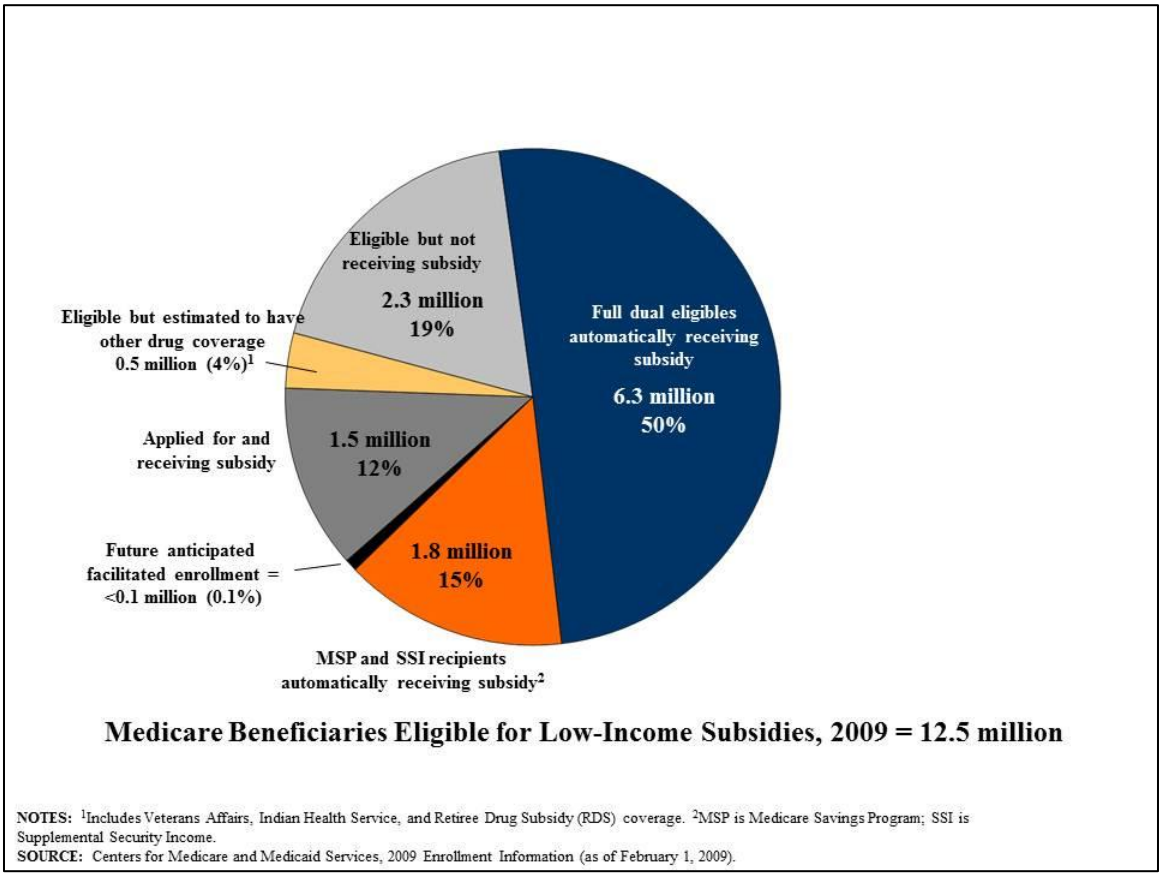
Endogeneity of Program Eligibility

Another problem in examining program take-up is the potential for endogeneity of eligibility. Individuals may adjust their living situation, employment, asset holdings, or sources of financial assistance to ensure program eligibility. Therefore, individuals who need more health services (insurance) are more likely to adjust their situation to satisfy the eligibility criteria. Endogeneity in asset eligibility is most common because it is most easily manipulated. For example, individuals may transfer assets to family members in order to spend down assets to qualify for Medicaid upon entering a facility [99, 125-129]. Cutler and Gruber offer one approach to address this issue. Their study to examine program take-up is to use a two stage instrumental variable model and instrumented for individual Medicaid eligibility using a simulated eligibility based on a national estimated eligibility rate[99].

Prior Estimates of LIS Eligibility and Enrollment

Similar to other financial assistance programs, take-up of LIS among non-auto-enrolled eligible beneficiaries is low. CMS estimates that approximately 27% of the Medicare population is eligible for the LIS. The majority of those eligible were automatically enrolled and only 1.5 million beneficiaries or about 35% of the remaining eligible population applied for and are receiving LIS (see figure 2)[22]. At present, there is uncertainty in the size of the eligible LIS population [2, 19, 21, 59, 130-132].

Figure 2 Eligibility and Participation in Medicare Part D Low Income Subsidies, 2009



NOTES: [1]Includes Veterans Affairs, Indian Health Service, and Retiree Drug Subsidy (RDS) coverage. [2]MSP is Medicare Savings Program; SSI is Supplemental Security Income.
SOURCE: Centers for Medicare and Medicaid Services, 2009 Enrollment Information (as of February 1, 2009).

Published studies offer a wide range of estimates of LIS eligibility and take-up. Estimates of the potentially LIS eligible population range from 21% - 36% of the Medicare population [33, 59, 105, 113, 130-132]. One reason for this uncertainty is that there is no single comprehensive data source available to effectively examine eligibility and enrollment in a Medicare benefit linked to income or assets. An ideal dataset would contain the following criteria and should be considered in evaluating the validity and generalizability of these estimates:

- Generalizable study sample that is representative of the total Medicare population including those who reside in the community and facility, are entitled based on disability and end stage renal disease (ESRD), and are elderly or non-elderly
- Reliable income and asset information to determine eligibility
- Detailed income and asset information to identify and distinguish income and asset eligibility exclusion "disregards"
- Valid enrollment records

The above criteria are not met in a single data source. Most published studies have primarily used either the SIPP or the Current Population Survey (CPS) to estimate eligibility, both of which lack enrollment information. Studies examining LIS take-up have used health survey datasets, that suffer from under-reporting of income and lack asset data altogether [110, 133].

Additionally, eligibility inclusion and exclusion criteria are complicated. Eligibility rules for the LIS follow SSI guidelines. Some exclusions or "disregards" include the first $240 of unearned income, the first $780 and half of remaining earned

income, refunds under an Earned Income Tax Credit, a portion of SSDI benefits for beneficiaries under age 65, SSI benefits, state funded need-based assistance payments, disaster relief, home energy or housing assistance, and certain payments made towards dependents among others. Resource exclusions include certain housing assistance, insurance, burial arrangements and plots, and more[28].

The range in estimates can also be attributed to varying sampling frame which is dependent upon the source of data. The most recent and comprehensive analysis conducted to estimate LIS eligibility utilized HRS survey data and the SIPP[130, 131]. The HRS is a longitudinal household survey that includes income and asset data in disaggregated amounts. Nationally-representative estimates were derived using various samples that are representative of the institutionalized, non-institutionalized, elderly, and non-elderly population in either dataset. Weights were applied to create a grand representative sample. Selective samples were matched to SSA data to reduce measurement error in financial information. Additional datasets included data from LIS application forms, data on SSI and social security benefits, and information that supplies wage data from tax information. These data were matched to the survey data to assess extent of measurement error and improve survey estimates.

The availability of detailed income and asset information in this study permitted closely matching measures with exclusion criteria. Results from that study reported that 12.2 million (29%) Medicare beneficiaries were potentially eligible for LIS in 2006. Almost 35% of those potentially eligible were below age 65 and the eligibility rate among the non-elderly was relatively higher (68% compared to 22%). Similarly, the eligibility rate is higher among the institutionalized compared to the non-institutionalized

(50% v. 29%). The majority (56%) of the total potentially eligible population would probably be automatically enrolled and the balance would be eligible for the partial subsidy [130, 131]. A significant weakness of this study is the lack of information on LIS take-up due to invalid enrollment data.

Another published study by Rice and colleagues (2006) utilized 2001 SIPP data to project estimates of LIS eligibility among the non-institutionalized Medicare population. The authors calculated countable income for each beneficiary by using SSI guidelines and then compared the remaining self-reported income to the FPL standards to determine income eligibility. Other deductions were not possible given data limitations. The SIPP is able to count most liquid assets and resources from rental property, but other disregards were ignored. The study found that 13.97 million (35%) would be eligible based on income alone, but including assets there would be 11.6 million beneficiaries (29.6%) would be LIS eligible. Major weaknesses of this study include the inability to identify LIS enrollment and distinguish between those who would not be auto-enrolled[113].

A different study that used the HRS similarly applied eligibility rules to examine the LIS. Most income disregards were incorporated and a beneficiary's home, value of their car, and burial expenses were excluded. This study found that 21% of elderly beneficiaries were potentially eligible for LIS, 42% of whom were eligible due to dual eligibility. Again, this study did not attempt to enhance the financial measures and ignored underreporting of income, lacked enrollment information, and is not generalizable to the total Medicare population[105].

LIS take-up estimates are available in a few studies with enrollment information but are problematic due to a much lesser focus on accurate eligibility determination. Levy and Weir (2007) also examined LIS take-up and was able to account for some but not all income and asset exclusion criteria. Furthermore, program enrollment in the HRS is based on self-report and is substantially underestimated. This study used nine definitions of LIS take-up to consider various approaches accounting for missing data and enrollment in MA plans or Medicaid. Results show that 30% of beneficiaries are eligible for LIS. The most generalizable estimates of take-up suggest that 29% of those eligible enrolled in LIS[59].

Cubanski and colleagues (2009) conducted a comprehensive analysis of Medicare supplemental and prescription drug insurance for community-dwelling beneficiaries using the 2007 MCBS Access to Care file. Part of this analysis focused on low income beneficiaries that were identified as having incomes approximately below 150% of FPL. The low income classification was defined to roughly correspond to the LIS eligibility criteria. This study classified 13.4 million beneficiaries as low income. Among these beneficiaries, 59% received LIS, of whom 17% were non-duals. About 19% of non-dual beneficiaries received LIS. This study also showed that about 22% of low income beneficiaries had drug coverage from either an employer, self-purchased, or other source. Strengths of this study include the use of administrative enrollment records and the ability to observe other sources of drug coverage. However, a major limitation is the inability to accurately identify LIS eligible beneficiaries, and instead focused only on those defined as low income[33].

In general, CMS estimates of LIS eligibility are the most commonly reported. However, the methods for generating these estimates has not been reported and the estimates have changed little since 2006[21, 22]. Few studies have focused on participation among eligible beneficiaries who are not auto-enrolled. These estimates range from 10-30% [2, 22, 59, 134, 135]. Overall, weaknesses of existing research methods include the use of non-validated enrollment information, non-representative samples, and unreliable eligibility measures. Still, there is no single comprehensive data source available to effectively examine eligibility and enrollment in a Medicare benefit linked to income or assets. Although estimated low-take up rates compare reasoonably to other subsidy or welfare programs, the true reach of LIS remains unknown[136]. More discouraging is the inability to quantify or target eligible beneficiaries who are not enrolled and would likely benefit from the subsidy. Table 2 summarizes the estimates of LIS eligibility and enrollment in the studies described above.

Table 2 Summary of Part D Low Income Subsidy Eligibility and Enrollment Literature

Study Data and Methods					All Beneficiaries			
					Estimated Eligible		Enrolled Among Estimated Eligible	
Study	Study Source	Administrative Enrollment Data Source	Population Studied	Asset Data	N (millions)	%	N (millions)	%
CBO (2004)	SIPP	CMS	Representative		14.2	35.5		-
McClellan (2006)	SIPP, CPS	CMS	Representative		13.2	30.0	8.9	68.0
CMS (2008, 2009)	SIPP, CPS	CMS	Representative		12.5	28.0	9.6	76.8
Rice and Desmond (2005, 2006)	SIPP		Community-dwelling	Yes	11.6	29.6	-	-
Meijer (2010)	SIPP, HRS	SSR, MEF	Representative	Yes	12.2	29.1	-	-
Meijer (2010)	SIPP, HRS	SSR, MEF	65+		7.9	22.4	-	-
Cubanski (2009)*	MCBS	CMS	Community-dwelling	No	13.4	32.8	7.9	59
Briesacher (2010)	HRS	None			-	21.0		-
Levy (2007)	HRS	None	65+	Yes	-	30.4	-	29

SIPP= Survey of Income and Program Participation, CPS= Current Population Survey, HRS= Health and Retirement Study, SSR=Supplemental Security Record, MEF=Master Earnings File

*Study classified beneficiaries as "low income" based on income cutoff values defined to roughly correspond to the LIS eligibility criteria.

4. C. Impact of Part D and LIS Participation on Drug Utilization

A thorough evaluation of Part D and the LIS requires an understanding of the program's impacts on drug use and spending as well as participation. This section reviews the theory and evidence of the impact of drug insurance and examples in Part D.

Demand for Health Care and Prescription Drugs

Demand theory suggests that a reduction in price will lead to an increase in quantity demanded. Any discussion of demand for healthcare generally begins with the RAND Health Insurance Experiment (HIE). The RAND HIE was the most expensive social experiment in U.S. history which randomized consumers to various insurance plans that differed by price or cost sharing. Findings from this study provided empirical estimates of price responsiveness to health care. Consistent with theory, study analysts concluded that all types of healthcare use decreased with cost sharing. For example, individuals with a 25% and 95% coinsurance spent 20% and 30% less overall than those with zero cost sharing, respectively. For the case of outpatient prescription drugs, it was found that plans offering free care experienced substantially higher use and spending than those with cost sharing. Additionally, the impact of drug coverage was significant for low income people only[137].

The effect of drug coverage and cost sharing has been estimated in various observational studies since the RAND HIE. Mark Pauly (2004) conducted a comprehensive review of this literature and concluded that the price elasticity of demand for prescription drugs is 0.3 to 0.4 for the elderly Medicare population[138]. This means

that a 10% reduction in out-of-pocket price is associated with a 3-4% rise in drug spending. These findings were consistent with that of the RAND HIE.

Effect of Part D and the LIS

Evidence of price responsiveness suggests that obtaining drug coverage under Part D would have a substantial effect on drug utilization and spending. Beneficiaries who previously did not have drug coverage realized a nontrivial reduction in out-of-pocket price. The standard Part D plan subsidizes 75% of the cost of prescription drugs. This reduction in price is likely to lead to significant increases in drug use among newly insured beneficiaries.

In the five years since the introduction of Medicare Part D there have been various studies examining Part D enrollment and impacts on the use of and spending on drugs. To date, most studies in Part D have used difference-in-difference pre-post comparison or interrupted time series analysis study designs to examine impacts. Studies estimate the average effect of Part D enrollment over all beneficiaries but vary by sampling frame, data source, and methods. Overall, early findings suggest that Part D was associated with an average increase in drug utilization within a range of 6-13% and a decrease in out-of-pocket spending in the range of 13-18% [3-11, 13].

Dual-eligibles who were automatically enrolled in the LIS saw no change in out-of-pocket price. Shrank and colleagues (2008) studied the transition from Medicaid to LIS coverage among this cohort and, as expected, observed no change in drug use[12].

More pronounced effects on drug use would be expected among non-dual-eligibles who receive the LIS. In particular, LIS enrollees who previously did not have drug coverage realized near 100% reductions in prices faced. However, there is no single study examining the impact of LIS enrollment on drug utilization among eligible beneficiaries who are not auto-enrolled. It is this cohort for whom the greatest discount occurred and would expect the greatest effect.

Empirical Estimation

A major challenge in examining the impact of price or drug insurance on drug utilization or spending is potential confounding due to unobserved selection into insurance. To understand this challenge in causal estimation, first consider the classic counterfactual framework in which there are two potential outcomes for each individual depending on whether the individual receives treatment or not. The causal effect of treatment is the difference in outcomes under both scenarios. The central problem in causal interpretation is that it is not possible to observe both outcomes for a single individual simultaneously leaving potential for endogeneity to affect the estimated causal effect.

Endogeneity of LIS participation in a model of drug spending is a result of unobserved factors jointly affecting the participation decision and drug spending. Many factors considered by individuals in the insurance participation decision are often not included in observational data, such as preferences for health care or severity of illness, and would also be associated with drug utilization under the insurance plan. Consequentially, the distribution of unobservable beneficiary characteristics differs

systematically by insurance choice and the factors influencing this decision process may also influence drug utilization. In this scenario, in which demand for drug coverage is correlated with the demand for prescription drugs, selection bias distorts estimates of demand response. If unaddressed, this would result in an upward bias of the estimated effect of enrollment on drug use. Therefore, researchers generally use natural experiments to estimate average effects for subgroups of treated and non-treated individuals.

4. D. Study Objectives

This study expand upon this literature to focus on three new topic areas which provide distinct perspectives related to selection into Medicare Part D coverage. The first two aims of this study use a pooled cross-sectional cohort study design to examine selection into and the impact of the Part D LIS for a nationally-representative sample of Medicare beneficiaries in 2006 and 2007. Aim 1 identifies factors influencing take-up of the Part D LIS among eligible beneficiaries who were not automatically enrolled. Aim 2 estimates the impact of LIS enrollment on drug spending among Part D enrollees who are presumably eligible for the LIS. The final aim of this study examines the role of acquiring a drug-intensive chronic condition on late Part D enrollment among beneficiaries who previously declined Part D. The following three chapters contain stand-alone manuscripts for each aim, consisting of relevant background literature, description of analytic strategy, results, and discussion.

Chapter 5: Examining Take-up of the Part D LIS

This consists of the manuscript that explains the background, approach, and results in answering research question 1: who is eligible for the Part D LIS and what characteristics are associated with take-up among those eligible who are not auto-enrolled?

Background

The Medicare Prescription Drug Improvement and Modernization Act of 2003 established a voluntary outpatient prescription drug benefit available to all beneficiaries under Part D. Since implementation, Part D has been largely successful in expanding drug coverage in the Medicare population. By 2010, the proportion of beneficiaries with drug coverage reached 90%, and almost 10 million beneficiaries, or 40% of Part D enrollees, were receiving financial aid through the Part D Low Income Subsidy (LIS) [2]. This subsidy program provides a substantial benefit to low income individuals in that enrollees without previous drug coverage realized about a 95% reduction in out-of-pocket prices. However, it is widely acknowledged that many LIS eligible beneficiaries are not enrolled, which is a common problem in welfare programs [19-21]. Persistently low take-up of LIS is a more recent concern of policymakers with little assurance of improvement in sight due, in part, to the lack of clear or reliable evidence surrounding eligibility and enrollment in the program.

The LIS subsidizes plan premiums and cost-sharing for eligible beneficiaries. Beneficiaries qualify for the LIS based on their income and assets [28]. In 2011, LIS eligibility required beneficiaries to have income below 150% of federal poverty level

(FPL) and assets below $12,640 for an individual (or $25,260 for a couple) [139][2]. Certain populations are "deemed eligible" and automatically enrolled by the Centers for Medicare and Medicaid Services (CMS). Deemed eligible beneficiaries include those who are dually enrolled in Medicaid, a Medicare Savings Program (MSP), or are receiving Social Security Insurance (SSI)[28]. Other qualifying beneficiaries are required to apply for the LIS through the Social Security Administration (SSA) or state Medicaid office.

According to CMS, 27% of the Medicare population is eligible for the LIS, of which 65% are auto-enrolled in the subsidy [22]. Based on this estimate, only 35% of the remaining 4.3 million eligible beneficiaries that are not auto-enrolled applied for and are receiving the LIS[3] [22]. Other studies also suggest that many beneficiaries who would benefit from this subsidy are not enrolling [19-21]. Low participation is a common problem in means-tested entitlement benefits and has been studied extensively in other programs such as Medicaid, Medicare Savings Programs, and Supplemental Security Income [22, 67-70, 140]. At present, there is little evidence available surrounding the LIS to elucidate this issue.

Conceptual Framework

Theory suggests that individuals will enroll in an insurance program if the expected benefit, as reflected in the value of healthcare received and the value of reduced

[2] Beneficiaries may qualify for either the full or partial LIS. In 2011, LIS eligibility for the full subsidy required beneficiaries to have income below 135% of federal poverty level (FPL) and assets below $8,180 for an individual (or $13,020 for a couple). Partial subsidies are also available for beneficiaries with income below 150% of FPL and assets less than $12,640 for an individual (or $25,260 for a couple).
[3] These CMS estimates are the most commonly reported. However, the methods for generating these estimates have not been published and the estimates have changed little since 2006.

uncertainty, is greater than the cost of participation. There is no explicit cost to LIS participation, yet there are substantial monetary benefits in reduced Part D premium subsidies and cost sharing relative to enrollment in a Part D plan without the LIS or a situation with no coverage. LIS recipients are eligible to enroll in Part D plans with no premium cost, compared to an average monthly premium of $39.40 in 2012 [141]. Relative to foregoing coverage entirely, Part D enrollees face reduced costs of prescription medication, as the benefit is subsidized by approximately 74%. Cost sharing is reduced further for those receiving the LIS. In 2012, maximum copays for LIS recipients are $2.65 for generics and $6.60 for brand name products, compared to median copays for non-recipients of $7 for generics and between $23 to $95 for non-preferred brand-name products [26, 142]. Given this scenario, there is a clear net benefit for eligible beneficiaries to participate in the LIS. Consistently low take-up of this and other publicly subsidized programs suggests that there are unobserved costs or other barriers to participation. Such obstacles may include lack of information about the program, application burden and complexity, time and search costs, cognitive ability, lack of social support, or stigma associated with welfare programs.

Eligibility and Take-up of the LIS

A better understanding of enrollment decisions can help to not only increase LIS participation, but to inform future policy regarding program design and expansions. There are two elements necessary to evaluate enrollment decisions in a subsidy program: (1) accurate estimates of the eligible and enrolled populations and (2) individual-level data on characteristics of the eligible and enrolled populations.

To date, researchers have examined LIS participation without reliable measures of eligibility or have estimated LIS eligibility without information on program participation. Estimates of the potentially LIS eligible range from 21% - 36% of the Medicare population [95, 105, 113, 130, 132]. Most published studies have used datasets sponsored by the Census Bureau to estimate eligibility, which lack administrative enrollment information. The most recent and comprehensive analysis to estimate LIS eligibility was conducted under contract with the SSA by Meijer and colleagues [130, 131]. This study used data from the Health and Retirement Study and Survey of Income and Program Participation matched to SSA data consisting of information from LIS application forms, SSI and social security benefits, and tax information. The availability of detailed income and asset information in this study made it possible to reduce measurement error surrounding LIS eligibility. However, this analysis did not incorporate LIS enrollment data to assess enrollment rates and associated characteristics among LIS eligible beneficiaries.

On the other hand, studies focused on LIS enrollment have used health survey datasets which are useful in identifying individual characteristics but suffer from under-reporting of income and generally lack asset data [110, 133]. As a result, estimated proportions of LIS eligibility are likely overestimated while enrollment may be underestimated using these data. Estimated enrollment ranges from 59% to 78% of those eligible [2, 19, 33, 59, 134].

Another weakness of available research is the failure to account for other potential sources of drug coverage that LIS eligible beneficiaries may be enrolled in, often due to the lack of this information in most data sources. Ignoring non-LIS drug coverage of LIS

eligible beneficiaries misrepresents the situation of those not participating in the subsidy. The Medicare Current Beneficiary Survey (MCBS) is a useful dataset for this purpose in that it solicits information on about all possible sources of supplemental insurance coverage. Using the MCBS, Cubanski and colleagues (2009) found that 22% of community-dwelling beneficiaries with income below 150% of FPL were enrolled in some form of non-Part D private drug coverage in 2007[33]. However, a major limitation of this analysis was the inability to accurately identify beneficiaries eligible for the LIS due to unreliable income measures and lack of asset data.

Study Goals

The goal of this study was to examine LIS take-up using the MCBS. The MCBS contains administrative enrollment records but underreporting of income and lack of asset information inhibit the ability to determine eligibility[133]. To address the weaknesses in financial data, we utilized unpublished supplemental MCBS files that report on income and assets. We also imputed income based on data from the Annual Social and Economic Supplement to the Current Population Survey (CPS-ASEC). Finally, we examined beneficiary characteristics associated with participation in LIS among LIS eligible beneficiaries accounting for other potential sources of drug coverage for LIS non-recipients. Findings from this study provide a better understanding of participation in the LIS and can be used to more effectively target unreached beneficiaries.

Methods

Data

The primary data source was the 2005-2007 Access to Care files of the MCBS. The MCBS is an annual survey of a nationally-representative sample of the Medicare population. Each year approximately 4,000 beneficiaries are enrolled in the MCBS and then followed for up to three additional years. The dataset contains self-reported information on the use of and access to health care services, sources of payment, health status, health insurance, functional limitations, and socioeconomic characteristics. The MCBS contains administrative Part D, Medicaid, MSP, and LIS plan enrollment and claims data to supplement survey information.

We used two additional data sources to introduce asset values for all beneficiaries and adjust for potential biases resulting from income measurement error among married beneficiaries: the MCBS Income and Assets Supplement (I&A) and the Annual Social and Economic Supplement to the Current Population Survey (CPS-ASEC)[4].

The MCBS I&A Supplement file is based on interviews conducted during the spring round of the survey to solicit detailed responses regarding beneficiary financial information from the prior calendar year. Thus, the 2006-2007 I&A Supplement provided financial information that covered the 2005-2006 time period. Initially, respondents are asked whether or not they have income or assets from a variety of sources[5]. Beneficiaries are then asked, "Taking these income sources into account, please

[4] The MCBS I&A file was obtained with special permission from CMS.
[5] Respondents are asked whether or not they have income or assets from the following sources: employment, pensions, Social Security benefits, Supplemental Security Income, banking/investment, or other. Another set of questions probe respondents about sources of asset holdings. These sources include

estimate you and your husband's/wife's income for the previous year"[143]. This total amount is included in the Cost and Use MCBS file of that year. Beneficiaries provide an estimate for the total value of their assets excluding their primary residence.

The CPS is a monthly survey conducted by the U.S. Census Bureau for the Bureau of Labor Statistics. The CPS samples approximately 50,000 households of the non-institutionalized U.S. population to provide a source to characterize the national labor force[144]. The ASEC supplement includes detailed questions about income, assets, financial sources and work experience in addition to labor supply information. There are over 20 questions in the CPS-ASEC soliciting information on income sources and the dollar amounts from each source which are totaled to obtain a complete measure of income. Like the MCBS I&A supplement, CPS-ASEC data also reflects income and asset information from the preceding year.

According to the U.S. Census Bureau, the CPS-ASEC is the preferred and most accurate source to provide cross-sectional national estimates of income and poverty[145]. CPS-ASEC data also contain information on health status and demographic characteristics. This survey is subject to non-response and measurement error, but is considered more accurate than the MCBS[146]. The CPS-ASEC is a useful standard in income measurement and its validity suggests potential in supplementing income data in the MCBS. We used the Medicare subsample of the 2006 CPS-ASEC to represent income reported for the year before potential LIS enrollment.

IRA or 401k accounts, interest earning checking or savings accounts, stocks, bonds and mutual funds, life insurance policies, as well as resident and vehicle property.

LIS eligibility requirements involve income and asset tests, so measures along both dimensions are essential to obtain a complete picture of LIS eligibility. The traditional MCBS datasets are limited in both of these ways. The MCBS reports only a single estimate of total income for the respondent (and spouse if married) and contains no asset information[6]. Published comparisons to the CPS show that the MCBS Cost and Use files underestimate family income by about 20% and household income by 40% [133, 144][7]. To assess the reliability of self-reported income in the MCBS we compared the distribution of reported income to that of the CPS-ASEC. Benchmark comparisons by marital status and sex showed discordance between the datasets. In particular, mean reported income among married beneficiaries was almost $10,000 lower in the MCBS relative to the CPS-ASEC estimates with a greater discrepancy observed among married female respondents.

Study Sample

The first phase of this study was to enhance financial measures in the MCBS in order to more reliably identify LIS eligible beneficiaries for a community-based sample of the Medicare population. Given the substantial underreporting of income for married beneficiaries, we imputed income values for this group using regression analysis based on the CPS-ASEC. This approach required that study samples in both the CPS-ASEC and MCBS be similar. Therefore, the samples in both datasets consisted of Medicare beneficiaries residing in the community at baseline (CPS-ASEC: N=15,672; MCBS: N=13,157). We identified the Medicare cohort in the CPS-ASEC based on self-reported

[6] The MCBS Access to Care file is even more limited in that income is presented in ranges only.
[7] In addition, nearly one-third of all MCBS respondents do not report an income amount. A hot deck imputation procedure assigns income values to non-respondents adopted from donors with similar characteristics within the MCBS. Hence, the imputed values are subject to under-reporting as well.

enrollment, age, and reasons of SSI receipt. It was necessary to exclude beneficiaries in long term care facilities because this population is not represented in the CPS-ASEC. We constructed the MCBS sample by pooling two two-year panels from the 2005 to 2006 and 2006 to 2007[8].

In the second phase we focused our analyses on evaluating LIS eligibility and enrollment in the MCBS. We identified LIS eligible cohorts using three approaches based on (1) native MCBS income, (2) imputed income, and (3) imputed income and I&A asset values. Next, we restricted the study sample to potentially eligible beneficiaries based only on our enhanced financial measures in order to examine LIS take-up among potentially eligible beneficiaries. Here, we excluded beneficiaries who were dual-eligible at baseline as they did not face the decision to enroll. However, we did allow for beneficiaries to become dual-eligible in the next year. We also excluded beneficiaries enrolled in non-Part D drug plans in the follow-up year as the vast majority was previously enrolled in retiree or other creditable plans which they would be unlikely to transition from into Part D. This final analytic sample consisted of 1,293 LIS eligible beneficiaries.

Key Measures

Eligibility

We determined LIS eligibility based on CMS criteria of income and asset holdings by marital status. Gross income of the individual or that of his or her spouse (if residing together) was compared to the FPL. Income eligibility was defined as income

[8] Approximately 70% of this sample was from the first panel (2005-2006) and the remaining 30% from the second panel (2006-2007).

below 150% of FPL[9]. In 2006, the LIS asset eligibility threshold was defined at $11,500 if single and $23,000 if married ($11,710 and $23,410 respectively in 2007)[21][10]. For this study, eligibility was determined based on total asset amounts reported in the MCBS I&A module.

Enrollment

Enrollment in Part D, the LIS, Medicaid, and Medicare Savings Programs was identified using CMS administrative records included in the Access to Care MCBS survey for 2006 and 2007. Upon receipt of an application for LIS, the SSA verifies income and asset information by matching it with existing SSA, Internal Revenue Service, and other governmental records [28]. This validation assures that LIS enrolled beneficiaries meet the eligibility criteria. The presence of drug coverage from other sources was determined based on self-reports. Other non-Part D coverage includes employer-sponsored, privately purchased, and other public benefits.

Statistical Analysis

Phase 1. LIS Eligibility Estimation

We imputed income for married beneficiaries with generalized linear regression models model with a log-link and gamma distribution to characterize the variance[11]. We

[9] LIS eligibility guidelines specify financial inclusion and exclusion criteria; however, due to availability of data, not all additional criteria were incorporated. Certain income disregards were applied, including the first $240 of unearned income, the first $780 and half of remaining earned income (if applicable).

[10] Countable asset holdings included liquid resources such as cash, stocks, bonds, financial saving or checking accounts, individual retirement accounts, and property values other than primary residence. Elements excluded for the asset criteria were non-liquid assets such as a beneficiary's primary residence, automobiles, personal possessions, whole life insurance policy valued under $1,500, or $1,500 intended for burial arrangements. We deducted $1,000 from assets for car owners and $1,500 in the assumption that all beneficiaries intended to save for burial arrangements.

[11] We did not impute assets for 2 reasons. First, our goal was to improve upon the LIS eligibility criteria measure that is conventionally used in the MCBS (i.e. income). Only income data is available in the

document the imputation procedure in detail in Appendix 1.The imputed income values for married beneficiaries and native values for single beneficiaries were then used in conjunction with asset values from the I&A file to determine whether beneficiaries met the criteria to qualify for the LIS. We evaluated the native and enhanced financial measures in estimating LIS eligibility under three distinct approaches. Approach 1 identified eligible beneficiaries based on financial information available in the published MCBS files. This approach used only native income values and lacked any asset information. Approach 2 utilized only imputed income values in place of the native values. Approach 3 used imputed income values in addition to asset totals from the I&A Supplement. We calculated LIS eligibility rates following each approach[12]. Approach 3 is used in the main analysis of LIS take-up.

Phase 2. LIS Take-up Estimation

Next, we examined participation in LIS by auto-enrollment, LIS by voluntary enrollment, Part D without the LIS, other coverage, or none at all among LIS eligible beneficiaries.

Phase 3. LIS Take-up Analysis

To further examine Part D LIS enrollment decisions we focused the next analysis phase on beneficiaries who were determined to be eligible using our enhanced financial measures (Approach 3). As previously stated, we excluded beneficiaries who were dual-

traditionally published MCBS files. We introduced asset data that is otherwise not available. Second, the required measures to impute assets using a regression procedure are not available in the CPS.

[12] Our strategy to assess error in each approach relied on the rate of enrollment in LIS among those not identified as eligible. This was done by identifying the proportion of beneficiaries estimated to be ineligible who were in fact enrolled in LIS according to administrative records. The rates of "false negative" eligibility were determined using all three approaches. Eligibility and error rates were assessed for the total and non-dual samples, and stratified by marital status

eligibles at baseline and those who enrolled in a non-Part D plan in the follow-up year because their choice set (including retiree health or other creditable coverage) was much broader than the norm for this population, and these options likely dominated Part D enrollment. Therefore, we distinguished between participation in three possible states of drug coverage available to LIS eligible beneficiaries: (1) Part D with the LIS, (2) Part D without the LIS, or (3) no drug coverage. Bivariate analyses and multivariable multinomial logistic regression were used to examine selection into one of the three drug coverage options. A major assumption of the multinomial logistic method is independence of irrelevant alternatives (IIA). The IIA assumption states that preference for one outcome is not affected by the presence of other choices. We verified that the assumption was met and that it was therefore appropriate to exclude beneficiaries enrolled in non-Part D plans [147]. A more detailed description of the methods to examine LIS take-up is presented in Appendix 3.

Independent variables in the multinomial logistic model included various factors that are expected to be associated with enrollment in drug coverage based on economic theory and prior studies. These consisted of demographic factors including sex, age, marital status, race, education, income, geographic region, and urbanicity. Administrative records were used to indicate current and former SSI receipt. Sources of supplemental medical insurance and the presence of non-Part D prescription drug insurance were also included. Survey responses of perceived cost-related non-adherence, number of self-reported chronic conditions, cognitive impairment, household composition, and if the beneficiary received help with health care decisions were also included. The lowest available stand-alone Part D plan premium in the state of residence and the presence of a

federally qualified health care institution in the county of residence were also included as they capture the price of non-LIS Part D and going without coverage, respectively [148]. A year dummy was added to control for time-varying factors. All beneficiary characteristics were measured at baseline.

All analyses were conducted with adjustments for the complex survey design and were performed using STATA 11 or SAS 9.2. The study protocol was approved by the University of Maryland Baltimore Institutional Review Board.

Results

Phase 1. LIS Eligibility Estimation

We compared estimates of mean income for native and imputed values in the MCBS stratified by marital status and sex to that of the CPS-ASEC. Overall, imputation reduced the relative difference in mean income among married individuals from -18% to -12% (Table 3). Descriptive characteristics of the sample populations in both datasets are presented in Appendix 1[13].

[13] Differences between the CPS-ASEC and MCBS are reflected in the differences in demographic characteristics. A sensitivity analysis was conducted to assess the effect of excluding variables that are poorly matched in the MCBS and CPS-ASEC in the income prediction model. This analysis gave similar results to those presented.

Table 3 Mean Income among Medicare Beneficiaries in the CPS-ASEC and MCBS, by Marital Status and Sex

		MCBS			
Sample	**CPS-ASEC**	**Native Income**	**Relative Difference**	**Imputed Income**	**Relative Difference**
Single	21,823	22,178	2%	-	-
Male Respondent	28,090	27,578	-2%	-	-
Female Respondent	19,136	19,784	3%	-	-
Married	52,563	42,855	-18%	46,210	-12%
Male Respondent	53,481	45,479	-15%	48,870	-9%
Female Respondent	50,277	39,479	-21%	42,787	-15%

Source: 2006 Current Population Survey Annual Social and Economic Supplement and 2005-7 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the community-based Medicare population; imputed income is based on methods used in study phase 1

Phase 2. LIS Take-up Estimation

Table 4 presents the proportion of beneficiaries who are estimated to be LIS eligible and the proportion enrolled among those identified as ineligible (error rate). In every case, LIS eligibility rates decreased with the substitution of imputed for native values and with the incorporation of asset information. In the total sample (N=13,157), the proportion of eligible beneficiaries was 31.8% using native MCBS income under Approach 1. Substituting native income for imputed values under Approach 2 resulted in a lower estimated eligibility rate of 29.8%. Approach 3, which incorporates asset data with imputed income, further reduced the eligibility rate to 25.3%. When restricting the sample to non-dual Medicaid or MSP recipients (N=10,632), the proportion of beneficiaries estimated to be eligible for LIS was 20.8%, 18.5%, and 13.7% under Approaches 1-3, respectively.

Across all approaches, the rates of LIS eligibility were consistently higher among single beneficiaries compared to married beneficiaries. Among married beneficiaries, imputing income resulted in substantially lower eligibility rates relative to using native income values (16.4% to 10.5% among the total sample and 12.1% to 6.1% among the non-dual sample). Income imputation (Approach 2) had a minimal effect on the rate of ineligible enrollees (3.1% to 3.3% among the total sample and 1.6% to 1.8% among the non-dual sample). In general, the greatest increase in error rate appeared to be attributable to the introduction of the asset test under Approach 3.

Table 4 Proportion of Beneficiaries Eligible for the Medicare Part D Low Income Subsidy and "Ineligible" Enrolled, by Marital Status and Method of Estimating Eligibility

	Method of Estimating Eligibility					
	Approach 1		**Approach 2**		**Approach 3**	
	Native MCBS Income		*Imputed Income*		*Imputed Income and Assets*	
Population	Percent Eligible	% Ineligible Enrolled	Percent Eligible	% Ineligible Enrolled	Percent Eligible	% Ineligible Enrolled
Total (N= 13,157)	31.8	4.2	29.8	4.0	25.3	4.7
Single (N= 6,632)	49.4	6.3	49.4	6.3	43.5	6.6
Married (N=6,525)	16.4	3.1	10.5	3.3	9.4	3.6
Non-duals (N= 10,632)	20.8	2.1	18.5	2.1	13.7	2.3
Single (N= 4,583)	33.6	3.0	33.6	3.0	26.1	3.1
Married (N= 6,049)	12.1	1.6	6.1	1.8	5.1	1.9

Source: 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population; all estimates determined to be stable based on relative standard errors

Table 5 presents LIS enrollment rates among beneficiaries estimated to be eligible using Approaches 1-3. In all samples the rate of enrollment is higher with the use of imputed income and asset data compared to using MCBS native income. Under Approach 1, 54.2% of all beneficiaries were enrolled in LIS. The proportion rises to

57.8% under Approach 2 and 65.7% under Approach 3. Among non-dual beneficiaries, LIS participation rates were 21.5%, 24.0% and 30.4% using Approaches 1-3, respectively. Among married beneficiaries in both the total and non-dual samples, income imputation resulted in higher enrollment estimates. Also in both samples, incorporating asset data (Approach 3) had a greater impact on raising the enrollment rate among single beneficiaries relative to married beneficiaries. All estimates in Tables 4 and 5 were determined statistically stable based on relative standard errors.

Table 5 Rate of LIS Take-up among Estimated Eligible Beneficiaries by Marital Status and Method of Estimating Eligibility

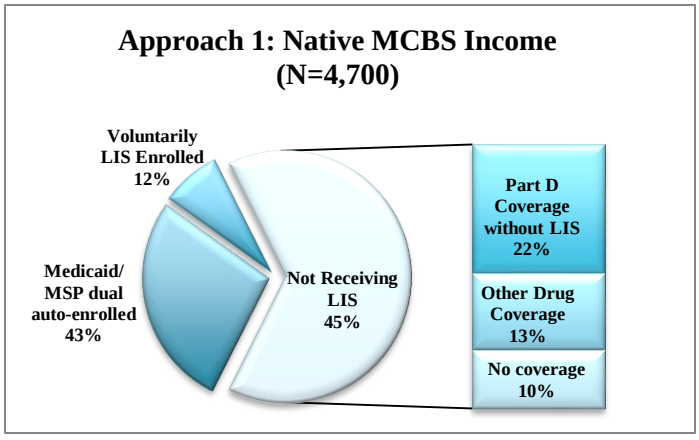
	Method of Estimating Eligibility		
	Approach 1	**Approach 2**	**Approach 3**
Population	*Native MCBS Income*	*Imputed Income*	*Imputed Income + Asset Data*
Total (N= 13,157)	54.2	57.8	65.7
Single (N= 6,632)	59.8	59.8	66.6
Married (N=6,525)	39.4	58.0	62.6
Non-duals (N= 10,632)	21.5	24.0	30.4
Single (N= 4,583)	24.9	24.9	30.8
Married (N= 6,049)	15.1	25.4	29.1

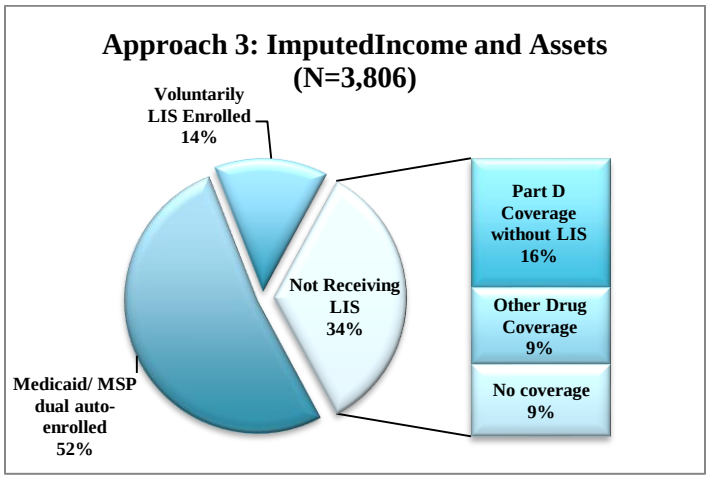
Source: 2005-20007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population; all estimates determined to be stable based on relative standard errors

Next, we examined the distribution of drug coverage among the eligible cohort defined based on Approach 3 and compared to that based on Approach 1 (Figure 3). A greater proportion of eligible beneficiaries under Approach 3 were automatically enrolled in LIS due to dual Medicaid or MSP status (52% v. 42%). A slightly higher portion voluntarily applied for and received the LIS (14% v. 12%). A total of 34% did not enroll

in LIS compared to 45% under Approach 1. Among the non-recipients under Approach 3, 16% enrolled in Part D without LIS, 9% with other drug coverage, and 9% remaining without coverage. Under Approach 1 a larger portion enrolled in Part D without LIS (22%), a lower portion with other drug coverage (13%), and slightly more remained without coverage (10%). LIS eligibility and enrollment is discussed in further detail in Appendix 2.

Figure 3 Sources of Drug Coverage among LIS Eligible Beneficiaries





Phase 3. LIS Take-up Analysis

Tables 6 and 7 present bivariate and multivariable results of Part D LIS participation among beneficiaries estimated to be eligible for LIS based on imputed income and asset values under Approach 3 (N=1,293). These tables stratify the eligible cohort by three alternative enrollment choices, specifically, Part D LIS, Part D without LIS, and neither.

Table 6 reports sample proportions of the study groups. LIS recipients or beneficiaries with no drug coverage tended to be former or current SSDI recipients. LIS recipients also tended to have lower income levels. A greater number of LIS and non-LIS Part D enrollees reside in metro areas compared to those with no coverage. The majority of beneficiaries with no drug coverage (70.6%) also had no supplemental medical coverage, whereas the majority (79.3%) of non-LIS Part D enrollees did have coverage, which was concentrated mostly in MA plans (36.2%). About half of LIS recipients had supplemental medical coverage. LIS recipients tended to have a greater number of chronic conditions and beneficiaries with no drug coverage tended to have a lesser number compared to non-LIS Part D enrollees. More LIS recipients tended to report cognitive impairment and cost-related non-adherence.

Table 6 Characteristics of Community-Dwelling Medicare Beneficiaries Eligible for LIS by Source of Drug Coverage (N=1,293)

	Type of Drug Coverage			
Characteristic	**Total**	**Part D LIS**	**Part D no LIS**	**No Drug Coverage**
Overall %	100	40.6	41.4	18.1
Sample N=	1,293	522	538	233
Sex (%)				
Female	69.3	67.6	75.0	53.1
Male	30.7	32.4	25.0	46.9
Age (%)				
<65	22.0	32.6	11.0	36.8
65-74	30.4	31.8	31.8	25.5
75-84	32.9	24.8	39.5	26.4
85+	14.3	9.9	17.4	11.3
Former SSDI and 65+	30.5	43.2	19.5	39.3
Marital Status (%)				
Married	23.7	22.1	26.1	25.3
Single	76.3	77.3	72.1	73.6
Race/Ethnicity (%)				
White	68.0	62.6	67.5	70.6
Other	32.0	37.7	32.7	30.0
Education (%)				
<High School	48.8	50.8	46.6	51.5
High School grad	29.4	26.2	32.9	26.8
Some college	20.8	23.0	20.6	21.7
Income as % of FPL (%)				
0-74.9	22.6	25.8	20.8	20.2
75-99.9	25.7	27.8	20.1	24.9
100-124.9	32.4	32.8	31.9	34.8
125-149.9	19.3	13.6	27.1	20.2
Enter facility in year 2 (%)	0.8	1.4	0.7	0.6
Household Composition (%)				
Lives alone	41.7	41.4	41.3	38.8
Lives with others	58.3	58.6	58.7	61.2
Metro (%)	69.1	68.2	74.9	59.0
Geographic Region (%)				
Northeast	21.9	23.8	19.8	12.9
Midwest	23.3	23.5	21.7	27.3

South	42.2	42.1	41.9	48.1
West	12.6	10.7	16.6	11.7
Newly Dual Eligible (%)	6.2	17.0	0.1	0.2
Supplemental Medical Insurance at baseline (%)				
None	36.1	51.4	20.7	70.6
Any	63.9	48.6	79.3	29.4
Other Private	20.0	15.9	28.2	19.8
MA	19.7	15.1	36.2	2.0
ESI	16.6	7.5	7.1	7.2
Other	7.6	10.1	8.5	0.4
Prescription Drug Insurance at baseline (%)				
None	42.7	39.3	37.8	91.8
Any	57.3	60.7	62.2	8.2
Cognitive Impairment (%)	14.8	16.4	13.2	13.6
No. of Self-reported Chronic Conditions (%)				
None (ref)	13.9	10.7	14.7	21.0
1 or 2	50.2	46.4	53.2	55.7
3 or 4	26.6	31.3	24.2	17.3
5+	9.3	11.6	7.9	6.0
Cost Related Non-adherence (%)	20.5	28.3	18.0	18.2
Get Help with Health Care Decisions (%)	35.9	37.5	36.6	33.7
FQHC in county (%)	53.7	53.1	58.0	50.8
Lowest PDP Premium in State (mean $ (se))	10.3 (0.29)	10.3 (0.29)	10.3 (0.29)	10.3 (0.29)
Panel 2005-2006 (%)	68.9	69.2	72.5	72.2

Source: 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population

Table 7 compares unadjusted enrollment rates and adjusted marginal effects for factors hypothesized to be predictive of enrollment in a non-LIS Part D plan or having no drug coverage compared to Part D with LIS. Approximately the same proportion of eligible beneficiaries enrolled in Part D with the LIS as without the LIS (41%). The remaining 18% of eligible beneficiaries did not have drug coverage. In general, greater

differences were apparent among those without drug coverage compared to LIS enrollees than non-LIS Part D enrollees. LIS enrollment rates were highest among current and former SSDI recipients ($p<0.01$). Beneficiaries 75 years or older were also likely to enroll in Part D, but the majority enrolled without the LIS ($p<0.01$). Beneficiaries who were single or non-white tended to enroll in the LIS over no drug coverage ($p<0.01$). High school graduates without any college were likely to enroll in Part D but with the majority in a non-LIS plan ($p<0.05$). Beneficiaries with lower incomes were more likely to enroll in LIS and those with the highest income were more likely to enroll in Part D without the LIS ($p<0.01$). LIS enrollment was highest in the Northeast while about one-fifth of beneficiaries from the Midwest and South went without drug coverage ($p<0.01$). As expected almost all beneficiaries who newly acquired dual-eligibility in year 2 enrolled in LIS ($p<0.01$). Half of beneficiaries with no supplemental medical coverage enrolled in LIS with 30% of the balance having no drug coverage. The majority of those with some form of supplemental medical coverage tended to enroll in non-LIS Part D ($p<0.01$), particularly Medicare Advantage (MA) plans ($p<0.01$). Most beneficiaries with 3 or more chronic conditions enrolled in Part D with the majority in LIS ($p<0.01$). Beneficiaries with cognitive impairment were more likely to go without drug coverage while those reporting cost-related non-adherence to prescription drugs were most likely to enroll in LIS ($p<0.01$).

Multivariable results from the multinomial logistic regression model reflect changes in the predicted probabilities of enrollment in non-LIS Part D or no drug coverage over LIS. In general, demographic characteristics did not stand out as strong predictors of enrollment. Having no more than a high school education was positively

associated with non-LIS Part D enrollment, but was not a factor in non-enrollment ($p<0.05$). Having income between 75 and 125% of income was associated with a 5-6 percentage points increase in the probability of having no drug coverage ($p<0.01$), but income had no effect on non-LIS Part D enrollment. Northeast residence decreased the probability of non-LIS Part D enrollment by 17 percentage points ($p<.05$). Newly acquiring dual-eligibility status decreased the probability of non-LIS Part D enrollment by 49 percentage points ($p<0.01$) and no coverage by 8 percentage points ($p<0.01$). Prior year supplemental medical coverage had a substantial impact on LIS choices. Enrollment in an MA plan increased the probability of non-LIS Part D (42 percentage points) and had a smaller but opposite effect on no drug coverage (-8 percentage points) over LIS ($p<0.01$). ESI coverage increased the probability of non-LIS Part D plan ($p<0.05$) but had no impact on non-enrollment. Other private coverage increased the probability of non-LIS Part D by 26 percentage points ($p<0.01$) and decreased the probability of no drug coverage by 4 percentage points ($p<0.01$) over LIS. Similar effects were observed for the remaining sources of coverage. Prior drug coverage had no effect on having a non-LIS Part D plan but decreased the probability of no drug coverage by 30 percentage points ($p<0.01$). Beneficiaries with multiple chronic conditions were more likely to enroll in LIS, particularly over a non-LIS plan ($p<0.05$). Reporting cost-related non-adherence to medications decreased the probability of no drug coverage ($p<0.01$). A dollar increase in the lowest Part D premium available decreased the probability of non-LIS Part D enrollment by 1.2 percentage point ($p<0.05$). Presence of a FQHC in the beneficiary's county of residence modestly increased the probability of having no coverage ($p<0.05$).

Table 7 Unadjusted Prescription Drug Coverage Enrollment Rates and Adjusted Marginal Effects Among LIS Eligible Medicare Beneficiaries (N=1,293)

	Unadjusted Rates of Enrollment			Marginal Effect on Probabilities of Enrollment	
Characteristic	**Part D LIS**	**Part D no LIS**	**No Drug Coverage**	**Part D no LIS**	**No Drug Coverage**
Overall %	40.6	41.4	18.1		
Sample N=	522	538	233		
Sex (%)					
Female	40.4	45.6*	14.1***	0.084*	-0.031*
Male (ref)	41.1	32.4**	26.5***		
Age (%)					
< 65	54.9	18.2***	26.9***	-0.138*	0.113
65 to 74 (ref)	43.1	42.0	14.9***		
75 to 84	33.1	51.6***	15.3***	0.066	0.030
85+	31.2	53.4***	15.3***	0.086	0.027
65+ and Former SSDI	53.6	24.7***	21.7***	0.018	-0.051
Marital Status (%)					
Married	36.8	44.4	18.8***	0.122*	0.013
Not married (ref)	43.1	39.2	17.7***		
Race/Ethnicity (%)					
White	38.5	42.2	19.3***	0.026	0.016
Other (ref)	45.6	38.7	15.7***		
Education (%)					
< High School	41.9	39.2	18.9***	-0.003	-0.002
High School Graduate	36.6	46.7**	16.6***	0.099**	-0.011
Some College (ref)	45.3	37.4	17.3***		
Income as % of FPL (%)					
0-74.9 (ref)	45.6	39.1	15.4***		
75-99.9	47.9	33.0***	19.1***	-0.066	0.057**
100-124.9	39.9	40.5	19.6***	-0.043	0.051**
125-149.9	26.1	56.6***	17.3**	0.079	0.055
Household Composition (%)					
Live Alone	41.1	41.8	17.1***	-0.023	-0.004
Live with Others (ref)	40.2	41.1	18.7***		
Urban (%)	39.9	44.7*	15.4***	0.045	-0.017
Geographic Region					
Northeast	47.9	40.6	11.5***	-0.170**	-0.033

Midwest (ref)	40.7	38.3	21.1***		
South	39.6	40.2	20.1***	0.060	-0.022
West	32.5	51.6***	15.9***	-0.015	-0.011
Dual eligibility in Year 2 (%)	99.1	0.5***	0.4***	-0.494***	-0.076***
Supplemental Medical Coverage at baseline (%)					
None (ref)	49.5	20.3***	30.2***		
Any	34.1	56.7***	9.2***		
Other Private	29.7	53.7***	16.5***	0.261***	-0.043***
Medicare Advantage	28.6	69.8***	1.6***	0.423***	-0.075***
ESI	41.8	40.5	17.8***	0.145**	0.011
Other	53.4	45.6	1.0***	0.212***	-0.061***
Rx Drug Coverage at baseline (%)					
None (ref)	33.1	32.4	34.5		
Any	47.5	49.6	2.8***	0.008	-0.297***
Cognitive Impairment (%)	45.7	37.5	16.9***	0.059	0.001
No. of Self-reported Chronic Conditions (%)					
None (ref)	30.6	42.7**	26.7		
1 or 2	37.0	43.2*	19.8***	-0.090*	-0.018
3 or 4	49.1	38.8***	12.1***	-0.150***	-0.047***
5+	52.0	36.1**	12***	-0.118*	-0.042**
Cost-related Non-adherence (%)	51.7	33.5***	14.8***	-0.038	-0.037***
Get Help with Health Care Decisions (%)	41.7	41.7	16.7***	0.019	-0.010
FQHC in County (%)	40.3	43.0	16.6***	0.046	0.026**
Lowest PDP Premium in State				-0.012**	0.001
Panel 2005-2006 (%)	40.4	41.4	18.2***	0.088*	-0.151***

Source: 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population; significance levels at *** p<0.01, ** p<0.05, * p<0.1; T-tests conducted comparing enrollment in Non-LIS Part D plans and no drug coverage compared to LIS; Beneficiaries enrolled in non-Part D drug coverage were excluded; marginal effects are interpreted as the change in the predicted probability of enrollment

Discussion

In this study, we focused on the MCBS as a source of data to fill gaps in the literature regarding participation in the LIS. The MCBS provides unique strengths relative to other surveys, including survey responses for a comprehensive set of individual characteristics, the panel design, annual measurement, self-reported prescription drug use, and administrative indicators for participation in CMS programs including the LIS. We addressed key limitations of MCBS data by imputing income using the CPS-ASEC and incorporating a supplemental financial data file not previously used by researchers. Our LIS eligibility estimates compare favorably to that of the most rigorous published study to date by Meijer and colleagues giving us confidence in our enhanced eligibility determination measures [130, 131]. Our approach to estimate eligibility improves upon current literature surrounding LIS take-up with the use of administrative enrollment data.

Based on our enhanced measures to determine eligibility, we found a LIS take-up rate of 30% among those who were not auto-enrolled. Our findings suggest that most published estimates over-represent the eligible population, and consequently, the portion of eligible beneficiaries not receiving the subsidy [2, 22, 59, 134, 135]. Nevertheless, we also find that one-third of all beneficiaries who were potentially eligible were not enrolled.

Another key finding of our study is that the majority of LIS eligible non-enrollees obtained unsubsidized drug coverage[14]. Our study results suggest that almost half of eligible beneficiaries not receiving the LIS were enrolled in an unsubsidized Part D plan. This finding calls into question whether or not the LIS program reaches its objectives to reduce financial barriers to improve access to prescription drugs. LIS eligible Part D enrollees who did not receive the LIS pay substantially more out-of-pocket for premiums and cost sharing than necessary. Preliminary research suggests that this additional burden significantly reduces drug utilization compared to that of LIS recipients. Future work is needed to further explore this issue. Outreach efforts should target these individuals who reveal themselves to demand drug insurance but are inadvertently paying the full Part D premium.

To date, a few studies have shed light on personal characteristics associated with LIS enrollment. Our results are consistent with these studies in suggesting that more vulnerable beneficiaries tended to enroll in LIS[20, 61, 94]. The presence of multiple chronic conditions appeared to dramatically motivate LIS enrollment, particularly in relation to enrolling in an unsubsidized plan. This is consistent with the theory that

[14] This finding represents another unique advantage of the MCBS survey and a failure of other studies. CMS estimated that 0.5 million, or 9% of the eligible population not auto-enrolled, had obtained drug coverage through Veterans Affairs, the Indian Health Service, or a Retiree Drug Subsidy (RDS), but disregards other potential sources. The present estimates of LIS participation provided by CMS discount the large share of eligible beneficiaries who are enrolled in some form of drug coverage and are not receiving LIS.

beneficiaries with a greater demand for drugs used to treat chronic illnesses would be more likely to enroll. Similar effects are observed for those reporting cost-related non-adherence. Supplemental medical coverage also had a very substantial role in the LIS enrollment. In particular, MA coverage was strongly associated with enrollment in a non-LIS Part D plan. Insurers, particularly MA plans, should encourage LIS enrollment or even take an active role in screening beneficiaries. The positive association between a federally qualified health center (FQHC) in the county of residence and having no drug coverage suggests that such centers are not successfully screening needy patients. Consistent with economic theory, increases in Part D premium levels is negatively associated with non-LIS Part D enrollment.

Conclusion

Incorporating supplementary measures in the MCBS enhances the ability to draw appropriate conclusions about eligibility and take-up of the LIS. Our results suggest that published literature may misrepresent the population unreached by LIS. Policymakers and Medicare advocates should be advised of the large portions of potentially LIS eligible beneficiaries that are enrolled in other unsubsidized drug plans. This may reflect unmet need among vulnerable beneficiaries and room for improvement in the program's objectives. Continued research is necessary to further develop tools to accurately assess eligibility and take-up and also to explore the impact of this program on drug utilization and, eventually, health outcomes.

Chapter 6: Part D Spending Among Low Income Subsidy Eligible Enrollees

This aim expanded upon the research conducted in Aim 1. In this study we examined the impact of LIS on drug utilization among presumed LIS eligible Part D enrollees who are not auto-enrolled.

Background

The establishment of the Medicare Part D prescription drug benefit was intended to improve medication initiation and adherence by reducing financial barriers to drug use. Having limited or no drug coverage is associated with high rates of cost-related non-adherence (CRN) to prescription drugs [149-152]. Not surprisingly, CRN is most pronounced among low-income beneficiaries, particularly those with higher out-of-pocket costs [153, 154]. The Low Income Subsidy (LIS) was created as a component of Part D to provide additional assistance with premiums and cost-sharing for low income beneficiaries, a population for whom out-of-pocket expenditure for prescription drugs can be a substantial burden. Prior to Part D implementation in 2006, three-fourths of Medicare beneficiaries with financial resources just above Medicaid thresholds spent about 30% of their income on out-of-pocket health care costs [155]. In response, the goal of the LIS is to provide "the greatest benefit to those with the greatest need" [156]. The program discounts drug costs for beneficiaries who are auto-enrolled due to dual enrollment in Medicaid, Medicare Savings Programs (MSP), or receiving Supplemental Security Income (SSI), but is also available to other low income beneficiaries up to 150% of the Federal poverty line (FPL).

Part D plans vary substantially in cost sharing and benefit design. The average monthly Part D premium in 2012 is $39.40 [141]. Coinsurance for the standard Part D benefit is 25%, although it is more common for plans to use copays, in amounts that vary widely across plans. In 2011, median copays for Part D enrollees without the LIS was $7 for generic products and ranged from $23 to $95 for non-preferred brand-name products [157]. Receipt of the LIS substantially reduces the price of obtaining drugs under Part D because CMS sets fixed limits on cost sharing for LIS recipients. All LIS enrollees are able to enroll in plans with zero premiums. However, if LIS recipients chose to enroll in plans above a regional premium benchmark or with supplemental premiums for enhanced benefits, they are required to pay the difference between the benchmark and basic premium of the chosen plan, plus all of any additional supplemental premiums. In 2010 the most common amount paid above the benchmark was $8 to $10 [158]. Cost sharing is minimal under LIS but varies by eligibility criterion. In 2012, maximum copays for LIS recipients with income below 100% of FPL are $1.10 for generic products and $3.30 for brand-name products. Recipients with income 100% to 135% of FPL and lower asset holdings face copays of $2.60 for generics and $6.50 for brand-name products. Beneficiaries with income 135 to 150% of FPL and somewhat higher assets face a maximum 15% coinsurance or $2.65 in copay for generics and $6.60 for brand name products.

Part D was expected to improve access to prescription drugs in the Medicare population. Recent studies show that significant increases in drug utilization and reduced rates of CRN were realized for Part D enrollees following the program's implementation [3, 4, 6-8, 10, 11, 159]. However, CRN remains high among beneficiaries with lower

incomes, the population that LIS was intended to reach [160]. This may be due in part to the fact that LIS is a voluntary program and many eligible beneficiaries who would benefit are not enrolled. CMS estimates that only 35% of the 4.3 million non-dual beneficiaries estimated to be eligible for the LIS are participating [22]. Recent work suggests that many other LIS-eligible beneficiaries are enrolled in other non-Part D sources of drug coverage such as employer-sponsored or self-purchased. However, many LIS-eligible beneficiaries are surprisingly enrolled in Part D without the subsidy [33, 61]. As a result, these beneficiaries who obtained coverage under Part D pay more out-of-pocket for prescription drugs than necessary. Our objective in this study is to estimate the effect of that additional burden by focusing on a comparison of drug spending among Part D enrollees with and without the LIS.

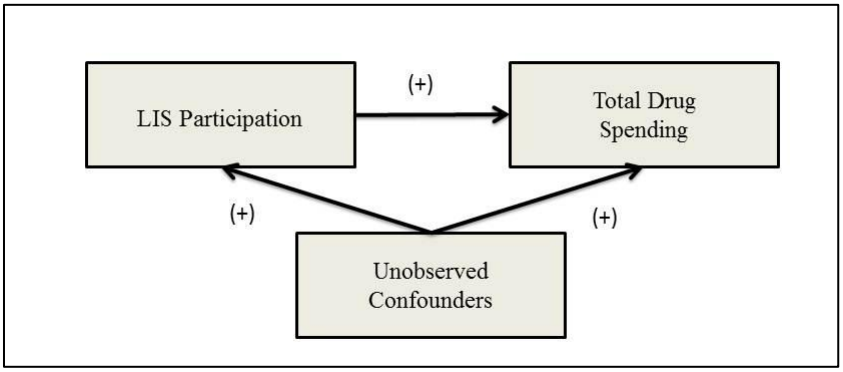
Conceptual framework

Demand for Prescription Drugs

Consistent with economic theory, empirical research has shown that reductions in cost sharing result in increased utilization of prescription drugs [137, 138]. This evidence would suggest that LIS receipt, which significantly reduces cost sharing, should have a positive effect on drug utilization compared to LIS-eligible Part D enrollees who do not have the subsidy. The positive association between LIS participation and total drug spending is represented in Figure 4. However, causal interpretation of the effect of LIS on drug spending in empirical studies is problematic in the presence of potential endogeneity of LIS participation. Endogeneity arises as a result of unobserved factors jointly affecting drug spending and LIS enrollment. For example, high anticipated drug

spending based on poor health status is not readily observed in all secondary data sources and might drive one to enroll in LIS to save on out-of-pocket costs. Unless health status measures are included in the empirical model, the estimates of LIS enrollment would be upwardly biased. Thus, to obtain unbiased estimates of the LIS effect among Part D enrollees, it is essential to consider the demand for LIS as well.

Figure 4 The Relationship between LIS Participation and Prescription Drug Spending



Demand for the Part D Low Income Subsidy

Demand for a subsidy program among insured individuals is conceptually different than demand for insurance. The LIS offers substantial benefits to eligible Part D enrollees and theory suggests that an individual will participate if the expected benefit exceeds the cost. Since there is no monetary cost to participate in the LIS, it would seem that there is a clear benefit to enroll. However, low take-up among eligibles suggests that there are other non-cost barriers to participation. Over time, a literature has developed that helps to identify these barriers and their role in limiting participation in public programs. These potential barriers include lack of information, time or search costs,

stigma associated with welfare participation, reluctance to disclose personal financial information, competing priorities related to family care, and perceived ineligibility. If such factors are also associated with Part D spending then not accounting for them in empirical analyses would result in endogeneity, and biased estimates of the LIS impact on drug use and spending. We explore some of these issues in our study.

Methods

Data

We used data from the Medicare Current Beneficiary Survey (MCBS) from 2005-2007. The MCBS is an annual survey of a nationally-representative sample of the Medicare population conducted by the Centers for Medicare and Medicaid Services (CMS). Each year approximately 4,000 beneficiaries are enrolled in the MCBS and followed for up to three additional years. Respondents are interviewed in the fall for the Access to Care survey and three additional times during following years for the Cost and Use survey.

The MCBS collects data on self-reported socioeconomic characteristics, health status, health insurance, functional limitations, healthcare seeking attitudes, access to care, and awareness and understanding of the Medicare program, as well as self-reported healthcare service use (including prescription drugs) and source of payment. The files are also linked to Medicare administrative enrollment records and medical claims. Since 2006, Part D claims data have been included. This study also used data from the Income and Asset (I&A) supplement to the Cost and Use survey. The I&A file contains respondents' estimates of total income and asset amounts as well as indicators of various

financial sources including pensions, banking/investment, property, and IRA or 401k accounts.

Study Sample

We constructed the study cohort pooling two sets of two-year panels for the MCBS. The panels are mutually exclusive. The first panel consisted of beneficiaries observed from 2005 to 2006 and the second panel observed during 2006 to 2007. Within each panel we determined LIS eligibility in the second year based on income and assets in the baseline year (2005 for panel 1 and 2006 for panel 2). Part D and LIS enrollment were measured in the second year.

Probable LIS eligibility was determined following CMS guidelines based on income and asset holdings. Income eligibility was defined as income below 150% of the federal poverty level (FPL) and asset values below $11,500 if single and $23,000 if married in 2006 ($11,710 and $23,410 respectively in 2007). Asset eligibility was identified using values provided in the I&A file. Prior research has shown that family income is underestimated in the MCBS, largely driven by underreporting among married beneficiaries [133]. To enhance the income estimates among married couples we applied a multivariable imputation procedure using the Annual Social and Economic Supplement to the Current Population Survey (CPS-ASEC). This procedure is documented in Chapter 5 and Appendix 1. Income eligibility among single beneficiaries was identified based on reported income amounts in the I&A file.

Using these results regarding probable LIS eligibility, the cohort was restricted to beneficiaries enrolled in Part D who were determined to be putatively eligible for the

LIS. We excluded beneficiaries who were dually eligible for Medicaid or a Medicare Savings Program (MSP) as they were automatically enrolled in the LIS. We also excluded residents in long-term care facilities during the first year of each panel, as they are not queried for the I&A supplement. The study design coupled with the small sample explains a 0% mortality rate during the study period. The final study sample consisted of 955 beneficiaries.

Measurement of Key Variables

Part D enrollment, LIS enrollment, and Part D use and spending were measured in the second year of each panel. All other variables were measured in the first year of each panel and included demographic and socioeconomic factors as well as characteristics of health insurance, health status, health seeking attitudes, and Part D program knowledge. An indicator for panel year (2005-2006 versus 2006-2007) was included to control for time period. We also included an indicator for whether a beneficiary entered into a skilled nursing home or long term care facility in the second year[15]. The transition into a facility typically leads beneficiaries to spend down and be Medicaid eligible and the facility generally provides assistance with applying for the LIS. The key measures are described below.

Part D Spending. The outcome measure was total annual Part D prescription drug spending in the second year of each panel. Total out-of-pocket Part D spending was also examined. All Part D spending measures were based on claims. Dollar amounts were inflated to 2007 dollars using the Consumer Price Index.

[15] All beneficiaries remained alive during the study period.

Drug Utilization. Drug utilization was measured annually across two domains: use and cost. We standardized the drug fills measures to 30-days based on days supply using Part D claims data. Fills with an annual days supply greater than 365 were capped at 12. Specifically, we measured presence of any drug use, number of total fills, number of total unique medications filled, and cost per fill.

Part D and LIS Enrollment. The primary independent variable was a binary indicator for LIS enrollment in the second year of each panel, where the reference was non-LIS Part D enrollment. Enrollment in Part D and the LIS was identified using CMS administrative records and measured in the Fall (2005 for panel 1 and 2006 for panel 2) at the time of the Access to Care interview. We also measured the number of months a beneficiary was enrolled in Part D or the LIS.

Sociodemographic Variables. Sociodemographic characteristics included age, marital status, race/ethnicity, urbanicity, and geographic region.

Health Insurance. We measured other supplemental medical and prescription drug insurance using CMS administrative records for traditional fee-for-service Medicare, Medicaid, MSPs, Medicare Advantage (MA), and Veterans Affairs (VA) coverage. The records were supplemented with self-reported indicators for enrollment in up to five private plans. Supplemental medical coverage was categorized into employer-sponsored, other private, MA, and other public. All insurance coverage indicators were measured at the time of the fall Access to Care survey.

Medical Debt. We included a measure indicating whether or not the beneficiary had any medical debt (from the I&A supplement) on the assumption that such debts would lessen demand for medical services including possibly prescription drugs.

Health Status. We measured general health and functional status by identifying the number of self-reported chronic conditions and activities of daily living (ADL) limitations. These characteristics are expected to reflect expected demand for drug utilization that may motivate LIS participation.

Cost-related non-adherence (CRN). We identified CRN as a composite measure reflecting that the beneficiary indicated going without a prescription drug due to cost or because it was not covered by insurance, or skipped doses or split pills to make a prescription last longer [19]. We speculate that CRN at baseline induces demand for the subsidy to obtain some relief for the out-of-pocket cost burden and subsequently increase demand for prescription drugs.

Program Awareness. Awareness of the Part D program was measured based on questions asking whether the respondent thought that there were multiple drug plans or if financial assistance was available for Medicare beneficiaries. Similarly, we observed whether beneficiaries reported that understanding Part D was difficult or easy. Program awareness may lead them to not only seek out the benefit but also to use it.

Healthcare Seeking Attitudes. We measured two dimensions of health care seeking attitudes. These included responses to questions asking whether the respondent would do "almost anything to avoid going to the doctor" and if the respondent "worried more about their health than others their age". We hypothesized that healthcare seeking attitudes are

associated with preferences for healthcare which influence participation decisions, encounters with the healthcare system, and use of medical services and prescription drugs.

Statistical Analysis

We present bivariate statistics for total Part D spending by characteristics of the non-dual LIS-eligible sample as a whole and stratified by LIS or non-LIS Part D enrollment. The adjusted impact of LIS enrollment on Part D spending was estimated using a generalized linear model with a gamma conditional mean function and log link.

The conceptual framework presented in Figure 4 shows that the causal effect of LIS receipt on drug spending will be biased in the presence of endogeneity. LIS is endogenous if the decision to participate is based on unobserved factors that are also correlated with drug spending. Common econometric techniques to correct for endogeneity include the use of instrumental variables (IVs). We attempted two-stage residual inclusion and two-stage least squares approaches. We aimed to identify LIS participation using state-level IVs that reflect plan availability because Part D plans vary by large regions resembling state designations. IVs included the lowest Part D Plan (PDP) premium available, the number of LIS eligible PDP plans available, the number of Part D plans available, PDP/MA penetration rate, and the presence of a Qualified Medicare Beneficiary (QMB) plus program. However, IV methods resulted in unstable estimates and inflated standard errors due to small sample size. Given these findings we chose a more direct approach using extensive covariate control and taking advantage of the wealth of data in the MCBS.

We estimated three multivariable models of Part D drug spending in which domains of independent variables were sequentially added. Evaluating Part D spending across three models permitted us to observe the change in the estimated LIS enrollment effect when including different sets of hypothesized confounding variables. Our first model contained baseline socioeconomic, demographic and insurance characteristics, and a count of the number of months enrolled in Part D or the LIS. The second model introduced indicators of health and functional status. The final model added healthcare seeking attitudes and Part D awareness. Results are presented as average marginal effects. The marginal effect reflects the average impact of LIS estimated across the entire study sample and does not capture the effect that LIS may have on current non-recipients if they were to obtain LIS. We isolated this effect by also calculating the difference in mean predicted spending when simulating LIS receipt for the non-enrolled.

Finally, we aimed to decompose the difference in drug spending between LIS and non-LIS recipients. To do so, we examined drug utilization among LIS and non-LIS Part D enrollees using descriptive statistics to compare rates of drug use, count of fills, and cost per fill.

All analyses were conducted with adjustments for the complex survey design of the MCBS and were performed using STATA 11 or SAS 9.2. The study protocol was approved by the University of Maryland Baltimore Institutional Review Board.

Results

Characteristics of the study sample are presented in Table 8. We found that approximately 45% of beneficiaries determined to be likely LIS-eligible Part D enrollees

received the LIS with the balance enrolled in a Part D plan without the LIS. Mean annual Part D spending for the total LIS-eligible Part D enrolled population was $2,344. LIS enrollees spent approximately $1,280 more than non-LIS enrollees ($3,054 v. $1,774). Out-of-pocket spending accounted for only 15% (CI: 13 - 17%) of total spending for LIS enrollees but 38% of total spending for non-LIS Part D enrollees (CI: 36% - 40%).

LIS recipients were more likely to be current or former SSDI recipients, younger age, and not married compared to non-LIS recipients. Less than half as many LIS recipients had supplemental medical coverage than non-recipients (49.5% v. 20.6%). Among non-LIS enrollees with supplemental coverage 36.2% were enrolled in an MA plan. About 62% of LIS and non-LIS enrollees had drug coverage in the prior year. More LIS recipients reported medical debt (18.6% v. 10.6%), CRN (27.5% v. 18.0%), and a greater number of chronic conditions and ADL limitations. More LIS recipients reported a greater awareness and understanding of the program. A greater proportion of LIS recipients reported awareness that financial assistance was available (68.4% v. 61.4%) and that the program was easy to understand (49.1% v. 39.5%). LIS recipients also tended to worry more about their health than their peers without LIS (30.5% v. 22.1%).

Table 8 Characteristics of Non-dual LIS Eligible Community-Dwelling Medicare Beneficiaries Enrolled in Part D, by LIS Receipt

Characteristic	Total	LIS Enrolled	Non-LIS Part D Enrolled
Unweighted N=	955	425	530
Total (%)	100	44.5	55.5
Part D Spending			
Total Spending (mean, s.e.)	$2,344 (114)	$3,054 (207)	$1,774 (87)***
Out-of-Pocket as a % of Total Spending (s.e)	27% (.01)	15% (.01)	38% (.01)***
Sex (%)			
Female	71.9	68.4	75.0*
Male	28.1	31.6	25.0
Age (%)***			
<65	19.1	29.7	10.8***
65 to 74	32.0	32.8	31.3
75 to 84	33.9	25.9	40.0***
85+	14.8	11.6	17.7***
Age 65+ and Former SSDI	28.7	40.7	19.5***
Marital Status (%)			
Married	24.4	21.7	26.2
Single	75.6	78.3	73.8
Race (%)			
White	65.1	62.4	67.5
Other	34.9	37.6	32.5
Education (%)*			
< High school	48.5	50.9	46.6
High school graduate	29.6	25.4	32.9**
Some College	21.9	23.8	20.5
Income as a % of FPL***			
0 to 74.9	21.6	22.2	21.2
75 to 99.9	24.9	30.5	20.4***
100 to 149.9	53.5	47.3	58.5***
Entered Short/Long Term Care (%)	3.9	0.5	0.3
Metro Status (%)			
Metro	72.3	68.6	75.3*
Rural	27.7	31.4	24.7*
Region (%)			
Northeast	22.4	26.0	19.8*
Midwest	22.9	24.5	21.7

South	41.1	39.5	41.9
West	13.7	9.9	16.6*
Medical Coverage (%)***			
None	33.6	49.5	20.6***
Other Private	23.2	17.2	28.2***
Medicare Advantage	26.7	14.9	36.2***
Other	9.8	11.0	8.5
ESI	7.1	6.9	7.2
Drug Coverage (%)			
Any	62.1	62.1	62.2
Medical Debt (%)	14.2	18.6	10.6***
No. of Months Enrolled (mean, s.e.)	10.6 (0.1)	10.6 (0.1)	10.5 (0.1)
Health and Function Status Measures			
No. of Chronic Conditions (%)***			
None	12.0	9.6	14.7**
1 to 2	51.4	48.9	53.2
3 to 4	27.4	30.9	24.2**
5+	9.2	10.6	7.9
No. ADLs (%)**			
None	62.5	58.4	65.8*
1	15.9	15.0	16.6
2	11.2	13.8	8.9**
3+	10.4	12.8	8.8*
Health Care Seeking Attitudes and Part D Awareness Measures			
Cost-related Non-adherence (%)	22.4	27.5	18***
Part D Awareness (%)			
Multiple Plan Choices	51.1	54.0	48.4
Extra Help Available	64.6	68.4	61.4*
Part D Understanding (%)			
Very/Somewhat Easy	36.3	49.1	39.5**
Very/Somewhat Hard	26.8	50.9	60.5
Healthcare Seeking Attitudes (%)			
Worry about Health	26.1	30.5	22.1**
Avoid Going to the Doctor	34.2	33.7	34.6

Source: 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population; T-tests compare LIS to non-LIS Part D proportions; significance Levels: ***p<0.01, **p<0.05, *p<0.1; Chi-square tests to compare LIS to non-LIS Part D categorical values; significance levels at category row headers.

Table 9 presents results from the multivariable regression models. Each model presents the estimated impact of LIS on Part D spending among the likely LIS-eligible

Part D population. Overall, the estimated marginal effect of LIS enrollment ranged from $534 to $747. Based on model 1, which adjusts for socio-demographic factors and health insurance, LIS was associated with an additional $747 in Part D ($p<0.01$) spending. Adding health and functional status measures in model 2 reduced the estimated effect to $639 ($p<0.01$). Including the measures for CRN, program awareness, and healthcare seeking attitudes resulted in an estimated effect of $534 under model 3 ($p<0.01$). Sociodemographic factors became less significant after the inclusion of the additional hypothesized confounders. Health status and health care seeking attitudes were strongly and significantly associated with spending. Program awareness measures were jointly significantly associated with spending.

We also estimated the potential effect of LIS specific to current non-recipients by simulating the difference in spending based on model 3 results. We found that if non-recipients were to obtain LIS their Part D spending would increase by $452.

Table 9 Multivariable Results of Estimated Effect of the Impact of LIS on Part D Spending among LIS Eligible Beneficiaries

Characteristic	Model 1	Model 2	Model 3
LIS Enrollment	747.37***	639.91***	534.44***
Female	92.55	18.95	-49.76
Age			
<65	409.33*	388.31*	168.51
65 to 74 (ref)			
75 to 84	376.15***	232.70	271.47*
85+	230.25	-23.42	121.29
Former SSDI and 65+	645.27***	361.76*	333.20*
Married (ref=not married)	266.78**	263.08**	200.53
White (ref=not white)	-11.44	69.81	117.08
Education			
Less than High School	-36.34	-125.54	-165.27
High School Graduate	54.04	-1.47	24.12
Some College (ref)			
Income as a % of FPL			
0 to 74.9 (ref)			
75 to 99.9	231.34	240.46	216.07
100 to 149.9	496.31***	352.89**	286.04*
Metro (ref=rural)	-187.20	-169.36	-257.41*
Geographic Region			
Northeast	99.36	295.91	229.32
South	-212.91	-131.82	-164.85
West	-313.50**	-314.90*	-373.78**
Midwest (ref)			
Baseline Supplemental Medical Insurance (ref=none)			
Employer-sponsored	596.29**	701.53**	636.89**
Other Private	592.35***	604.68***	481.15***
Medicare Advantage	43.31	14.04	-6.12

Other	269.10	220.28	110.22
Prescription Drug Insurance	275.28**	359.25**	359.63**
Medical Debt	51.92	-199.80	-237.59*
Panel 2005-2006	-5.92	30.24	70.29
Entered Short/Long Term Care	321.44	166.94	17.17
No. of Months Enrolled	71.71***	68.88***	67.40***
Health and Function Status Measures			
No. of Self-reported Chronic Conditions			
0 (ref)			
1 or 2		780.88***	696.99***
3 or 4		1,659.38***	1,398.66***
5+		2,737.96***	2,299.93***
No. of ADL Limitations			
0 (ref)			
1		-6.10	4.28
2		317.75*	229.14
3+		393.41**	448.02**
Health Care Seeking Attitudes and Part D Awareness Measures			
Cost-related Non-adherence			223.82*
Part D Awareness			
Multiple Plan Choices			234.45**
Extra Help Available			142.62
Part D Understanding			
Somewhat/Very Easy (ref)			
Somewhat/Very Difficult			-150.34
Healthcare Seeking Attitudes			
Avoid Going to the Doctor			-477.51***
Worry about Health			531.81***

Source: 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the Medicare population; significance Levels: ***p<0.01, **p<0.05, *p<0.1; standard error in parenthesis

Table 10 compares annual drug utilization under Part D for LIS recipients and non-recipients. Over 90% of the members of each group filled at least one Part D prescription and that the difference was not statistically significant. However, LIS enrollees tended to fill a greater number of fills overall (52.5 v. 38.2) and unique medications filled (9.0 v. 7.2), representing differences that are both statistically and clinically significant. Cost per fill was also significantly greater among LIS enrollees ($64 v. $52).

Table 10 Drug Utilization among LIS Eligible Part D Enrollees Beneficiaries, by LIS Receipt

Medication Utilization Measures	LIS Enrolled (N=425)	Non-LIS Part D Enrolled (N=530)
Percent Using 1+ Fill	93%	94%
Mean Drug Utilization (std. err.)		
# Total Annual Fills	52.5 (2.4)	38.2 (1.5)*
# Unique Annual Medications Filled	9.0 (0.3)	7.2 (0.3)*
Mean Cost per Fill (std. err.)	$64 (2)	$52 (3)*
Distribution of Cost per Fill		
Min	$3	$5
25%	$32	$26
Median	$52	$42
75%	$75	$61
Max	$495	$683

Note: All calculations are based on 30-day adjusted annual fills. Drug use and cost measures are calculated among drug users; * indicates that values are statistically significant at $p<0.01$ based on t-test comparisons

Discussion

This study brings attention to the high rate of unsubsidized Part D enrollment among beneficiaries putatively eligible for the LIS subsidy and the effect of the added out-of-pocket burden on drug spending. According to 2009 CMS estimates, 3.8 million (approximately 11%) non-dual beneficiaries were eligible for the LIS, of whom 60% were not enrolled [22]. Any useful comparison of drug use among the LIS eligible enrolled population requires a data resource that includes information on individual characteristics. Other studies based on survey data suggest that up to four-fifths of LIS eligible non-dual beneficiaries did not receive the LIS and half of those eligible were enrolled in Part D plans with basic premiums above the regional benchmark or enhanced plans (non-LIS Part D plans) [33, 61]. Using the MCBS with enhancements to eligibility determination measures, we found that approximately 14% of non-dual beneficiaries were eligible for the LIS, and 70% of whom did not receive the LIS. Among the non-recipients, about half enrolled in a non-LIS Part D plan, one-quarter remained without coverage, and one-quarter obtained other private or public coverage.

All members of this low-income cohort voluntarily selected into Part D, but less than half enrolled in the LIS. LIS recipients were younger, more likely to be male, non-white, have less education and income, more medical debt, and suffered higher numbers of comorbidities and activity limitations. All of these differences are also plausibly associated with drug spending. LIS recipients reported higher baseline rates of cost-related non-adherence to prescription medications and greater functional and health status problems which, consequently, were also positively related to greater Part D spending. Given that all eligible Part D enrollees are able to participate in the LIS at no monetary cost, the most plausible explanation for non-enrollment is the lack of information. We found that more LIS recipients were aware that multiple Part D plans

and extra help was available. More LIS recipients also expressed more ease in navigating Part D. Indeed, many other studies have found that lack of awareness, as well as confusion and complexity of the application process were significant barriers to LIS enrollment [22, 61, 84]. Under the assumption that program awareness is also associated with drug spending, then excluding awareness in an empirical model would confound the relationship between LIS and spending. Similarly, LIS recipients worried more about their health which was also a driver of prescription drug spending. Including these potential confounding in the spending model had a significant impact on the estimated effect[16].

When we collectively control for the above factors, the estimated effect of LIS enrollment on prescription spending dropped from $1,280 to $534. Although we cannot rule out the possibility that additional unmeasured factors would further reduce the estimated LIS effect, we think the magnitude of such residual confounding is likely to be small. We found that if non-LIS Part D enrollees obtained LIS coverage their annual drug spending would have risen by $452. The simulated policy effect is almost $100 less than the average effect. This difference in these point estimates is consistent with our theoretical discussion on LIS demand suggesting that non-LIS enrollees anticipate less demand for prescription drugs compared to LIS recipients. At the same time, our analysis of the difference in OOP costs between LIS enrollees and non-LIS enrollees suggests that non-LIS enrollees may underestimate their total OOP cost burden and thus, the need for the LIS. As expected, out-of-pocket spending differed greatly among Part D enrollees with and without the LIS, not counting the fact that LIS provides discounts in Part D

[16]We also acknowledge the possibility for reverse causality in the measures of Part D awareness. If more encounters with the healthcare system increase the likelihood of gaining information, then greater spending would lead to greater awareness of the program. However, we feel that this would not have a substantial impact on the overall study findings.

premiums. In 2007, the average monthly LIS premium subsidy was $28 which suggests that LIS enrollment could save eligible individuals another $336 per year on average [158, 161].

Based on economic theory we expected to find that LIS-eligible beneficiaries who received the subsidy would have higher drug spending than those who did not. And indeed, after controlling for various factors that could confound the relationship we estimate that, on average, LIS receipt increases Part D spending by almost a third. We found that the additional spending can be attributed to more prescription fills and higher cost fills among LIS enrollees compared to non-LIS enrollees. We acknowledge that these differences in drug use are measured at an aggregate level and do not account for therapeutic class or brand/generic status. However, the findings broadly suggest that LIS may be associated with greater adherence and use of more expensive prescription drugs implying that LIS may, in fact, improve access to prescription drugs. This also implies a negative societal effect in that recipients may be prescribed drugs inefficiently by filling more expensive drugs. Future research should examine this issue.

While this study provides a first look at the impact of LIS status on drug spending among LIS eligible Part D enrollees, there are limitations. First, data availability limited our ability to identify LIS eligibility with complete accuracy in the MCBS. As part of our analysis we enhanced the reliability of income data and accounted for asset holdings by using the I&A supplemental file that is not regularly available in the MCBS. Still, potential error in identifying the eligible population remains. The likelihood of error in eligibility assignment increases closer to the income and asset eligibility thresholds. In order to test the effect of potential measurement error, a sensitivity analysis was conducted excluding observations within income ranges close to the eligibility thresholds. The results were robust to this sensitivity analysis.

CONCLUSIONS

A substantial portion of putatively LIS eligible beneficiaries are enrolled in Part D without receiving the subsidy. The greater cost-sharing faced by Part D enrollees without the LIS is associated with significantly lower total Part D spending, reflecting probable unmet need for a vulnerable population. The lack of access to prescription drugs can have long term implications for individual health and ultimately, be costly to societal welfare. Changes in program design or greater outreach efforts should be made to improve LIS take-up rates in order to reduce financial barriers to prescription drugs for low income beneficiaries.

Chapter 7: The Role of Health Shocks in Late Part D Enrollment

This chapter provides the manuscript used to answer research question 3: does experiencing a health shock affect demand for Part D among beneficiaries who initially declined coverage?

Background

Introduction

At present, the Medicare Part D benefit provides drug coverage to over half of the Medicare population. In 2006, nearly all Medicaid and Medicare Advantage enrollees transitioned into Part D. Most beneficiaries who were previously enrolled in non-creditable drug coverage also took up the drug benefit and a small degree of employer-sponsored crowd-out was reported [3, 20, 59, 162]. However, the primary goal of the program was to expand coverage to nearly one-third of the Medicare population who lacked it [1]. While mostly successful in doing so, approximately 10% of beneficiaries remained without creditable drug coverage by the end of Part D's inaugural year. Current literature evaluates enrollment in the early stages of the program and has not evaluated changes in subsequent beneficiary enrollment decisions among those who did not initially participate in Part D.

Part D Policy

Similar to other insurance benefits, the viability of Part D is dependent upon risk pooling [163]. This rationale requires that healthy individuals enroll prior to health decline in order to subsidize current high cost enrollees. As such, Part D was designed to encourage all healthy and unhealthy beneficiaries without other creditable drug coverage to participate.

Specific aspects of the policy design include restricted enrollment periods and a financial penalty for late enrollment. The initial enrollment period, during which all beneficiaries had the first opportunity to enroll in Part D, took place from November 15, 2005 to May 15, 2006. After this time, most beneficiaries were only able to newly enroll or modify Part D coverage during a 6-week period at the end of each year, known as the open enrollment period. Any change in benefit begins January 1st of the following calendar year. Additionally, beneficiaries who did not enroll in Part D during the initial enrollment period and did not have other creditable coverage face a financial penalty if they choose to enroll in a subsequent enrollment period. This penalty is permanent and takes the form of an added 1% to the plan premium for each month of delayed enrollment [24].

Low Income Subsidy (LIS) recipients are exempt from these policies. Beneficiaries who qualify for the LIS upon Part D enrollment based on income and assets criteria do not face a late enrollment penalty and are allowed to enroll at any time [27].

Additionally, certain non-LIS eligible beneficiaries are granted Special Enrollment Periods (SEP) during which they may enroll outside of traditional open enrollment periods. The duration of SEPs vary by eligibility criteria. Beneficiaries who involuntarily lose drug coverage from another creditable source are granted a 2-month window to enroll in Part D without penalty. Other eligibility criteria include being impacted by Hurricane Katrina, Wilma, and Rita[17], transitioning in or out of a skilled nursing or long term care facility (for the duration in the institution and two months following discharge), loss of Medicaid eligibility, change of residence, and involvement with a State Pharmaceutical Assistance Program (SPAP) or Special Needs Plan (SNP) [27].

[17] Hurricane victims are also exempt from the late enrollment penalty.

Theoretical Framework: Demand for Part D

Insurance is obtained, in part, to help cover expenses that are expected to be incurred. To understand Part D participation decisions it is also important to consider a critical assumption of conventional insurance demand theory. Theory states that individuals purchase insurance to protect from uncertainty of loss due to unanticipated negative health events, i.e. "health shocks". Accordingly, the enrollment decision depends on individual risk preferences, in addition to expected spending. Part D policy is designed to increase cost of non-enrollment by imposing a penalty on delayed enrollment and forcing late enrollees to wait to obtain coverage. As a result, if healthy beneficiaries decline Part D and later realize the need to take prescription drugs then they must wait until the following open enrollment period and face a higher premium. This complicates the enrollment decision and forces a long term perception of risk. Beneficiaries must consider the tradeoff between paying the premium and having protection against risk with no immediate benefit versus the savings from not paying for insurance in the short run, but incurring a penalty upon future enrollment. Consequently, risk adverse beneficiaries are likely to perceive a greater benefit in timely enrollment regardless of current health status. On the other hand, individuals who expect low drug expenses and are risk tolerant, highly discount the future, or lack the disposable income may not participate in Part D. A preference for use of non-prescription alternative medicine such as homeopathy, herbal medication, and chiropractic therapy, is common among the elderly and may also cause beneficiaries to decline coverage [164, 165].

Empirical Evidence: Demand for Part D

Despite policies in place to encourage timely enrollment, a substantial portion of uninsured beneficiaries chose to forego Part D its first year. When the enrollment period closed

in the May 2006, nearly 5 million beneficiaries remained without a known source of creditable drug coverage [19, 24]. Consistent with theory, many beneficiaries who declined Part D generally reported good health and low demand for prescription drugs [19, 56, 61, 65]. This literature suggests that most beneficiaries without prior coverage who expected to benefit from drug coverage did enroll. However, future declines in health and consequent increases in drug expenses are uncertain. A study conducted by Vetter and colleagues (2012) used 2006 national survey data on Medicare beneficiaries to assess the relationship between risk aversion and the Part D enrollment decision. Risk aversion was measured using hypothetical lottery questions. Findings suggested that beneficiaries determined to be risk tolerant were less likely to enroll in Part D. This calls into question the effectiveness of the policy design in encouraging healthy beneficiaries to enroll.

While many beneficiaries initially declined Part D, subsequent experience of a health shock may effectively shift their risk perception, preference for healthcare, or expected drug spending, and thus, induce a change in Part D demand. We evaluate this hypothesis by examining the role of health shocks on late Part D enrollment among Medicare beneficiaries who declined coverage during the initial enrollment period. This study also evaluates the effect of timing of the health shock on the enrollment decision because health shocks can occur at any time during the year but, for most non-LIS recipients, Part D enrollment is restricted to certain times of the year for coverage to begin the following January. It is possible that a delay from the time of the health shock to availability of coverage affects the enrollment decision because the acquired condition may have been resolved or the expected need for medication therapy did not materialize. LIS recipients are permitted to enroll at any time and so their enrollment decision should not be affected by the time of the health shock.

Methods

Data and Study Population

We used Medicare Chronic Condition Warehouse (CCW) data from 2006 to 2008 for a 5% random sample of beneficiaries. The CCW contains information on Medicare plan enrollment, fee-for-service Part A and B medical claims, and Part D drug claims from January 1, 2006 to December 31, 2008[18].

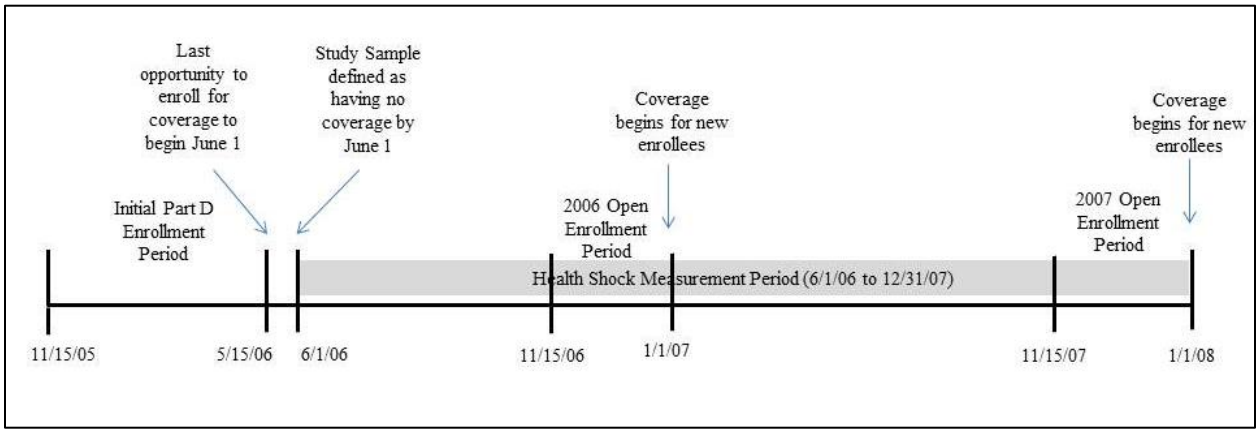
We analyzed 2 samples of Medicare beneficiaries. The first sample consisted of beneficiaries with (1) both Part A and B coverage from January 1, 2006 to the end of the study period and (2) no missing administrative data. This sample consisted of approximately 2.1 million beneficiaries.

The sub-sample, which was used in our analysis of late Part D enrollment, excluded beneficiaries (3) with drug coverage from any source as of July 1, 2006, (4) who subsequently obtained non-Part D coverage, (5) enrolled in Medicare Advantage (MA) prior to incurring a health shock, and (6) who experienced a health shock during the initial enrollment period (January 1, 2006 to May 15, 2006). We excluded beneficiaries who obtained non-Part D drug coverage because of our focus on Part D policy, which was the only insurance benefit available to all beneficiaries. MA enrollees were excluded because they did not generate Part A or B claims which are necessary to identify health shocks. Beneficiaries who experienced a health shock prior to June 2006 and enrolled after that date would mistakenly be classified in the comparison group of healthy beneficiaries, diluting the estimated effect of a health shock on late enrollment.

[18] The CCW data are subject to administrative processing errors due to difficulties in working with new large administrative data. Data anomalies are more likely to be expected in 2006, the first year for which the data was processed [166. Buccaneer, A.V.C., *Chronic Condition Data Warehouse Part D Data User Manual* 2010.].

Figure 5 presents the study timeline. The Part D Initial Enrollment Period ended May 15, 2006. Beneficiaries who enrolled before May 15th began coverage in the next month. Therefore, all beneficiaries who were not eligible for LIS or SEPs and remained without coverage by June 1, 2006 were subject to the late enrollment penalty if they enrolled after this time. We followed beneficiaries who were without creditable drug coverage as of June 1, 2006 to observe enrollment choices up to January 1, 2008.

Figure 5 Study Timeline Depicting Part D Enrollment Periods and Observation Time



Key Measures

Health Shock

We defined health shocks as hospital admissions resulting in a diagnosis of a drug-intensive chronic condition. We focused on hospital admissions because they serve as an acute event that reflects an unexpected change in health status. Health shocks were identified using the date of inpatient admission between June 1, 2006 and December 31, 2007. Admissions without a date of discharge were excluded. Diagnoses for drug-intensive conditions were identified based on prescription drug hierarchical condition categories (RxHCCs). RxHCCs were developed by

CMS to predict drug spending risk[19]. The list of RxHCC is presented in Appendix 1 and the associated ICD-9 codes can be found at the CMS website [168].

Health shocks were operationalized as a categorical variable based on the occurrence of a hospital admission resulting in a diagnosis that is considered to be an RxHCC. The categories were defined as follows: (1) zero RxHCC-related hospital admissions, (2) one RxHCC-related hospital admission, and (3) greater than one RxHCC-related hospital admission. .

We used the health shock definition to define an index month for each beneficiary. The period following the index month is when potential late Part D enrollment is measured. The index month was defined as the month in which the initial RxHCC-related hospitalization occurred for beneficiaries who experienced an RxHCC-related hospitalization. Beneficiaries who did not experience an RxHCC-related hospitalization (i.e. control group) during the study period were assigned an index month based on the distribution of months in which RxHCC-related hospitalizations occurred among beneficiaries who experienced an RxHCC-related hospitalization (approximately 4-8% each month from July 2006 to December 2007).

Prescription Drug Coverage

Prescription drug coverage was measured using Medicare monthly administrative enrollment records. We identified late Part D enrollment as any evidence of Part D between the index month and January 2008. LIS receipt in conjunction with Part D enrollment was also identified. We defined LIS status based on evidence at the first month of Part D enrollment following the index month.

[19] The condition categories are included in a model to predict beneficiary drug spending which generates estimated coefficients representative of the association with drug spending. The diagnostic codes used to identify RxHCCs for this analysis are based on the 2006-2010 Part D risk adjustment model. A new risk adjustment model was implemented in 2011 [167. Services, C.f.M.a.M., *Medicare Advantage Rates & Statistics*. 2010.].

Duration between Index Month and Following January

For non-LIS recipients and beneficiaries not granted a SEP, any new Part D coverage period begins in January of the following year. To measure the duration between the initial health shock and next opportunity for coverage we calculated the number of months between the health shock and the following January. If a health shock occurred between June 2006 and December 2006, we counted the number of months from the month of health shock to January 2007. Likewise, for health shocks that occurred January to December 2007, we counted the number of months from the month of health shock to January 2008.

Covariates

We also identified other factors likely to affect the decision to enroll in Part D. We measured baseline beneficiary demographic characteristics (sex, age, race, region of residence) and number of chronic conditions. We also identified death and entrance into a long term care or skilled nursing facility (SNF) occurring after the index month. We adjusted for death in order to account for censoring. We adjusted for facility entrance because it is probable that enrollment is facilitated in a facility setting, particularly because facility residents are granted a SEP. Preference for health is also a likely factor in the decision to obtain drug coverage. To proxy these preferences we captured receipt of four health care preventive measures using binary indicators for: influenza vaccinations, colorectal cancer screening, prostate cancer screening (reference group is men without prostate cancer screening + women), and mammography screening or pap smears (reference group is women without mammography/pap smear + men).

Demographic factors were measured using Medicare enrollment records. Baseline conditions (occurring prior to 2006) were captured using CCW defined variables and the first

date of diagnosis. We identified date of death and SNF stays using Medicare records. Nursing home admissions were captured using procedural Healthcare Common Procedure Coding (HCPC) and place of service claims codes in Part B claims [169]. Use of preventive behaviors was identified using HCPC codes identified in the Part B claims records.

CCW data lack individual socio-demographic information. As an alternative, we capture contextual influences obtained at the zip-code level from the Spatial Impact Factor Database, a public use database generated by RTI [170]. Using variables based on the 2000 census we characterized educational attainment and English language proficiency for persons aged 65 or older.

Finally, we captured other area level characteristics to reflect access to healthcare coverage and services. We used the 2009 Area Resource File (ARF) data, a publically available dataset produced by the Health Resources and Services Administration, to capture presence of a federally qualified health center (FCQH), and the number of physicians per capita in each beneficiary's county of residence. Using state level data assembled by the Kaiser Family Foundation, we also identified the presence of medically needy programs, qualified State Pharmaceutical Assistance Programs, and the lowest PDP premium available in each state.

Statistical Analysis

Using the first study sample (N~2.1 million), we characterized drug coverage choices within the Medicare population during the study period. We calculated the proportion of beneficiaries who were continuously enrolled in Part D, Retiree Drug Subsidy (RDS) or other creditable coverage, or without creditable coverage over the 3-year study period. Additionally, we categorized coverage transitions. We identified two groups of beneficiaries transitioning into

Part D after June 2006, including those transitioning from no previous coverage and those from previous RDS or other creditable coverage. We categorized all other possible transitions as Part D-related and not Part D-related.

Using the analytic sub-sample, we focused on beneficiaries who declined Part D during their initial enrollment period and did not have any other source of creditable drug coverage by June 2006. The sample exclusion criteria are presented in Figure 7. This final sample consisted of 207,674 beneficiaries. We described characteristics of the sample overall and stratified by Part D enrollment. Bivariate tests were used to compare sample proportions between late Part D enrollees and non-enrollees.

We used multivariable logistic regression to examine the impact of an RxHCC-related hospitalization on the probability of late Part D enrollment. The dependent variable was a binary indicator for enrollment into Part D after the index month relative to remaining without drug coverage. The main independent variable was the presence of a RxHCC-related hospitalization relative to not experiencing a RxHCC-related hospitalization during the study period (eq. 1). Other covariates included all variables listed in Table 1. Estimated coefficients in multivariable results were transformed to reflect the change in the marginal probability of enrollment.

(Eq. 1) $\Pr[Late\ Part\ D] = \alpha + \beta Health\ Shock + X'\beta + \mu$

To gain insight into the amount of time that passed between an RxHCC-related hospitalization and Part D enrollment, we compared the distribution of months between the index month and enrollment for Part D enrollees with and without the LIS.

Most non-LIS Part D enrollees began coverage in the January following the period in which they enrolled. But, certain groups of beneficiaries were granted SEPs which made

coverage available at other times of the year. We assessed the extent to which beneficiaries enrolled in Part D under a SEP by observing the proportion of non-LIS beneficiaries in our analytic sample who obtained Part D coverage during each month.

Next, we tested whether the timing of an RxHCC-related hospitalization influenced the probability of enrollment among those who experienced a health shock. First we conducted bivariate tests to compare proportions of beneficiary characteristics across two sample groups: (1): Part D No LIS compared to no drug coverage and (2): Part D LIS compared to no drug coverage. Next, to examine the effect of RxHCC-related hospitalization timing on Part D enrollment, and test for different effects among non-LIS Part D enrollees and LIS recipients, we estimated 2 logistic regression models predicting enrollment among beneficiaries who experienced an RxHCC-related hospitalization. The main independent variable of interest in both models was count of months between the health shock and the following January operationalized in categorical ranges. The open enrollment period takes place during the last 2 months of the year (November and December), and therefore would be represented in months 0 and 1 from RxHCC-related hospitalization to the following January. The dependent variable in the first model was Part D without LIS relative to no creditable coverage (eq. 2). The dependent variable in the second model was Part D with LIS relative to no creditable coverage (eq. 3.). Other covariates are listed in Table 4.

(Eq.2)

$$\Pr[Late\ Part\ D|\ LIS = 0] =$$

$$\alpha + \beta Months\ from\ \text{RxHCC} - \text{related hospitalization}\ to\ January + X'\beta + \mu$$

(Eq.3)

$$\Pr[Late\ Part\ D\ |No\ LIS = 0] =$$

$$\alpha + \beta Months\ from\ \text{RxHCC} - \text{related hospitalization}\ to\ January + X'\beta + \mu$$

Three sensitivity analyses were conducted. First, in order to assess the generalizability of our findings to private sources of coverage we analyzed the effect of RxHCC-related hospitalizations on enrollment into RDS or other creditable drug coverage among beneficiaries with no previous creditable coverage. Second, we considered that each observation has distinct index months and therefore different follow-up times to observe additional RxHCC-related hospitalizations. To test the effect of differential follow-up times we estimated a model based on (eq. 1) excluding additional RxHCC-related hospitalization as a covariate. Third, we created and tested other approaches to operationalize RxHCC-related hospitalization, including an indicator for any hospital admission and an indicator using only the top 25^{th} percentile of RxHCCs predictive of drug spending. These tests were conducted to determine if the estimated effect was not specific to using all RxHCC condition categories.

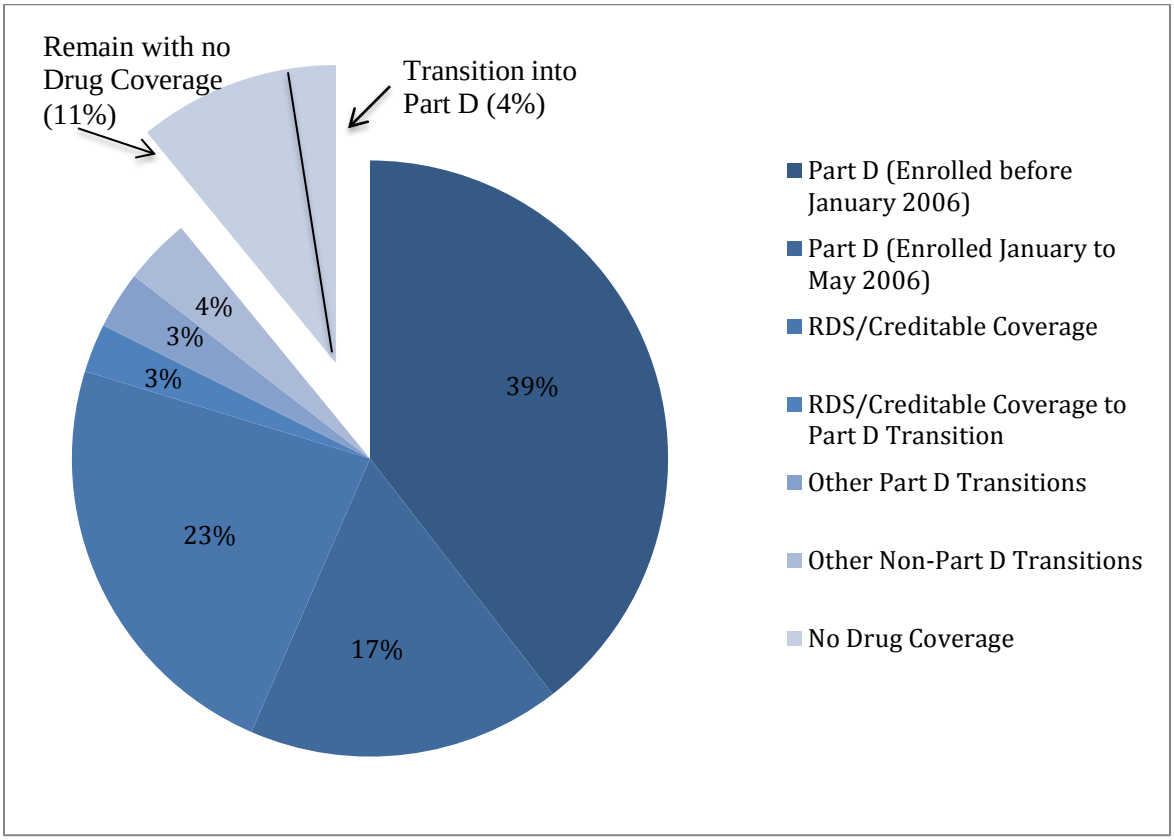
All analyses were conducted using SAS 9.2 and STATA 11. The study protocol was approved by the University of Maryland Baltimore Institutional Review Board.

Results

Figure 6 presents sample proportions of drug coverage sources from 2006 to 2008 among the first study sample of approximately 2.1 million beneficiaries. Approximately 56% of the population was continuously enrolled in Part D, 39% enrolled by January 2006 and 17% enrolled between January and May 2006. About 23% of the sample had continuous RDS or other creditable coverage and 3% transitioned from RDS or creditable coverage into Part D. Another

3% and 4% experienced other Part D and non-Part D transitions, respectively. The analytic sample is represented in the remaining 15% who had no drug coverage by June 2006, consisting of 4% who enrolled late into Part D and 11% who maintained no drug coverage throughout the study period.

Figure 6 Drug Coverage among Medicare Beneficiaries 2006 to 2008



Next, we focused on the analytic sub-sample of beneficiaries without creditable drug coverage by June 2006. Individual characteristics are presented in Table 11. About 18% of the sample enrolled into Part D after their index month and the balance remained without creditable drug coverage. More enrollees experienced an RxHCC-related hospitalization compared to non-enrollees (31% v 24%). Enrollees also tended to have more chronic conditions at baseline, have additional RxHCC-related hospitalizations, used more preventive services, and entered a facility

compared to non-enrollees. All differences were statistically significant at $p<0.01$ except FQCH in state and number of primary physicians.

Figure 7 Sample Selection Criteria for Aim 3 Analytic Sample

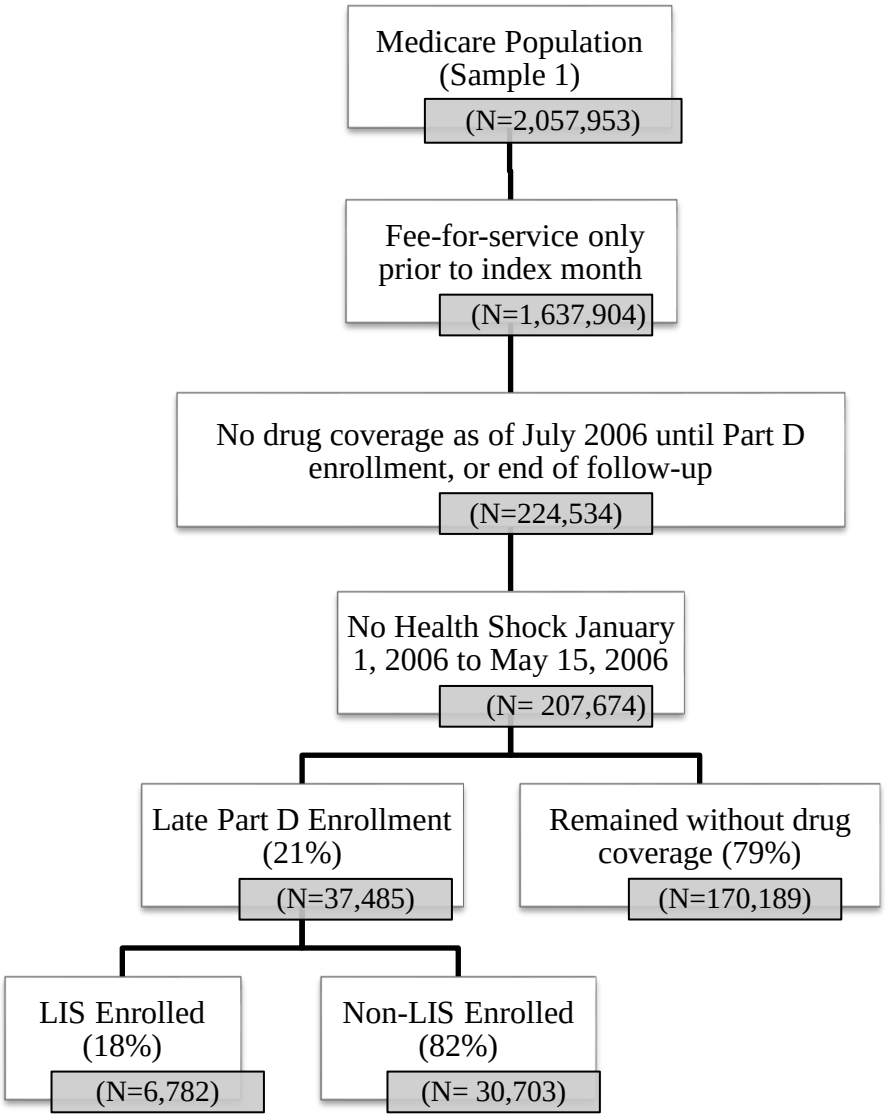


Table 11 Characteristics of Medicare Beneficiaries with No Creditable Drug Coverage after the Initial Part D Enrollment Period, by Late Part D Enrollment (N=207,674)

Characteristics	Total	Late Part D	No Drug Coverage
RxHCC-related hospitalization	25%	31%	24%
Additional RxHCC-related hospitalization	9%	13%	8%
Sex			
Female	65%	66%	65%
Male	35%	34%	35%
Age			
<65 and SSDI	12%	14%	12%
65 to 74	41%	42%	41%
75 to 84	31%	30%	32%
85+	15%	14%	15%
Age 65+ and Former SSDI	5%	6%	4%
Race			
White	89%	86%	90%
Black	7%	9%	7%
Hispanic	1%	1%	1%
Other	3%	4%	3%
Region			
Midwest	26%	22%	26%
Northeast	20%	28%	18%
South	37%	35%	38%
West	17%	15%	17%
Mortality Status at End of Follow-up			
Dead	8%	2%	9%
Alive	92%	98%	91%
Facility Entrance			
Yes	6%	9%	5%
No	94%	91%	95%
Baseline Comorbidities			
None	24%	22%	25%
1 to 3	49%	49%	49%
4 or more	26%	29%	26%
Preventive Services			
Influenza vaccine	45%	50%	44%
Mammography/Pap Smear	29%	32%	29%
PSA	13%	14%	13%
Colorectal Cancer Screening	14%	15%	14%
Contextual Measures			

Qualified SPAP	43%	47%	42%
Medically Needy program	76%	79%	76%
Presence of FQHC	50%	50%	50%
Lowest PDP Premium (mean)	9.85	9.58	9.90
No. of Primary Care Physicians			
0 to 3 (ref)	36%	35%	36%
4 to 6	31%	31%	31%
7+	33%	34%	33%
Speaks Poor or No English	18%	19%	18%
Education as % of 65+ Population			
Less than High School	34%	35%	34%
High School	32%	33%	32%
Some College	18%	17%	18%
College Graduate	9%	9%	9%
Post College Education	7%	6%	7%

Note: All differences statistically significant at $p<0.01$ except FQCH in state and number of primary physicians; facility entrance is a binary indicator reflecting whether or not a beneficiary entered a long-term care facility following the initial RxHCC-related hospitalization (or index month)

Results from the multivariable analysis to assess the impact of RxHCC-related hospitalizations on late Part D enrollment are presented in Table 12. A single RxHCC-related hospitalization and additional RxHCC-related hospitalization were associated with 5% and 7% change in the probability of Part D enrollment, respectively ($p<0.01$). Admission to a facility, female gender, former and present SSDI status, younger age, and minority race were associated with an increased probabilities of enrollment. The presence of baseline chronic conditions and use of preventive services (except colorectal screening) are also positively associated with late enrollment. Presence of a qualified SPAP or FQHC reduced the likelihood of enrollment. But, a medically needy program was associated with a modest increase in the likelihood of enrollment ($p<0.01$).

Table 12 Factors Associated with Late Part D Enrollment among with Medicare Beneficiaries with No Creditable Drug Coverage after the Initial Part D Enrollment Period (N=207,674)

Characteristics	Marginal Probability of Part D Enrollment
RxHCC-related hospitalization	0.05**
Additional RxHCC-related hospitalization	0.07**
Sex	
Female (ref)	
Male	-0.01**
Age	
<65 and SSDI	0.01**
65 to 74 (ref)	
75 to 84	-0.02**
85+	-0.02**
Age 65+ and Former SSDI	0.02**
Race	
White (ref)	
Black	0.06**
Hispanic	0.05**
Other	0.06**
Region	
Midwest (ref)	
Northeast	0.11**
South	0.01**
West	0.01**
Mortality Status at End of Follow-up	
Dead	-0.16**
Alive (ref)	
Facility Entrance	
Yes	0.11**
No (ref)	
Baseline Comorbidities	
None (ref)	
1 to 3	0.01**
4 or more	0.03**
Preventive Services	
Influenza vaccine	0.02**
Mammography/Pap Smear	0.01*
PSA	0.03**
Colorectal Cancer Screening	-0.00

Contextual Measures	
Qualified SPAP	-0.02**
Medically Needy program	0.01**
Presence of FQHC	-0.01**
Lowest PDP Premium (mean)	0.00
No. of Primary Care Physicians	
0 to 3 (ref)	
4 to 6	0.00
7+	0.01
Speaks Poor or No English	0.01*
Education as % of 65+ Population	
Less than High School (ref)	
High School	0.02*
Some College	-0.05**
College Graduate	-0.10**
Post College Education	0.02

*p<0.05, **p<0.01

Results from the three sensitivity analyses consistently resulted in statistically significant positive relationships between RxHCC-related hospitalizations and late enrollment. We found that RxHCC-related hospitalizations were associated with a 4% increase in the probability of late enrollment into RDS or other creditable drug coverage. Excluding additional RxHCC-related hospitalizations as a covariate in the analysis of late Part D and only including a binary measure for the initial RxHCC-related hospitalization (based on eq. 1) resulted in an estimated 7% change in marginal probability. Thirdly, testing other approaches to operationalize RxHCC-related hospitalizations resulted in positive effects on Part D enrollment (6% using any hospitalization; 8% using the top 25th percentile of RxHCCs).

A descriptive comparison of the mean and median number of months between the index month and Part D enrollment by LIS status and observed RxHCC-related hospitalizations are presented is Table 13. Overall, the mean number of months between the index month and

obtaining Part D was lower among LIS recipients compared to non-recipients (5.24 vs. 6.72). Enrollees who experienced an RxHCC-related hospitalization enrolled in less time compared to enrollees who were assigned an index month (4.61 vs. 6.32). Among enrollees with an observed RxHCC-related hospitalization, LIS recipients enrolled over one month sooner than non-LIS enrollees (4.61 vs. 6.32). There was less of a difference by LIS status among enrollees with an assigned index month (5.78 vs. 6.87).

Table 13. Number of Months from Index Month to Part D Enrollment, by Observed RxHCC-related Hospitalization and LIS Receipt, among those with Late Part D Enrollment (N=37,485)

No. Months from Index to Part D Enrollment	Overall	Part D no LIS	Part D LIS
Overall			
Proportion (row %)	100%	82%	18%
Mean (std. dev.)	6.46 (5.04)	6.72 (5.11)	5.24 (4.49)
Median	5	6	4
Observed RxHCC-related hospitalization			
Proportion (row %)	100%	73%	27%
Mean (std. dev.)	5.86 (4.61)	6.32 (4.74)	4.61 (3.95)
Median	5	5	4
Assigned RxHCC-related hospitalization			
Proportion (row %)	100%	86%	14%
Mean (std. dev.)	6.72 (5.19)	6.87 (5.24)	5.78 (4.84)
Median	6	6	4

Figure 8 shows the distribution of non-LIS recipients who obtained Part D coverage during each month over the period of June 2006 to January 2008 (N= 30,703). As expected, coverage began in January 2007 and January 2008 for the majority of enrollees (37% and 32%, respectively). There was also a spike in enrollment in July 2007 (13%). The remainder of enrollees (18%) obtained coverage at consistently low rates during the rest of the year.

Figure 8 Proportion of Beneficiaries Enrolled in Part D during each Month of the Study Period, among Medicare Beneficiaries without Creditable Drug Coverage by June 2006 (N= 30,703)

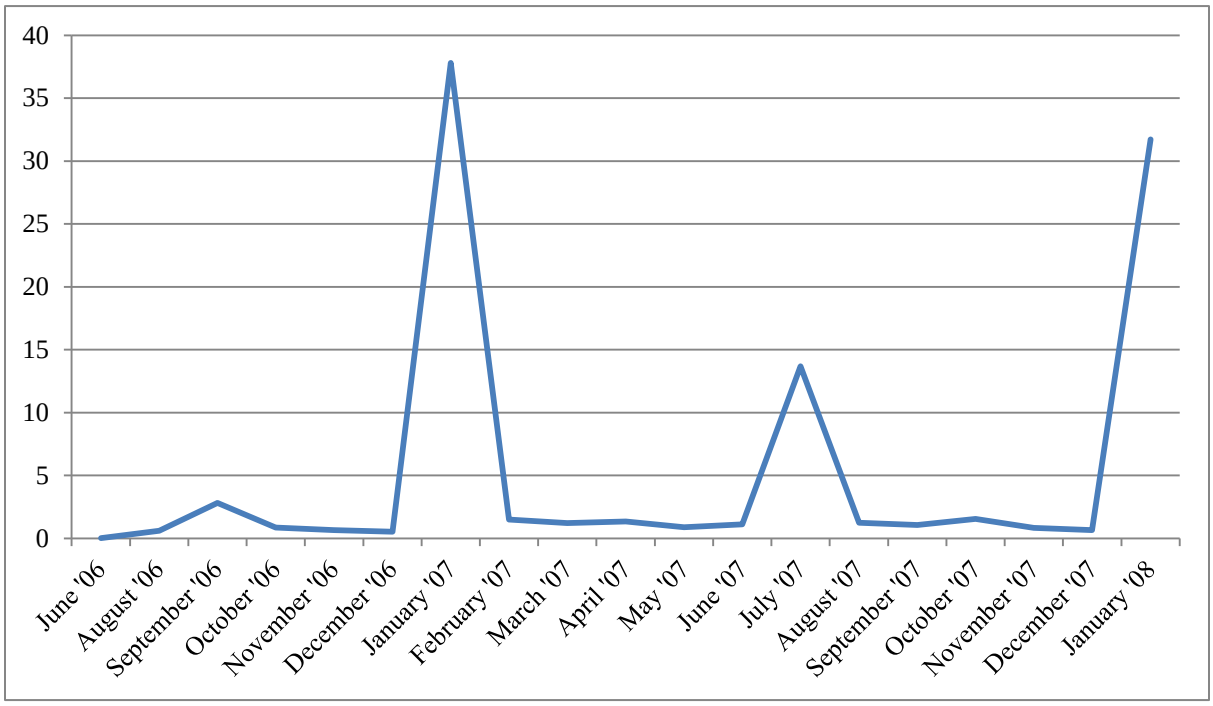


Table 14 displays characteristics of the study sample restricted to beneficiaries who experienced an RxHCC-related hospitalization (N= 51,799). About 16% (N= 8,373) enrolled in Part D with no LIS and 6% (N= 3,092) enrolled in Part D with LIS. . More non-LIS Part D enrollees (20% vs. 15%) enrolled during this time compared to LIS enrollees. LIS enrollees tended to be current or former SSDI status, minority race, enter a facility, have less baseline chronic conditions, and used less preventive services compared to non-LIS enrollees and non-enrollees.

Table 14 Characteristics of Medicare Beneficiaries with no Creditable Drug Coverage after the Initial Part D Enrollment Period who Experienced a RxHCC-related Hospitalization, by No Drug Coverage, Late Part D, and LIS Enrollment (N= 51,799)

Characteristics	Overall	No Drug Coverage	Part D No LIS	Part D LIS
	%/Mean	%/Mean	%/Mean	%/Mean
Total %	100%	78%	16%	6%
No. of Months from Index Month to Following January				
0 to 1	19%	19%	20%	15%
2 to 4	33%	33%	34%*	35%
5 to 9	33%	33%	32%	34%*
10 to 12	15%	15%	14%*	16%*
Additional RxHCC-related hospitalization	35%	33%	40%	51%
Sex				
Female	67%	67%	66%	69%
Male	33%	33%	34%*	31%*
Age				
<65 and SSDI	9%	9%	10%	20%
65 to 74	29%	28%	34%	23%
75 to 84	37%	38%	36%	32%
85+	25%	26%	20%	26%*
Age 65+ and Former SSDI	6%	6%	7%	9%
Race				
White	92%	92%	90%	78%
Black	6%	6%	7%	16%
Hispanic	1%	1%	1%*	3%
Other	2%	2%	3%*	3%
Region				
Midwest	27%	28%	23%	27%
Northeast	21%	19%	32%	21%
South	37%	37%	34%	41%
West	15%	15%	12%	11%
Mortality Status at End of Follow-up				
Dead	26%	31%	5%	7%
Alive	74%	69%	95%	93%
Facility Entrance				
Yes	23%	21%	23%	50%
No	77%	79%	77%	50%
Baseline Comorbidities				
None	12%	11%	14%	21%
1 to 3	43%	43%	45%	40%

4 or more	45%	46%	41%	39%
Preventive Services				
Influenza vaccine	48%	48%	55%	31%
Mammography/Pap Smear	26%	26%	29%	15%
PSA	13%	13%	15%	9%
Colorectal Cancer Screening	13%	13%	15%	8%
Contextual Measures				
Qualified SPAP	45%	43%	51%	44%*
Medically Needy program	77%	76%	80%	76%*
Presence of FQHC	50%	50%	49%	50%*
Lowest PDP Premium (mean)	9.9	9.94	9.43	10.32
No. of Primary Care Physicians				
0 to 3 (ref)	35%	35%	33%	36%
4 to 6	32%	32%	32%*	31%
7+	33%	33%	35%	33%
Speaks Poor or No English	18%	18%	18%*	19%
Education as % of 65+ Population				
Less than High School	33%	33%	34%	39%
High School	33%	33%	33%*	32%
Some College	18%	18%	17%	16%
College Graduate	9%	9%	9%	7%
Post College Education	7%	7%	6%*	5%

Note: T-tests conducted to compare Part D no LIS and Part D LIS enrollment to non-enrollment samples; * denotes insignificant differences across groups, all other comparisons are significant at $p<0.01$.

Multivariable results are displayed in Table 15. For non-LIS enrollees, a greater number of months between the RxHCC-related hospitalization and the following January was associated with a decreased likelihood of enrollment. Ranges of 0 to1, 2 to 4, and 5 to 8 were associated with 2.3%, 2.2%, and 1% increase in the probability of enrollment compared to 9 to 12 months from the time of RxHCC-related hospitalization, respectively. Additional RxHCC-related hospitalizations and facility entrance were associated with 5.4% and 3.2% increased probabilities of enrollment, respectively ($p<0.01$). Minority race (except Hispanic) and northeast and southern residence increased the likelihood of Part D enrollment with no LIS.

For LIS recipients, the time of the RxHCC-related hospitalization had no effect on the probability of enrollment. Other strong factors that were positively associated with enrollment into LIS were additional RxHCC-related hospitalizations, facility entrance, current and former SSDI status, and minority race. Use of preventive services and presence of baseline comorbidities had a negative effect on Part D enrollment**.**

Table 15 Impact of RxHCC-related Hospitalization Timing on Late Part D Enrollment among Medicare Beneficiaries with No Creditable Drug Coverage following the Initial Part D Enrollment Period who Experienced an RxHCC-related Hospitalization

	Marginal Probability of Enrollment	
Characteristics	**Part D No LIS**	**Part D LIS**
N=	48,707	43,426
No. of Months from Index Month to Following January		
0 to 1	0.023**	-0.004
2 to 4	0.022**	0.004
5 to 8	0.010*	0.002
9 to 12 (ref)		
Additional RxHCC-related hospitalization	0.054**	0.020**
Sex		
Female (ref)		
Male	0.003	-0.009**
Age		
<65 and SSDI	-0.022**	0.040**
65 to 74 (ref)		
75 to 84	-0.014**	0.001
85+	-0.012**	0.003
Age 65+ and Former SSDI	0.011	0.019**
Race		

White (ref)		
Black	0.025**	0.043**
Hispanic	0.017	0.098***
Other	0.035**	0.027**
Region		
Midwest (ref)		
Northeast	0.107**	0.010**
South	0.012**	0.002
West	-0.004	-0.003
Mortality Status at End of Follow-up		
Dead	-0.191**	-0.061**
Alive (ref)		
Facility Entrance		
Yes	0.032**	0.080**
No (ref)		
Baseline Comorbidities		
None (ref)		
1 to 3	-0.030**	-0.019**
4 or more	-0.037**	-0.019**
Preventive Services		
Influenza vaccine	0.007*	-0.021**
Mammography/Pap Smear	-0.012**	-0.020**
PSA	-0.001	-0.009**
Colorectal Cancer Screening	0.001	-0.007**
Contextual Measures		
Qualified SPAP	-0.015**	-0.004*
Medically Needy program	0.007	0.003*
Presence of FQHC	-0.009**	-0.001*
Lowest PDP Premium (mean)	-0.021**	0.008*

No. of Primary Care Physicians		
0 to 3 (ref)		
4 to 6	0.005	0.000
7+	0.008*	0.000
Speaks Poor or No English	0.013	0.004
Education as % of 65+ Population		
Less than High School (ref)		
High School	0.017	-0.033**
Some College	-0.034	-0.021
College Graduate	-0.090**	-0.042*
Post College Education	0.007	-0.023**

*p<0.05, **p<0.01

Discussion

Timely enrollment, regardless of current health status, ensures availability of penalty-free Part D coverage. Atherly and Dowd (2009) showed that timely enrollment was more cost-effective over a lifetime for beneficiaries than if enrollment was delayed until acquiring a chronic condition [49]. Yet, millions did not enroll in the drug benefit. Early studies showed that beneficiaries generally made rational, but perhaps myopic choices related to their drug expenses in the initial enrollment decision [53]. Using multiple years of Part D data, we assessed whether or not some beneficiaries delayed enrollment until coverage was needed, despite policies to discourage such behavior.

We examined a group of beneficiaries who initially declined Part D. In theory, insurance is declined based on low expected spending and low aversion to risk. Evidence suggests that

non-enrollees used comparatively fewer prescription drugs, were healthier, and exhibited a greater risk preference compared to enrollees [19, 50, 56, 61].

However, while risk tolerance may have led some non-enrollees to discount the probability of future health shocks, based on our findings about one-quarter experienced one. Overall, those who experienced a health shock were more likely to later participate in Part D compared to those who did not.

There are multiple reasons that Part D enrollment may be affected by admission to a hospital beyond a change in perceived demand for prescription drugs. For example, it is possible that enrollment may be facilitated in a hospital setting due to discharge counseling or onsite Medicaid or LIS enrollment. Study results also suggested that facility entrance, baseline chronic conditions, and the use of preventive services were also strong predictors of late Part D enrollment. Facility residence qualifies beneficiaries for a SEP so that they are able to enroll at any time. Nursing homes may also facilitate enrollment as resources are available to aid in the process and nursing homes are legally at risk of paying for medications that residents cannot afford. Additionally, nursing home residents tend to be of lower economic status and may qualify for the LIS [171].

Contextual factors appeared to play a role in late enrollment also. Presence of a qualified SPAP or FQHC in the state of residence had a negative effect on Part D enrollment. SPAPs generally require recipients to enroll in Part D and will provide wrap-around benefits. If an enrollee does not qualify for the LIS they are still liable for a portion of the cost sharing which may be an unintended barrier to enrollment. FQHCs may represent a potential substitute for Part D. On the other hand, the positive association between enrollment and residing in a state with a

Medically Needy program may be due to the fact that these programs prepared states to be well equipped for providing resources for LIS enrollment.

We found that the majority of late enrollees obtained non-LIS Part D in January of each year. However, a large portion also began coverage in July 2007. This coincides with the same month in which a major SPAP, Elderly Pharmaceutical Insurance Coverage (EPIC) of New York, first required participants to enroll in Part D. Prior to this month, EPIC was deemed an alternative source of creditable drug coverage. By September 2007, over 260,000 EPIC beneficiaries had enrolled in Part D [172]. To investigate this connection we compared beneficiary state of residence to July 2007 enrollees and found that over 90% resided in New York. However, a significant portion of remaining enrollees began coverage at other times of the year, suggesting that SEPs are common, although the reasons that individuals qualify are not observed.

However, most beneficiaries are subject to restricted enrollment periods and, as a result, it is not always possible to obtain coverage at the time of a health shock (unless LIS eligible). Our results indicate that a lag from the time of health shock to the next coverage period reduced the likelihood of enrollment among non-LIS recipients. On the other hand, another key goal of Part D policy was to ensure continuous access to drug coverage for low income beneficiaries by exempting them from restrictive policies. Consistent with policy objectives, we observed no relationship between the time of the health shock and LIS enrollment. We observed that LIS recipients waited slightly fewer months in between the index month and obtaining coverage, and that the lag was shorter among those who experienced a health shock. Nonetheless, LIS recipients did experience delays in obtaining Part D coverage from observed health shocks,

which suggests that there is room for improvement in the program's objective of ensuring timely access to coverage.

While we found that many beneficiaries who experienced health shocks later enrolled into Part D, many also chose to remain without drug coverage. Non-enrollees were forced to either absorb the full cost of prescription drugs or forgo them. Forgoing recommended therapies can not only have long term health implications, but may increase costs of traditional Part A and B Medicare services. As more years of data become available it will be possible to explore the effect of Part D policies on drug use and subsequent health outcomes. It is possible that penalizing the initial decision to decline Part D actually deters later enrollment. Future research is needed to identify an optimal penalty that effectively encourages on-time enrollment but is also not insurmountable at a time when late enrollment is appropriate.

Our results suggest that current Part D policy is not fully effective in motivating enrollment, which has important implications for other publically-subsidized insurance programs. Under the Affordable Care Act, individuals without health insurance are required to pay a penalty if they chose not to obtain coverage beginning in 2014. It can be expected that a nontrivial portion of individuals, with little or no expectation of using healthcare services and low aversion to risk will opt out of coverage and instead pay the penalty. Our findings suggest that many individuals will delay enrollment even after health shocks which raises questions about the size of the penalty.

Findings from this study should be viewed in light of the following limitations. First, operationalizing health shocks that are likely to drive change in drug insurance demand is complex. There is no way to know prospectively what specific factors will affect this decision.

We focused our analysis on the effect of hospital admissions resulting in a diagnosis of a drug-intensive chronic condition. This was a realistic, but arguably arbitrary measure. We tested the sensitivity of our measure by comparing our results against alternative measures, including hospitalizations for the highest 25th percentile of RxHCCs associated with drug spending and any hospitalization. However, there are other drug-intensive conditions or health shocks that would not be captured in a hospital setting. For example, cancer, depression, infections, and dermatological conditions constitute major diagnoses that are often realized in an outpatient setting. While it is likely that not all relevant factors affecting the Part D enrollment decision were captured, any misclassification of true health shocks occurring in the control group would bias the estimated effect to the null. As such, our results should be viewed as a lower bound of the potential effect of health shocks on late Part D enrollment.

Other weaknesses involve data availability. We hypothesize that beneficiaries initially decline Part D based on expected spending, preference for health, and risk tolerance. We are not able to observe risk attitudes and we are only able to proxy for health preferences in use of preventive measures. Also, we were not able to observe health shocks occurring prior to 2006. Again, in this case, the estimated effect of a health shock on late enrollment would be underestimated. We were also not able to capture preferences for alternative therapies over conventional prescription drug use which would tend to negate the role of health shocks on late enrollment. A final limitation of this study is the lack of information on beneficiary socio-demographic characteristics, a common trait of claims data.

Chapter 8: Summary

This dissertation offers a comprehensive examination of key aspects of the Part D benefit during its first few years. Part D provided universal access to prescription drug coverage for all Medicare beneficiaries and is considered a largely successful public drug insurance program. The primary reasons for studying Part D are two-fold: (1) to provide an evaluation of the program in meeting its objectives and (2) to offer lessons to inform efficient design of other publicly provided insurance programs.

The goal of public insurance programs, such as Part D, is to increase access to quality and affordable healthcare. To reach this objective, policy design expands insurance coverage through two distinct approaches to influence individual behavior: voluntary means or involuntary means. Voluntary means include economic incentives such as subsidies, late enrollment penalties, or restricting enrollment periods to encourage enrollment. Involuntary means include mandates or opt-out policies to discourage disenrollment. The choice of means is often a question of politics, but the program success is evaluated based on social and economic consequences.

Part D policy represents an example of using voluntary means to influence behavior. Over the next several years, health reform policies under the Affordable Care Act (ACA) will aim to expand insurance using a blend of voluntary and involuntary means. Evaluating the successes and remaining challenges of Part D provide valuable insight into these efforts.

Subsidies represent one incentive mechanism to expand coverage by targeting vulnerable individuals. This was the goal of the Part D Low Income Subsidy (LIS). Low take-up of the LIS among eligible beneficiaries is an ongoing policy concern. In particular, a substantial portion of eligible beneficiaries place a high value on access to prescription drugs by obtaining

unsubsidized Part D coverage, observed in the willingness to pay full premium and cost sharing expenses. This suggests that there are other non-monetary barriers to LIS enrollment, such as lack of information or transaction costs affecting participation. The additional cost sharing associated with non-LIS coverage creates excessive out-of-pocket burden and consequentially significant reductions in drug utilization.

Low take up of the LIS suggests the need for greater outreach efforts to target eligible beneficiaries or use of involuntary means to induce participation. Involuntary means may include automatic enrollment of all eligible beneficiaries and requiring those who prefer to decline receipt to opt-out. Auto-enrollment would negate most barriers to enrollment. Until the problem is remedied, LIS take-up and the effects on drug use should continue to be studied, but using enhanced data and methods to identify and target eligible individuals. Linkages to Internal Revenue Service or SSA data, for valid financial information, with Medicare records would be a useful tool in this effort. Until then, researchers are reliant upon survey datasets such as the Medicare Current Beneficiary Survey (MCBS).

Similar to the LIS, the ACA includes voluntary means to increase insurance participation such as expansion of eligibility criteria in some states under Medicaid and Children's' Health Insurance Program (CHIP) and subsidies to qualifying individuals and employers. Lessons under the LIS should be considered in employing these policies. However, coordination of information between Medicaid and health benefits exchanges under the ACA will provide a helpful mechanism to facilitate enrollment and identify individuals eligible for subsidy programs but otherwise unreached.

Other incentive mechanisms are used to nudge individuals to obtain insurance coverage when they might otherwise decline or delay enrollment because of low perceived risk or value of participation relative to premium costs. Part D employs voluntary means to encourage participation among healthy individuals through a penalty assessed on late enrollment and restricted enrollment periods. These policies force healthy individuals to consider long term tradeoffs in the enrollment decision. As such, delayed enrollment comes at a high cost for beneficiaries who experience a health shock and are forced to pay out-of-pocket for needed care.

In an alternative approach to encourage insurance enrollment, ACA policy will use involuntary means through a universal coverage mandate in which individuals must opt-out and pay a penalty. While Part D was mostly successful in enrolling beneficiaries without mandates, many remain uninsured and the long term implications are unknown. Future studies will show the effects of Part D penalties on unintended consequences related to mortality, medical expenses, and other outcomes. Additional research will be useful in identifying other efficient policy mechanisms in insurance expansion, particularly in light of the potential loss of the mandate as a policy lever pending the Supreme Court ruling.

More lessons from Part D will inform policy as research continues to evolve with the expansion of available datasets. Four years of Part D enrollment data is currently available with the release of 2010 MCBS Access to Care files[20]. Additional years of Part A, B, and D claims will also provide answers to anticipated research questions regarding long-term impacts. Medicare Chronic Condition Warehouse (CCW) data can now be linked to the National Death Index to determine cause of death. CCW also includes 7 new chronic conditions which offer new opportunities to study prevalent conditions. Other upcoming research opportunities include

[20] 2010 CCW files are scheduled for release in spring 2013.

coordinated care efforts for dual-eligible beneficiaries using shared state Medicaid and Part D data and an initiative to collect Part C data.

Other ongoing research surrounding the Part D will help understand challenges and improvements in the program itself. Part D will have a significant impact on the future of the Medicare population. More evidence is needed to evaluate the effect on offsets in future medical expenditure. The relationship between Part D with Part A and B suggests value in coordinating care across all Medicare programs. The closing of the Part D coverage gap will provide an interesting natural experiment to observe reactions to price changes.

As time goes on, lessons gained from Part D will provide valuable insight into the implications of policy design. Continued research will aid in informing efficient provision of healthcare under public insurance programs. Understanding the implications of economic incentives on individual decision-making offers an important perspective for the effectiveness of program design and evaluation.

Appendices

Appendix 1. Imputing Income in the MCBS

Objective

A critical objective of Aim 1 was to obtain reliable financial measures in the MCBS in order to assess eligibility and take-up of the Part D Low Income Subsidy. This appendix provides a summary of the approach used to generate an enhanced income using an imputation procedure.

Plan of Action

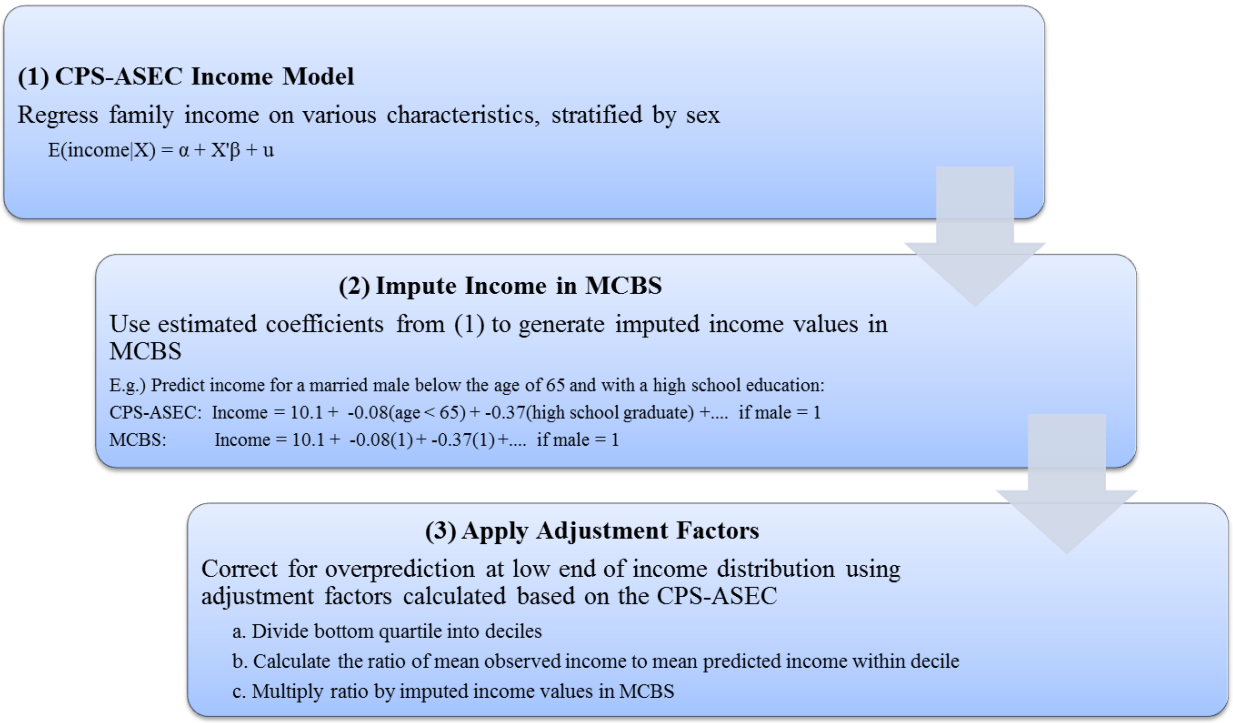
First, to assess the reliability of native income in the MCBS we compared the distribution of income to that of the CPS-ASEC. Benchmark comparisons by marital status and sex showed discordance between the datasets causing us to question the generalizability of the MCBS estimates. Underreporting of income in the MCBS was minimal among single beneficiaries. However, mean reported income among married beneficiaries was almost $10,000 lower in the MCBS relative to the CPS-ASEC estimates. The greatest discrepancy was observed among married female respondents leading us to stratify our imputation approach by sex. We hypothesize that because single beneficiaries only account for their own income they can provide a more accurate reporting, whereas married couples must account for combined income. Additionally, we hypothesize that among the elderly Medicare population, it was more common for the male spouse to manage the family finances. This is how we account for the greater misreporting of income among females.

To address underreporting of income among married beneficiaries in the MCBS we imputed income using multivariable models estimated in the CPS-ASEC. We also utilized an additional data source, an unpublished MCBS file, the Income and Assets (I&A) Supplement.

The relatively superior reliability of the income information in the CPS-ASEC served to explain the relationship between characteristics and income as reflected in regression coefficients. To do this, we imputed income in the MCBS using multivariable models estimated in the CPS-ASEC. The income models were estimated using generalized linear regression models with a gamma distribution and a log link. Separate models were estimated for married male and female beneficiaries to allow for structural differences in the models. The coefficients generated from the final income model were used to generate predicted income values for each observation in the MCBS. Scale factors were used to adjust for poor prediction at the lower end of the income distribution. The scale factor multiples the predicted income values by a constant proportion. This factor was dependent upon the distribution of income in the CPS-ASEC and is calculated as the ratio of observed to predicted values in the CPS-ASEC at different point estimates in the distribution.

The figure below presents the general plan of action to impute income in the MCBS using the CPS-ASEC.

Figure 9 Income Imputation Plan of Action



Informing Model Inputs

First, I identified all relevant predictors of income in the CPS-ASEC. While it is only possible to include explanatory variables in the final model that are also available in the MCBS, it is essential to understand the effect of excluding relevant factors on the predictive power of the model. To inform development of the income model I reviewed literature surrounding use of Census data to estimate income of the elderly. Most studies focus on the non-elderly population which can provide responses to questions specific to their employment and industry. These responses are useful in estimating income but were not available for my purpose.

However, there are many helpful points to consider when examining income of the elderly. First, there are substantial gender differences in incomes among the elderly. Women receive a larger share of their income from Social Security and assets, while men receive more

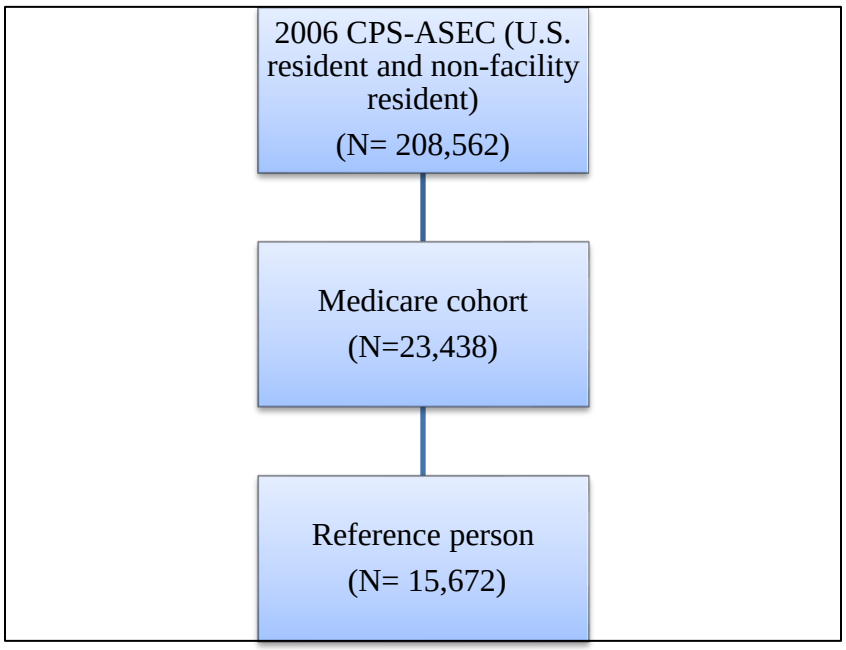
income from employment-related sources, although this gap is decreasing overtime. The oldest individuals and those with lower incomes receive the vast majority of their income from Social Security. The main sources of income are pensions and annuities, assets and earnings for all income classes. Married elderly receive a larger share of their income from earnings and pensions and annuities than non-married elderly [173-175].

Comparison of datasets

This income imputation procedure is based upon estimating coefficients in one dataset for use in another dataset. The ability to generate imputed values in one dataset from another is dependent upon those datasets being similar. To evaluate the comparability of data sources descriptive characteristics of the sample populations in both the CPS and MCBS were examined. The estimates for both samples are restricted to the Medicare population and are weighted to be nationally representative. The inclusion criteria used to generate both samples is presented in Figure 10.

Figure 10 Sample Selection Criteria, Current Population Survey and Medicare Current Beneficiary Survey

Current Population Survey, Annual Social and Economic Supplement File



Medicare Current Beneficiary Survey

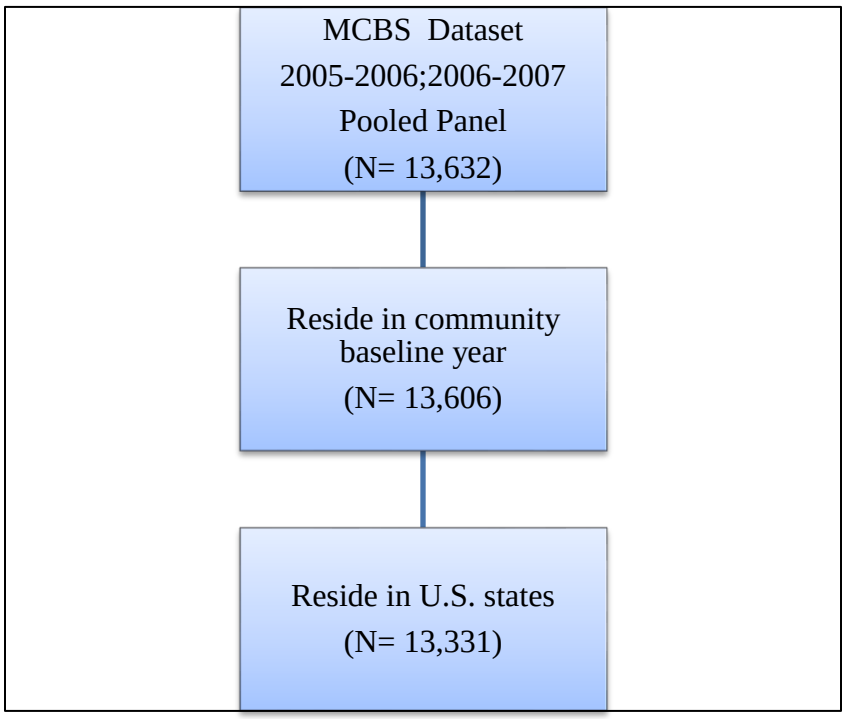


Table 16 presents these results, stratified by marital status. The table shows that certain characteristics do exhibit different distributions across data sets. There are many possible reasons for this. First, the surveys target different populations. The CPS is representative of the overall U.S. population, while the MCBS is only representative of the Medicare population. Additionally, the MCBS includes administrative enrollment data which will be more accurate than self-report used in the CPS.

Most of the socio-demographic characteristics and distribution of financial resources are similar and these are most relevant to my purpose. My goal is to obtain a coefficient on each variable that accurately represents the relationship between the relevant characteristic and income. The differences in these samples should not result in biased coefficients.

Table 16 Characteristics of Medicare Populations in the Medicare Current Beneficiary Survey and Current Population Survey by Marital Status

	MCBS (13,157)	**CPS (N=15,672)**	**MCBS (13,157)**	**CPS (N=15,672)**
Characteristic	**Not Married**		**Married**	
Total	45.4	59.6	54.6	40.3
Sex				
Female	69.3	70.0	43.7	28.7
Male	30.7	30.0	56.3	71.3
Age				
<65	20.9	15.7	11.3	10.2
65-74	33.8	34.6	54.6	52.0
75-84	20.3	34.9	21.3	30.5
85+	2.3	13.9	1.4	5.6
65+ Former SSDI	21.0	5.5	11.5	3.2
Marital Status				
Married	0.0	0.0	100.0	100.0
Widowed	57.5	57.8	-	-
Single	42.5	42.2	-	-
Education				
Less than High School	31.0	27.8	21.5	20.8
High School grad	30.7	36.5	31.5	34.7

Some College	24.7	20.2	27.0	21.4
College Grad	13.0	15.5	19.7	23.1
Household Composition				
Live alone	62.6	74.0	1.5	0.0
Live with others	37.4	4.8	98.5	100.0
Home Ownership				
Own home	50.9	66.5	86.8	90.4
Rent/other	49.1	33.5	13.2	9.6
Live with Spouse				
Yes	-	-	97.4	98.0
No	-	-	2.6	2.1
Metro Status				
Metro	76.4	79.3	73.0	77.3
Rural	23.6	20.7	27.0	22.7
Geographic Region				
Northeast	21.4	20.7	17.5	18.2
Midwest	22.7	23.0	24.1	22.5
South	37.2	36.9	38.3	38.5
West	18.7	19.4	20.0	20.8
No. of Family Members				
1	69.3	82.5	-	-
2	15.6	11.7	80.7	83.7
3	8.9	3.6	11.1	10.8
4+	6.3	2.2	6.5	5.6
Race/Ethnicity				
White	74.9	77.7	83.9	84.2
Black	13.6	13.2	5.5	5.6
Hispanic	6.8	6.0	5.4	5.9
Other	4.7	3.2	5.2	4.2
Supplemental Insurance Coverage				
Any	85.4	49.6	90.9	64.1
None	14.6	50.39	9.1	35.92
Medicaid	25.9	17.7	6.3	7.6
ESI	28.2	24.9	47.3	30.2
Other Private	25.2	26.3	31.6	23.5
Other	14.6	5.6	14.8	9.5
Health Status				
Excellent/Very Good	40.6	25.8	46.8	31.8
Good	30.3	31.5	30.7	34.1
Fair/Poor	28.5	42.7	22.4	34.1

Employed				
Yes	11.9	10.6	16.2	13.5
No	88.1	89.4	83.8	86.5
Financial Sources				
Disability	4.4	1.9	5.5	2.7
Retirement	38.3	34.5	56.6	49.0
Welfare	8.1	6.6	2.1	2.3
Rental Income	4.2	6.3	9.1	10.3
Dividends	18.2	14.8	32.5	27.1
Financial Assistance	5.8	1.1	1.5	0.3
Other	18.9	7.5	35.7	9.7
Interest	68.3	43.7	86.8	61.4

Source: 2006 Current Population Survey Annual Social and Economic Supplement and 2005-2007 Medicare Current Beneficiary Survey; numbers weighted to be nationally-representative of the community-based Medicare population

Data Exploration

The dependent variable in these models was family income. It is critical to characterize the distribution of the dependent variable (income) in the CPS-ASEC and the MCBS. First, I quantified the number of beneficiaries with zero income in both datasets. Less than 1% of the samples included beneficiaries reporting zero incomes whose values were replaced with $1 (0.89% in the CPS and 0.22% in the MCBS).

A correlation matrix was generated to present correlations between all variables. This was useful in identifying which variables are associated with the dependent variable (income) but also to observe correlations between covariates. Strong multicollinearity among right hand side variables can mask independent associations and increase standard errors.

Observations with large residuals, or outliers, are thought to fit the model poorly. Observing residuals is useful in removing outliers. Similarly, observations with a large effect on model parameters are known as “influential” cases and can be problematic. An adaptation of cook’s distance was used to measure this. Cases with high influence were removed.

Measures

In the final model, covariate measures were restricted to those available in both the CPS-ASEC and MCBS. This included age, race, family size, education level, geographic region and urbanicity, self-reported health status, home ownership, enrollment in Medicaid, employer-sponsored insurance, or other supplemental medical insurance, and whether or not the beneficiary was living with their spouse. In addition, indicators were included for various sources of income including disability, retirement, welfare, dividends, interest income, income from a rental property, earned income, and all other sources.

However, it is possible that variables that are not included in both datasets may better explain income. I estimated an optimal model to predict income in the CPS in order to compare the compare the explanatory power of the final income model. The various measures tested are included below.

- INCOME is a vector of continuous values reflecting total family income
- DEMOG is a vector of binary indicators for age, race/ethnicity, count of family members, household composition, geographic region, and urbanicity
- SOCIO is a vector of binary indicators for education and employment
- HEALTH is a vector of binary indicators for self-reported health status
- FINANCE is a vector of binary indicators for the presence of income from SSI benefits (SSI), disability benefits (DISABL), personal financial assistance (FINASSIST), retirement (RETIRE), welfare (WELF), rental property (RENTAL), dividends (DIVID), interest (INTEREST), and other (OTHINC)

- SUPPINS is a vector of binary indicators for various sources of supplemental medical insurance, including: Medicaid, ESI or private, or any other.
- CPSONLY consists of vectors of continuous variables that are available only in the CPS and not in the MCBS. These include: employer contribution to health insurance (EMPCONT), fungible value of Medicare (FMCARE), fungible values of Medicaid (FMCAID), federal tax liability (TAX).
- CONTEXT consists of vectors of county-level continuous variables reflecting the area in which the individual lives. These are derived from the Index of Multiple Deprivation (based on Census data). These include: number of vehicles available per occupied house (VEHICLE), number of reported robberies per capita (ROBBERY), number of vacant housing units per capita (VACANT), median value of housing unit (HOUSE), and labor force unemployment rate (UNEMP).

Model Specification

Regression is a useful tool to identify factors that explain income and obtain predicted values. Regression coefficients quantify the relationship between various factors and income. Statistical tests can aid in selecting the most important factors in specifying an efficient model. I used a systematic approach to specify the income prediction model in the CPS-ASEC. I started with a full model that includes all potential factors believed to be associated with income. Using theory and statistical testing I evaluated the effect of removing selected variables from the full model by comparing it to nested versions. In addition, non-linearity in terms was examined by adding selected polynomials. This process was repeated until a final model was decided upon (table 17).

Correct specification of a GLM model depends on the appropriateness of the selected family distribution and link. I assessed the specification of the GLM model and test fit. There are different ways to assess the appropriate link function. First, the Box-Cox test was used determine relation between $x\beta$ and E (y|x). Three other link tests were applied. These included the Pregibon link test to check linearity, Modified Hosmer-Lemeshow tests for systematic bias in fit, and Pearson's correlation to tests for systematic bias in fit. The modified Park test was used to assess the distribution fit. Also, the normality of the residuals was assessed with a probability density and normal probability plot.

Table 17 Income Model Specification

Model Specification	**Status**
$INCOME = \beta_0 + \beta_1 DEMOG + \beta_2 SOCIO + \beta_3 SUPPINS + \beta_4 HEALTH + \beta_5 FINANCE + \beta_6 CPSONLY + \beta_7 CONTEXT + \mu$	Full model
$INCOME = \beta_0 + \beta_1 DEMOG + \beta_2 SOCIO + \beta_3 SUPPINS + \beta_4 HEALTH + \beta_5 DISABL + \beta_6 FINASSIST + \beta_7 RETIRE + \beta_8 WELF + \beta_9 RENTAL + \beta_{10} DIVID + \beta_{11} INTEREST + \beta_{12} OTHINC + \mu$	Final model

Sensitivity Analysis

Two separate analyses were conducted following different methods to observe any substantial changes in the results.

Non-stratified model

Another version of the income model was estimated for the full sample of married beneficiaries, i.e. not stratified by sex. The results from this model generated lower overall values of imputed income than the version that stratified by income. This resulted in higher estimated rates of LIS eligibility. This approach also resulted in greater error rates as reflected in

higher proportions of beneficiaries identified as ineligible but who were enrolled. Stratifying by sex appeared to provide more conservative estimates of eligibility and with less error.

Unmatched explanatory variables

Both the CPS-ASEC and MCBS datasets provide weights linked to each observation to allow sample estimates to be representative of the overall population. Again, the CPS-ASEC is nationally-representative of the total U.S. population and the MCBS is nationally-representative of the Medicare population. This, and the fact that they are different surveys, creates differences in some of the characteristics of the populations represented in both datasets. Characteristics in which major differences were apparent included health status, other and interest income, supplemental medical insurance (particularly employer-sponsored and none), and veteran status. Among variables included in the final model unmatched variables included health status, supplemental medical insurance, interest and other income. Another version of the income model was estimated without these unmatched variables to see if there was a substantial difference in imputation results. In doing so there was no difference in the imputed income values or estimates of LIS eligibility and take-up.

Application to the MCBS

The coefficients estimated from the income models in the CPS-ASEC were used to generate imputed income values for married individuals in the MCBS. The imputed (i.e. predicted) income was calculated by multiplying the regression model coefficients from the CPS-APEC–based analysis with the matched explanatory variables the MCBS using the gamma regression conditional mean function (with log link) as the mathematical expression for calculating income levels. Initial comparisons benchmarking imputed incomes in the MCBS to the CPS-ASEC sample showed that the imputed values were generally greater than CPS-ASEC

point estimates at the low end of the distribution. It is common for regression models to predict with poor accuracy at the extremes of the dependent variable. In order to adjust for over-prediction at the low end of the income distribution we applied adjustment factors. To do this, we returned to the study samples in the CPS-ASEC and stratified the lower quartile of both (i.e. male and female) income distributions into ten deciles. For each decile, adjustment factors were calculated as the ratio of observed to predicted mean income. These adjustment factors were then multiplied by the predicted values by decile in the MCBS. The factors ranged from 0.08 to 0.76, increasing progressively with income of each decile. Imputed income for married beneficiaries in the 2006-2007 panel was inflated to correspond with the 2007 FPL.

Appendix 2. Evaluating Eligibility and Enrollment in the Part D Low Income Subsidy

This appendix summarizes supplemental topics in LIS eligibility and participation observed in the MCBS. The topics were examined to inform analytic and measurement decisions in this study.

Objective

The purpose of this analysis is to examine LIS eligibility and participation using enhanced financial measures. This document covers various topics surrounding eligibility and enrollment in the LIS. Topics include policy issues, understanding the role of duals, and changes in eligibility and enrollment over time.

LIS Eligibility Criteria

Income

LIS eligibility is determined based on the income of the applicant and that of the spouse who resides with the applicant. Therefore, the income criterion for LIS eligibility among married beneficiaries is applied only for those who reside with their spouse. Otherwise, married beneficiaries not living with their spouse will be determined eligible based on criteria for single beneficiaries.

Earned income is counted on an annual basis. At the time of the application, income is adjusted prospectively based on the number of months remaining in the calendar year. Unearned income is counted upon time of receipt. Verification of eligibility is based on records from the SSA or financial institutions (if conducted through the state). These records are likely based on income from prior year. Additionally, in reporting income in the application an individual would

most likely site their income known from the prior year. Therefore, this study bases income eligibility from the prior year.

Assets

Countable resources are determined as of the month of application for the subsidy. Asset eligibility thresholds are applied only if the applicant/spouse intends to use resources for burial or funeral arrangements. This study assumed that this was the case for all beneficiaries.

Deemed eligibles

Beneficiaries may apply for the LIS through the Social Security Administration (SSA) or with their State Medicaid agency. The law requires states to screen subsidy applicants who apply at the State Medicaid office for eligibility for the Medicare Saving Programs (MSP). However, if beneficiaries apply for LIS directly with SSA then states are not required to screen for and offer MSP enrollment to those individuals. Beginning in December 2007, CMS offered this information, known as leads data, to be available to the states to aid them in identifying potentially MSP eligible beneficiaries.

Deemed eligibles include beneficiaries who are dually eligible for Medicaid, receive SSI, and are participants in MSP. It is possible for a beneficiary to not qualify for the LIS based on federal guidelines but to qualify for a MSP based on the states guidelines. Under this scenario the beneficiary would acquire deemed status and be enrolled in LIS. These individuals maintain deemed status from the first month of until the end of the calendar year. If a beneficiary loses dual status during the year they maintain LIS throughout the remainder of the calendar year.

Deemed eligibles are automatically enrolled in LIS and are required to select a drug plan. CMS will assign them a plan if one is not selected within the first month of enrollment. Duals may opt out of a Part D plan if they have other creditable coverage.

If the applicant is pending Medicaid spenddown in the month of LIS application then gross income prior to spenddown is considered in the application. However, upon meeting Medicaid eligibility the beneficiary becomes deemed eligible [28, 81, 176].

Changes in LIS Eligibility

This study examines take-up of LIS during the first two years of the program. The design of this study pools two mutually exclusive two-year panels to assess LIS eligibility in the year prior to enrollment. As eligibility is only identified at baseline for each observation, changes in eligibility over time are not relevant to this analysis. However, it is critical to consider that LIS eligibility and enrollment may not be constant in this time as it is re-determined each year. Otherwise, LIS recipients do not have to report changes in income, resources and/or living arrangements unless they receive a request from SSA.

To explore this issue, I examined changes in eligibility over the two years for the first study panel with three years of income and asset data (N=5,526). Approximately the same proportion (7%) of beneficiaries newly acquired for LIS eligibility as lost eligibility in year two. On the other hand, 30% of the sample was LIS eligible in both years while the balance was not eligible in either year. The relatively small proportions of beneficiaries experiencing changes in eligibility and the fact that the gains and losses in eligibility appear to balance out suggested that further exploration was not necessary.

Reasons for Changes in Eligibility

The circumstances in which eligibility changes over time may have implications for generalizability and validity of study results. Changes in beneficiary circumstances that may affect eligibility status include changes in deemed status, financial status, living arrangement, or marital status. These circumstances may change due to situations that are out of the beneficiary's control, or due in part to the beneficiary's behavior.

Unintentional Changes in Eligibility

Changes in marital status affect the criteria with which LIS eligibility is determined. In addition, a change in marital status can have a profound effect on the amount of income and assets an individual may have. In my study sample, approximately 5% of beneficiaries change marital status over two years. Prior to 2011, an individual whose spouse dies would lose eligibility if the death resulted in a loss of eligibility otherwise.

Intentional Changes in Eligibility

Beneficiaries may manipulate their finances in order to become eligible for subsidy programs such as the LIS. This would result in potential endogeneity of eligibility. Individuals may behave by changing their living situation, employment, asset holdings, or sources of financial assistance to acquire eligibility for the program, and thus will be more likely to enroll. Manipulation of income is unlikely in this population. Medicare beneficiaries are often retired and do not generally receive income from a current employer and are not able to substantially alter their income from other sources. Additionally, among married beneficiaries income is imputed and not subject to manipulation. However, asset holdings are easier to manipulate. For example, individuals may transfer assets to family members in order to spend down assets to qualify for a welfare program. Approaches to addressing this issue include the use of imputed

values or simulating eligibility based on a national rates to instrument for individual eligibility [99, 125, 126, 128, 129].

To observe whether or not there was evidence of asset manipulation to acquire LIS eligibility, I examined changes in assets over three years in the MCBS. I identified whether or not beneficiaries with income below 200% of FPL were eligible for the LIS based on their assets in years 2004-2006, stratified by any LIS enrollment. Findings suggested that there is no significant change in asset eligibility overtime. Among LIS enrollees, asset eligibility remained constant at 95% over the three years. Among non-enrollees, asset eligibility changed in the range of 55-58% with no monotonic relationship. Examining mean asset values among low income beneficiaries gave consistent results.

Changes in LIS Enrollment 2006-2007

Only recently has data become available to examine longitudinal aspects of the Part D benefit. As a result, little is known about changes in LIS enrollment over time. Exploratory analysis was conducted to describe patterns in enrollment over two years among beneficiaries in the 2006-2007 panel of my dataset (N= 3,727). Part D, LIS, and Medicaid enrollment are measured at the time of the Access to Care interview.

LIS Enrollment

I found that 24% of beneficiaries were enrolled in LIS in 2006. Among them, the majority (86%) maintained LIS in 2007. Among those that lost it, 20% kept Part D without LIS and the rest went without coverage. This suggests that LIS is generally selected because it is heavily subsidized and that drug coverage otherwise is not preferred. On the other hand, 95% of LIS enrollees in 2007 were also enrolled in 2006. Only 1% of the sample obtained LIS in 2007.

LIS and Medicaid enrollment

Medicaid dual-eligibles automatically receive the LIS. In examining LIS take-up using secondary data we do not observe the process by which beneficiaries acquire LIS or Medicaid. It is possible that LIS is acquired via Medicaid enrollment or Medicaid was acquired via the LIS application process. Transitions in dual and LIS status appear too uncommon to make generalizations. The data suggest that a very small portion of beneficiaries (1.2%) newly acquired Medicaid or MSP status in 2007. However, 70% of all new duals were already enrolled in LIS the year before. This suggests that it is not likely that Medicaid induced LIS enrollment and that upon application for LIS they may not have been screened for dual-eligibility. This may be because in the early years of Part D the state Medicaid offices are required to screen LIS applicants but SSA offices are not. A small portion (1%) also newly obtained LIS in year two. Among those, 25% also acquired dual status in year two.

Appendix 3. Modeling LIS Take-up among Eligible Beneficiaries

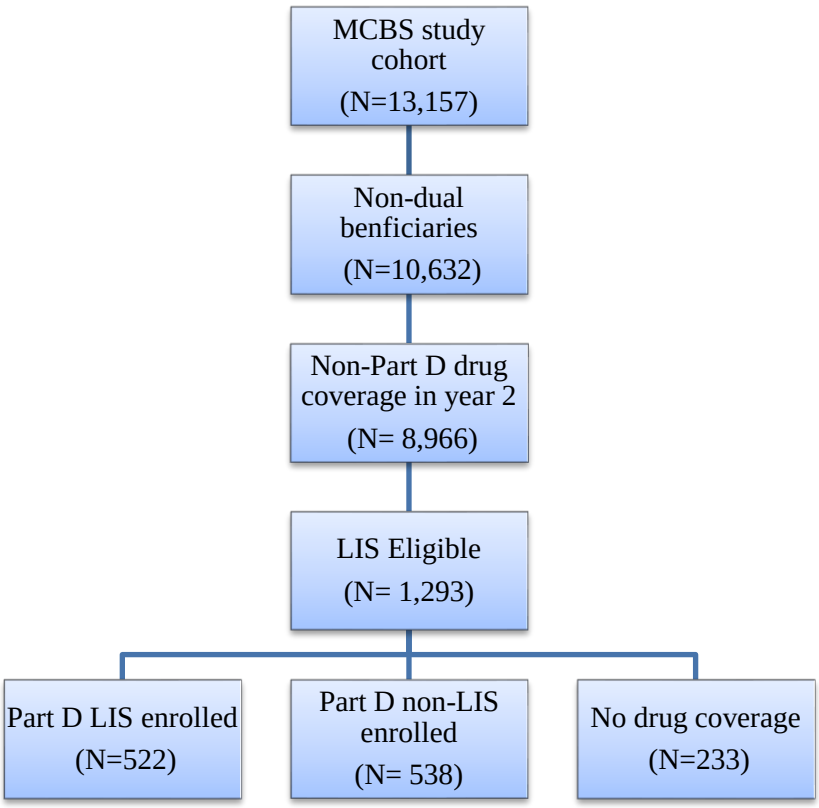
Objective

The objective of this analysis is to examine drug coverage participation decisions among beneficiaries eligible for the LIS.

Sample Selection Criteria

Figure 11 presents the inclusion criteria used to identify the study sample. To examine Part D LIS selection I excluded beneficiaries who were not likely to face a selection decision. Beneficiaries with dual status at baseline were excluded because they were automatically enrolled. Beneficiaries were allowed to newly acquire dual status in the following year because it is possible that they did so in applying for the LIS. Similarly, beneficiaries with non-Part D coverage (or VA payments) were excluded from this analysis because they would be likely to opt out of Part D and remain in their other creditable coverage. In the remaining sample we identified 1,293 LIS eligible beneficiaries. Among those eligible there are three potential drug coverage options available: Part D with LIS, Part D without LIS, or no drug coverage.

Figure 11 Sample Selection Criteria in LIS Take-up Model



Exploratory analyses

Preliminary studies were conducted to examine LIS enrollment between 2006 and 2007. Most results are presented in Appendix 2; however, some of the findings were useful in informing model development.

- Very few beneficiaries (N=14) entered into a facility in the study follow-up year. Among them, 2 had no drug coverage, 9 enrolled in LIS, and 4 enrolled in a Part D non-LIS plan. These numbers are too small to account for in a multivariable setting. Nevertheless, I tested the effect of controlling for facility entrance in the model and it proved to make no difference. Therefore, while beneficiaries are allowed to enter a facility, it is not controlled for in the final take-up model.

- A small portion of beneficiaries lose LIS and maintain Part D in year 2, but more chose not to keep Part D after losing LIS. This suggests that LIS is generally selected because it is heavily subsidized and that drug coverage otherwise is not preferred and argues against a nested model.
- Only a small portion of beneficiaries newly acquire LIS in 2007. About 1% of beneficiaries newly enroll in LIS in 2007 and most 2007 LIS enrollees were already enrolled in 2006. This suggests no controlling for "prior year LIS" on the RHS of the take-up model because it is almost perfectly predictive. Instead, I will include an indicator for "any prior drug coverage" while realizing that the majority of this is Part D.
- Few beneficiaries (N=98) newly acquired Medicaid or MSP status in 2007 and all but 2 of them enrolled in LIS. While it is almost perfectly predictive of LIS enrollment I think it important to control for in the model. It is an important predictor in the model, although excluding it does not have an effect on the other coefficients.

Modeling Part D and LIS Participation

In multivariable analysis, multiple unordered alternatives suggest the use of a multinomial logistic regression. Other approaches such as the nested logistic regression model would be inappropriate in this context due to model assumptions. The nested logistic model assumes a hierarchical, or sequential, decision process. In the application of LIS take-up, the nested logistic would be appropriate if we presume that beneficiaries choose to enroll in Part and then choose to enroll in the LIS or not. We believe that this is not the case. Therefore, a multinomial logistic regression is used to model the probability of Y which can take 3 possible values; k = 0, 1, or 2 where:

$$Y = \begin{cases} 0\ if\ no\ drug\ coverage \\ 1\ if\ Part\ D\ LIS \\ 2\ if\ Part\ D\ non-LIS \end{cases}$$

The multinomial logit regression is modeled with Part D LIS (k=1) as the base category with the equation:

$$P(y = k) = \frac{e^{X\prime B}}{1 + \sum_{k=0}^{2} e^{X\prime B}}$$

Independence of Irrelevant Alternatives (IIA)

A critical assumption of the multinomial logit model is that the relative probabilities of the outcomes depend only on the attributes of those outcomes. In other words, changing the characteristics of one outcome does not change the relative probabilities of the other outcomes. Therefore, the alternatives are not "irrelevant". This assumption can be tested by comparing the coefficients of the full model to one that excludes one or more of the alternatives. This can be conducted with a Hausman-McFadden or Small-Hsiao test. Results of both tests suggested that the IIA assumption is met.

Combining Alternatives

Model efficiency can be assessed by determining whether or not alternatives are indistinguishable. If none of the independent variables significantly affect the odds of one alternative compared to another then they are considered indistinguishable. This can be tested with a Wald or likelihood ratio test. If alternatives are not distinguishable with respect to

explanatory variables then the model can be made more efficient by combining them. Results from both tests showed that we can reject the hypothesis that alternatives are indistinguishable.

Appendix 4. Using the CCW to Estimate the Impact of a Health Shock on Late Part D Enrollment

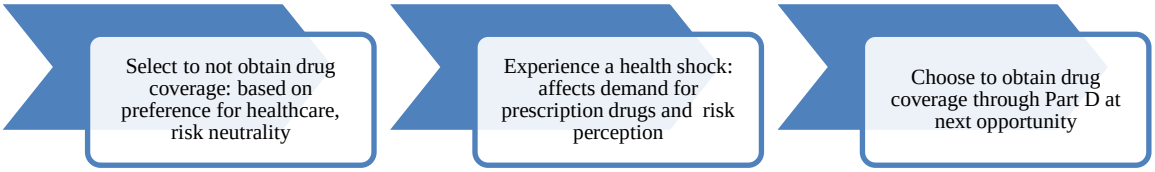
This appendix expands upon the manuscript to provide additional information regarding analytic decisions, measures, and sensitivity tests.

Objective

Using 3 years of Part D data this study examined the extent to which beneficiaries who initially denied coverage under Part D chose to participate at a later time and whether acquiring a drug-intensive condition motivated the change in insurance demand. Part D policy was designed to motivate a long term perception of future health risk among beneficiaries who do not perceive a clear benefit to enrollment. We evaluated the efficiency of the policy to expand drug coverage and how the policy effects have played out over time. The objective of this study was to examine the role of health shocks on late Part D enrollment among Medicare beneficiaries who refused coverage during the initial enrollment period.

We hypothesized that a beneficiary who did not initially enroll in Part D and experiences a health shock is faced with a new decision about drug coverage. They are presented with the option to enroll in Part D to help cover the cost of drugs and incur the higher premium or to continue to remain without drug coverage. If they choose to remain without coverage they must then either decide to absorb the full cost of prescription drugs or forgo therapy all together. Figure 12 presents hypothesized relationship between health shocks and the Part D enrollment decision.

Figure 12 Relationship of Health Shocks and Late Part D



Study Sample

The analytic sample consists of beneficiaries who opted to not enroll in Part D by the end of the initial enrollment period. In order to examine the impact of a new drug benefit available under Part D it is important to first understand why these individuals first chose not to obtain drug coverage. Non-enrollees perceived themselves as healthy and had little demand for prescription drugs. Theory is useful to understand other factors that are generally associated with the decision not to obtain insurance. Uninsured individuals tend to be risk seeking or neutral, underweight their probability of a future illness, have a high rate of time preference, low disposable income, a preference toward substitutes, or may not find an sufficiently attractive plan.

Sample Selection Bias

We restricted our study to a sample with no apparent demand for drug coverage at baseline. As discussed above, characteristics of this sample are systematically different from the general population. Non-enrollees value an unmeasured factor (e.g. taste for healthcare) differently than enrollees. If these unmeasured factors are correlated with the subsequent decision to enroll late into Part D, then non-enrollees will have a weaker response to a health shock compared to

beneficiaries that already reveal a demand for drug coverage. These differences in unobserved traits affect the generalizability and validity of study results. The estimated average effect of a health shock on late enrollment would be underestimated in the presence of sample selection.

However, we are not concerned with generalizing the study results to the total Medicare population. It is the selected group of non-enrollees that is of policy interest. We are interested in understanding why this group denied coverage and if they instead delay enrollment and the implications of doing so. This study informs policy regarding the effects on non-enrollees.

Nevertheless, we attempted sample selection correction models to address this nonrandom selection problem. However, this requires an instrumental variable that is predictive of "on time" enrollment and not predictive of "late" enrollment. Factors predictive of "on time" versus non-enrollment might include risk aversion, preferences for healthcare, self-assessment of present and future health states, market supply prices, and rate of time preference. These factors are difficult to operationalize and also likely predictive of late enrollment. State level insurance variables to represent drug insurance supply and use of preventive healthcare services to represent preferences for healthcare were tested as potential instrumental variables but were not successful. The inability to correct for nonrandom selection into having no drug coverage is a limitation of this study.

Health Shock Definition

The key focus of this study is the role of a health shock on a change in demand for Part D. We hypothesized that if individuals initially deny drug coverage though Part D because they presume themselves to be healthy, and a later, exogenously determined negative health event, or a "health shock", would alter that decision. A health shock is generally unexpected and can have

significant effects on healthcare utilization and expenditures. Furthermore, such an event can also have dramatic implications for personal income or assets. A health shock that is chronic will require costly drug therapy, affect expected spending and self-perception of future risk, and thus increase the perceived benefit of enrollment. Such a condition would occur most unexpectedly as an inpatient hospital admission.

For the purposes of this study, a health shock is defined as a hospital admission resulting in a diagnosis of a drug-intensive chronic condition. A diagnosis of such a condition would be an unexpected and result in prescriptions for recommended drug therapies, and consequently, an unexpected increase in demand for drugs. Diagnoses for drug-intensive conditions were identified based on prescription drug hierarchical condition categories (RxHCCs).

RxHCCs were developed by CMS as inputs in a model used to generate predicted drug spending risk factors for Medicare beneficiaries. The risk factors are used to adjust spending risk for payment to insurance plans. RxHCCs are selected groups of diagnoses that are predictive of drug spending. The 2006 Part D Risk Spending Model consists of 84 condition categories (table 18)[21]. The model generates estimated coefficients on each of the categories which are representative of the relative association with drug spending.

In the analytic sample of this study, the monthly prevalence of each RxHCC ranged from 0 to 11%. A single binary measure was generated to identify the first occurring admission with a diagnosis for one of the above conditions. We also accounted for repeating health shocks by generating indicators for hospital admissions for any of the select conditions occurring after the

[21] In the past year, CMS has made revisions to the diagnoses included. Nine RxHCCs were removed from the 2006 model, 3 were added, and 4 were revised.

index month. We hypothesize that the index health shock admission is the primary driver for a change in Part D demand, but that repeated events would intensify this effect.

Table 18 List of RxHCC Condition Categories and Associated Dollar Amounts

RxHCC Condition Category	Dollar Coefficient
HIV/AIDS	12314.00
Multiple Sclerosis	1926.99
Acute Myeloid Leukemia	1689.53
Opportunistic Infections	1647.65
Disorders of Immunity	1403.95
Parkinson's Disease	1377.19
Schizophrenia	1268.40
Dementia with Depression or Behavioral Disturbance	1103.73
Diabetes with Complications	1091.45
Attention Deficit Disorder	991.13
Rheumatoid Arthritis and Other Inflammatory Polyarthropathy	931.89
Kidney Transplant Status	882.63
Motor Neuron Disease and Spinal Muscular Atrophy	876.70
Inflammatory Bowel Disease	753.96
Metastatic Cancer, Acute Leukemia, and Severe Cancers	729.38
Congestive Heart Failure	717.49
Psoriatic Arthropathy	695.26
Diabetes without Complication	658.61
Other Major Psychiatric Disorders	644.59
Esophageal Disease	644.19
Cystic Fibrosis	637.90
Asthma and COPD	637.90
Severe Hematological Disorders	624.40
Dementia/Cerebral Degeneration	558.69
Migraine Headaches	542.02
Chronic Viral Hepatitis	516.44
Seizure Disorders and Convulsions	497.65
Other Psychiatric Symptoms/Syndromes	477.69
Hypertensive Heart Disease or Hypertension	469.14
Disorders of the Vertebrae and Spinal Discs	456.69
Open-angle Glaucoma	446.49
Polyneuropathy, except Diabetic	443.15
Acute Myocardial Infarction and Unstable Angina	436.02
Major Organ Transplant Status	433.46
Other Significant Endocrine and Metabolic Disorders	400.91
Disorders of Lipoid Metabolism	397.06

Incontinence	395.50
Inflammatory Spondylopathies	392.74
Muscular Dystrophy	391.39
Infectious Diseases	345.61
Fibrosis of Lung and Other Chronic Lung Disorders	341.15
Chronic Renal Failure	328.48
Nephritis	328.48
Mononeuropathy, Other Abnormal Movement Disorders	323.60
Polycythemia Vera	320.79
Vertebral Fractures without Spinal Cord Injury	304.88
Behçet's Syndrome and Other Connective Tissue Disease	294.36
Chronic Pancreatic Disease	293.08
Osteoporosis and Vertebral Fractures	292.27
Salivary Gland Diseases	281.75
Huntington's Disease	269.28
Quadriplegia, Other Extensive Paralysis, and Spinal Cord Injuries	261.77
Pelvic Fracture	250.06
Other Organ Transplant/Replacement	245.87
Psoriasis	244.58
Other Diseases of Upper Respiratory System	243.66
Cerebral Hemorrhage and Effects of Stroke	232.31
Female Stress Incontinence	228.45
Specified Heart Arrhythmias	223.95
Empyema, Lung Abscess, and Fungal and Parasitic Lung Infections	222.96
Bone/Joint/Muscle Infections/Necrosis	202.75
Other Musculoskeletal and Connective Tissue Disorders	182.63
Vitreous/Retinal Hemorrhage and Vascular Retinopathy except Diabetic	182.63
Delirium and Encephalopathy	168.96
Glaucoma and Keratoconus	168.39
Cellulitis and Local Skin Infection	162.37
Aspiration and Specified Bacterial Pneumonias	158.65
Other Specified Endocrine/Metabolic/Nutritional Disorders	158.53
Urinary Obstruction and Retention	156.29
Fecal Incontinence	156.29
Chronic Ulcer of Skin, Except Decubitus	156.29
Pulmonary Embolism and Deep Vein Thrombosis	147.95
Other Neurological Conditions/Injuries	147.75
Peptic Ulcer and Gastrointestinal Hemorrhage	141.62
Polymyalgia Rheumatica	136.31
Vascular Disease	134.53
Bullous Dermatoses and Other Specified Erythematous Conditions	131.84
Acute Bronchitis and Congenital Lung/Respiratory Anomaly	115.26
Lung, Upper Digestive Tract, and Other Severe Cancers	111.55

Larynx/Vocal Cord Diseases	104.61
Macular Degeneration and Retinal Disorders, Except Detachment and Vascular Retinopathies	101.03
Coagulation Defects and Other Specified Blood Diseases	93.35
Impaired Renal Function and Other Urinary Disorders	72.71
Vaginal and Cervical Diseases	66.85

Source: 2006 CMS Part D Risk Spending Model

Comparison of Claims-based Health Shock and Self-reported Health Status

To test whether or not the select conditions were truly unexpected and therefore likely to induce a change in demand for prescription drug coverage, I examined how a related hospital admission would affect an individual's self-perception of health status. The MCBS contains the same inpatient hospital admission claims as the CCW. Using the same diagnosis codes, I identified admissions for the RxHCCs in the top 25th percentile ranked by magnitude of association with drug spending and additional select RxHCCs. I compared the selected condition categories based on hospitalizations resulting in a relevant diagnoses occurring in 2006 to compare to beneficiary report a change in health status to being worse in 2007 from the year before. The sample consisted of 14,804 beneficiaries in the 2006 and 2007 MCBS Access to Care files.

Among beneficiaries who had a health shock based on a hospital admission for any of the select conditions, 23.6% said that their health was worse than the year before compared to 21.1% of beneficiaries with no health shock who reported worse health. In comparing the 22 individual conditions, only admissions for a kidney transplant status, inflammatory bowel disease, metastatic cancer, a major psychological disorder, and esophageal disease were not associated with a self-report of worse health in the following year. Diagnoses of Multiple Sclerosis,

opportunistic infections, Hematological disorders, and stroke resulted in the largest differences (results not presented).

These findings show that hospital admissions for drug-intensive conditions in claims data are associated with self-perception of health decline. This suggests that such admissions lead individuals to perceive themselves in worse health. This change in self-assessed health is the impetus we hypothesize that alters demand for drug coverage under Part D.

Prescription Drug Coverage in the CCW

The CCW contains Medicare enrollment records that are used to identify sources of drug coverage. A limitation of these measures to identify drug coverage is that they only include sources validated by the government. These sources include Part D, RDS, and other creditable (i.e., FEHB, Veterans Affairs, Tricare, SPAP, or working aged). This is problematic because it is possible that beneficiaries with drug coverage from a source other than those identified by Medicare would be misclassified as having no drug coverage.

Comparison to Self-reported Drug Coverage in CCW and MCBS

The Medicare Current Beneficiary Survey (MCBS) includes self-reported measures of drug coverage in addition to Medicare enrollment records. To quantify the correspondence between measures I compared drug coverage in the MCBS and the CCW. The goal was to determine the extent to which beneficiaries are classified as having no drug coverage in the CCW while reporting a source of coverage that is considered non-creditable in the MCBS. I identified sources of drug coverage in the MCBS using weighted indicators from the Access to Care survey which took place in the fall of 2007. To obtain a comparable measure in the CCW I explored measures in October to December of 2007.

I observed little change in source of drug coverage over 3 months. Therefore, for purposes of simplicity I selected to use November indicators only. Table 19 compares the proportion of beneficiaries identified in each major source of drug coverage available in the CCW. In both datasets about 60% of the samples were enrolled in Part D. Slightly more beneficiaries were identified as having RDS in the CCW than the MCBS (17.2% vs. 15.8%). Almost 14% of beneficiaries reported having other coverage in the MCBS compared to 10.2% of beneficiaries reporting having other creditable coverage in the CCW. Fewer beneficiaries reported having no coverage in the MCBS compared to the CCW (10.9% vs. 12.4%).

Among beneficiaries reporting other coverage in the MCBS, 90% reported ESI, 5.5% reported other private coverage, and 4% reported other public. The balance reported combinations of the above.

Table 19 Comparison of Prescription Drug Coverage Sources using the MCBS and CCW

Drug Coverage	MCBS	CCW
Part D	59.41%	60.2%
RDS	15.75%	17.21%
Other Creditable	13.95%	10.22%
None	10.96%	12.38%
Total	100%	100%

These findings suggest that there may be beneficiaries classified as having no coverage in the CCW that do in fact have coverage. However, given the small difference, it is likely not problematic. Also, the other reported sources of coverage in the MCBS may not be very generous, or considered creditable.

Low Income Subsidy receipt and time to enrollment

Late Part D enrollees that are eligible to receive the LIS may enroll to obtain Part D coverage at any time without a penalty. LIS recipients are able to enroll in Part D at any time and are not restricted to the open enrollment periods. Consequently, the time to enrollment for LIS recipients can be shorter. They are not forced to delay enrollment and therefore, are not affected by the lag in time. We would expect that the time from the health shock to the time of the next available coverage to begin (January) to have no effect on LIS recipients. However, we would expect that the greater the amount of time between health shock and the next coverage period would reduce the likelihood of enrollment among non-LIS recipients. Our analysis proved this to be the case.

One potential concern is that beneficiaries who enroll in Part D and qualify for the LIS may not obtain the LIS until a later time. This is possible if the beneficiary did not realize they were eligible for the LIS until a later time, or if there was a delay in the LIS approval process and delay in the time that information is conveyed to the Part D plan by CMS.

We conducted simple descriptive statistics to assess the extent to which beneficiaries enroll in Part D and later obtain LIS. We found that 87% of our sample that obtained the LIS do so at their first month of Part D enrollment, the other 13% received LIS at a later date during the study period. Also, among all beneficiaries who enrolled in Part D without the LIS, only 5% did obtain the LIS later on. We are not able to determine whether the changes in LIS status are a result of newly qualifying for the subsidy or if the individual was simply not aware of the program upon Part D enrollment.

References

1. Juliette Cubanski, M.V., Michelle Kitchman, Tricia Neuman, Medicare Chartbook. 2005, The Henry J. Kaiser Family Foundation.
2. The Henry J. Kaiser Family Foundation, Low-Income Assistance under the Medicare Drug Benefit. 2009
3. Lichtenberg, F.R. and S.X. Sun, The Impact Of Medicare Part D On Prescription Drug Use By The Elderly. Health Aff, 2007. 26(6): p. 1735-1744.
4. Polinski, J.M., et al., Changes In Drug Use And Out-Of-Pocket Costs Associated With Medicare Part D Implementation: A Systematic Review. Journal of the American Geriatrics Society, 2010. 58(9): p. 1764-1779.
5. Ketcham JD, S.K., Medicare Part D's Effects on Elderly Drug Costs and Utilization. Am J Manag Care, 2008 14(11): p. SP14-22.
6. Yin, W., et al., The Effect of the Medicare Part D Prescription Benefit on Drug Utilization and Expenditures. Annals of Internal Medicine, 2008. 148(3): p. 169-177.
7. Joyce, G.F., et al., Medicare Part D after 2 years. The American Journal of Managed Care, 2009. 15(8): p. 536-544.
8. Zhang, Y., et al., The Effect of Medicare Part D on Drug and Medical Spending. New England Journal of Medicine, 2009. 361(1): p. 52-61.
9. Zhang, Y., et al., The Impact of Medicare Part D on Medication Treatment of Hypertension. Health Services Research, 2011. 46(1): p. 185-198.
10. Zhang, J.X., et al., The impact of the Medicare Part D prescription benefit on generic drug use. Journal of general internal medicine, 2008. 23(10): p. 1673-1678.

11. Schneeweiss, S., et al., The Effect Of Medicare Part D Coverage On Drug Use And Cost Sharing Among Seniors Without Prior Drug Benefits. Health Aff, 2009. 28(2): p. w305-316.

12. Shrank, W.H., et al., The Effect Of Transitioning To Medicare Part D Drug Coverage In Seniors Dually Eligible For Medicare And Medicaid. Journal of the American Geriatrics Society, 2008. 56(12): p. 2304-2310.

13. Basu, A., W. Yin, and G.C. Alexander, Impact of Medicare Part D on Medicare-Medicaid Dual-Eligible Beneficiaries' Prescription Utilization And Expenditures. Health Services Research, 2010. 45(1): p. 133-151.

14. Donohue, J.M., et al., Impact of Medicare Part D on Antidepressant Treatment, Medication Choice, and Adherence Among Older Adults With Depression. American Journal of Geriatric Psych, 2011. 19(12): p. 989-997

15. Briesacher, B.A., et al., Medicare Part D and Changes in Prescription Drug Use and Cost Burden: National Estimates for the Medicare Population, 2000 to 2007. Medical Care, 2011. 49(9): p. 834-841

16. Liu, F.X., et al., The Impact of Medicare Part D on Out-of-Pocket Costs for Prescription Drugs, Medication Utilization, Health Resource Utilization, and Preference-Based Health Utility. Health Services Research, 2011. 46(4): p. 1104-1123.

17. Ettner, S., et al., Drug Benefit Changes Under Medicare Advantage Part D: Heterogeneous Effects on Pharmaceutical Use and Expenditures. Journal of general internal medicine, 2011. 26(10): p. 1195-1200.

18. Lau, D.T. and J. Stubbings, Medicare Part D Research and Policy Highlights, 2012: Impact and Insights. Clinical Therapeutics, 2012. 34(4): p. 904-914.

19. Davidoff, A.S., Bruce; Shaffer, Thomas; Shoemaker, J. Samantha; Kim, Melissa; Zacker, Christopher, Lessons Learned: Who Didn't Enroll In Medicare Drug Coverage In 2006, And Why? Health Affairs, 2010: p. hlthaff.2009.0002.
20. Levy, H.W., David R, Take-up of Medicare Part D: Results From the Health and Retirement Study. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 2010. 65B(4): p. 492-501.
21. Bovbjerg, B.D., Medicare Part D Low-Income Subsidy SSA Continues to Approve Applicants, but Millions of Individuals Have Not Yet Applied, U.S.G.A. Office, Editor. 2008.
22. Summer, L.H., Jack; Hargrave, Elizabeth, The Medicare Part D Low-Income Subsidy Program: Experience to Date and Policy Issues for Consideration. 2010. The Henry J. Kaiser Family Foundation.
23. Cubanski, J., Overview Of Medicare Part D In 2012 And Trends Over Time. 2012. The Henry J. Kaiser Family Foundation.
24. The Henry J. Kaiser Family Foundation., The Medicare Prescription Drug Benefit. 2010.
25. Duggan, M. and F.S. Morton, The Effect of Medicare Part D on Pharmaceutical Prices and Utilization. The American Economic Review, 2010. 100: p. 590-607.
26. Hoadley, J. et al. Medicare Part D:A First Look at Part D Plan Offerings in 2012, in Data Spotlight. 2011, The Henry J. Kaiser Family Foundation.
27. Center for Medicare Advocacy, I., Part D/Prescription Drug Benefits. 2012, Center for Medicare Advocacy, Inc.
28. CMS, Guidance to the States on the Low Income Subsidy. 2009, The Centers for Medicare and Medicaid Services, U.S. Department of Health and Human.

29. Social Security, A., Medicaid Information, 2011.

30. Center for Medicare Advocacy, I., Medicare Savings Programs, 2011.

31. Social Security Administration, HI 03001.005 Medicare Part D Extra Help (Low-Income Subsidy). 2012.

32. The Henry J. Kaiser Family Foundation, Medicare Chartbook, Fourth edition, 2010.

33. Cubanski, J.N. et al. Examining Sources of Supplemental Insurance and Prescription Drug Coverage Among Medicare Beneficiaries: Findings from the Medicare Current Beneficiary Survey, 2007. 2009, The Henry J. Kaiser Family Foundation.

34. Arrow, K.J., Uncertainty And The Welfare Economics Of Medical Care. The American Economic Review, 1963. 53(5): p. 941-973.

35. Von Neumann, J. and O. Morgenstern, Theory Of Games And Economic Behavior. Vol. Princeton: Princeton University Press. 1944: Princeton Univ Pr.

36. Bernoulli, D., Exposition of a new theory on the measurement of risk. Econometrica: Journal of the Econometric Society, 1954. 22(1): p. 23-36.

37. Pratt, J.W., Risk Aversion in the Small and in the Large. Econometrica: Journal of the Econometric Society, 1964. 32(1): p. 122-136.

38. Nyman, J.A., The Theory Of Demand For Health Insurance. 2003: Stanford Economics and Finance.

39. Morgenstern, O. and J. Von Neumann, Theory Of Games And Economic Behavior. Vol. 3. 1947: Princeton University Press Princeton, NJ.

40. Nyman, J.A., The Value Of Health Insurance: The Access Motive. Journal of Health Economics, 1999. 18(2): p. 141-152.

41. Mas-Colell, A., M.D. Whinston, and J.R. Green, Microeconomic Theory. Vol. 981. 1995: Oxford university press New York.

42. Friedman, M. and L.J. Savage, The Utility Analysis Of Choices Involving Risk. The Journal of Political Economy, 1948. 56(4): p. 279-304.

43. Nyman, J.A., The Demand for Insurance: Expected Utility Theory from a Gain Perspective. University of Minnesota, Working Paper, 2001.

44. Kahneman, D. and A. Tversky, Prospect theory: An Analysis Of Decision Under Risk. Econometrica: Journal of the Econometric Society, 1979: p. 263-291.

45. Tversky, A. and D. Kahneman, Rational Choice And The Framing Of Decisions. Journal Of Business, 1986. 59(4): p. 251-278.

46. Tversky, A. and D. Kahneman, The Framing Of Decisions And The Psychology Of Choice. Science, 1981. 211(4481): p. 453.

47. Bell, D.E., H. Raiffa, and A. Tversky, Decision making: Descriptive, normative, and prescriptive interactions. 1988: Cambridge Univ Pr.

48. Feldstein, P.J., Health Care Economics, 6e. 2004: Delmar Thomson Learning.

49. Atherly, A. and B. Dowd, Should Healthy Medicare Beneficiaries Postpone Enrollment in Medicare Part D? Health Economics, 2009. 18(8): p. 921-931.

50. Vetter, S.H., Florian; McFadden, Daniel L.; Winter, Joachim Klaus, Risk Attitudes And Medicare Part D Enrollment Decisions, 2012, University of Munich, Department of Economics.

51. Akerlof, G., The Market for "Lemons": Quality Uncertainty and the Market Mechanism. The Quarterly Journal of Economics, 1970. 84(3): p. 488-500.

52. Rothschild, M. and J. Stiglitz, Equilibrium in Competitive Insurance Markets: an Essay on the Economics of Imperfect Information. Quarterly Journal of Economics, 1976. 90(4): p. 629-649.

53. Heiss, F.M., D. Winter, J, Mind The Gap! Consumer Perceptions And Choices Of Medicare Part D Prescription Drug Plans, National Bureau Of Economic Research. 2007.

54. Daniel McFadden, C.N., Pau Olivella, Remedies for Sick Insurance, in Barcelona GSE Working Paper Series. 2012: Barcelona

55. Duggan, M., P. Healy, and F.S. Morton, Providing prescription Drug Coverage To The Elderly: America's Experiment With Medicare Part D. The Journal Of Economic Perspectives : A Journal Of The American Economic Association, 2008. 22(4): p. 69-92.

56. Heiss, F., D. McFadden, and J. Winter, Who Failed To Enroll In Medicare Part D, And Why? Early Results. Health Affairs (Project Hope), 2006. 25(5): p. w344-54.

57. Goldman, D.P. and G.F. Joyce, Medicare Part D: A Successful Start With Room For Improvement. JAMA : The Journal Of The American Medical Association, 2008. 299(16): p. 1954-1955.

58. Goldman, D.P., G.F. Joyce, and W.B. Vogt, Part D Formulary and Benefit Design as a Risk-Steering Mechanism. The American Economic Review. 101(3): p. 382-386.

59. Levy, H.W., David Take-Up of Medicare Part D and the SSA Subsidy: Early Results from the Health and Retirement Study, in WP 2007-163 2007, University of Michigan Retirement Research Center Research Paper.

60. Winter, J., et al., Medicare Prescription Drug Coverage: Consumer Information and Preferences. Proceedings of the National Academy of Sciences of the United States of America, 2006. 103(20): p. 7929-7934.

61. Neuman, P.S. et al. Medicare Prescription Drug Benefit Progress Report: Findings From A 2006 National Survey Of Seniors. Health Affairs (Project Hope), 2007. 26(5): p. w630-43.

62. Barnes, A.J., et al., One Fish, Two Fish, Red Fish, Blue Fish: Effects of Price Frames, Brand Names, and Choice Set Size on Medicare Part D Insurance Plan Decisions. Medical Care Research and Review, 2012.

63. Wood, S. and Y. Hanoch, The Impact of Numeracy on Medicare Part D Insurance Choice in Older Adults

Consumer Knowledge and Financial Decisions, D.J.J. Lamdin, Editor. 2012, Springer New York. p. 255-267.

64. Abaluck, J.T. and J. Gruber, Choice inconsistencies among the elderly: Evidence from plan choice in the Medicare Part D program. NBER Working Paper No. 14759, 2009.

65. Regan, J.F. and C.A. Petroski, Prescription Drug Coverage Among Medicare Beneficiaries. Health Care Financing Review, 2007. 29(1): p. 119-125.

66. Summer, L., Increasing Participation in Benefit Programs for Low-Income Seniors. The Commonwealth Fund, 2009.

67. Moon, M.F. et al. Medicare Beneficiaries and their Assets: Implications for Low-Income Program. The Henry J. Kaiser Family Foundation, 2002.

68. Kalman Rupp, J.S., Eligibility for the Medicare Buy-in Programs, Based on a Survey of Income and Program Participation Simulation. Social Security Bulletin, 2000. 13.

69. Selden, T.M. et al. Medicaid's Problem Children: Eligible But Not Enrolled. Health Affairs, 1998. 17(3): p. 192.

70. Selden, T.M. et al. Waiting in the Wings: Eligibility And Enrollment In The State Children's Health Insurance Program. Health affairs (Project Hope), 1999. 18(2): p. 126-133.

71. Stuber, J. and K. Kronebusch, Stigma And Other Determinants Of Participation in TANF and Medicaid. Journal of Policy Analysis and Management, 2004. 23(3): p. 509-530.

72. Sarat, A., Law Is All Over: Power, Resistance and the Legal Consciousness of the Welfare Poor, The. Yale Journal of Law & the Humanities, 1990. 2(1): p. 343-379.

73. Lipsky, M., Street-level bureaucracy: Dilemmas of the individual in public service. 2010: Russell Sage Foundation Publications.

74. Haber, S.G., et al., Evaluation of Qualified Medicare Beneficiary (QMB) and Special Low-Income Medicare Beneficiary (SLMB) Programs. Waltham, MA: RTI International, 2003.

75. U.S. Government Accountability Office, Low-Income Medicare Beneficiaries Further Outreach And Administrative Simplification Could Increase Enrollment. 1999.

76. Yelowitz, A.S., The Medicaid Notch, Labor Supply, And Welfare Participation: Evidence From Eligibility Expansions. The Quarterly Journal of Economics, 1995. 110(4): p. 909-939.

77. Ku, L., How Welfare Reform and Economic Factors Affected Medicaid Participation: 1984-96. 2000.

78. Dion, M.R. and L. Pavett, Access to and Participation in Medicaid and the Food Stamp Program: A Review of the Recent Literature. Mathematica Policy Research, Inc, 2007. 8661-401.

79. Zedlewski, S.R., Former Welfare Families Continue To Leave The Food Stamp Program. 2001.

80. Neumann, P.J., et al., Participation in the Qualified Medical Beneficiary Program. Health care financing review, 1995. 17(2): p. 169-178.

81. Center for Medicare Advocacy, Health Care Reform and Low Income Beneficiaries. 2010, Center for Medicare AdvocacP.

82. U.S. Government Accountability Office, Medicare Part D Low-Income Subsidy: Progress Made In Approving Applications, but Ability to Identify Remaining Individuals Is Limited. 2007.

83. Rudolph, N. and M. Montgomery, Low-Income Medicare Beneficiaries and their Experiences with the Part D Prescription Drug Benefit. Inquiry, 2010. 47(2): p. 162-172.

84. Lipson, D., Barrett, A., Merrill, A. and Denny-Brown, N, Doors to Extra Help: Boosting Enrollment in the Medicare Part D LowIncome Subsidy. 2007, AARP Public Policy Institut.

85. Butler, M.G., et al., Medicare Part D information seeking: The role of recognition of need and patient activation. Research in Social and Administrative Pharmacy.

86. Moffitt, R., An Economic Model Of Welfare Stigma. The American Economic Review, 1983. 73(5): P. 1023-1035.

87. Soss, J., Unwanted Claims: The Politics Of Participation In The US Welfare System. 2002: Univ Of Michigan Pr.

88. Goodsell, C.T., The Case For Bureaucracy: A Public Administration Polemic. 1983: Chatham House Publishers.

89. Bertrand, M., E.F.P. Luttmer, and S. Mullainathan, Network Effects and Welfare Cultures. The Quarterly Journal of Economics, 2000. 115(3): p. 1019-1055.

90. Ebeler, J., Cusick, Elizabeth, Guterman, Stuart, King-Shaw, Ruben J., Nibali, Kenneth and Waxman, Judith, Improving the Medicare Savings Programs. National Academy of Social Insurance, 2006.

91. Perry, M.J., S. Kannel, and A. Dulio, Barriers to Medicaid Enrollment For Low-Income Seniors: Focus Group Findings. 2002: Kaiser Commission on Medicaid and the Uninsured.

92. Cusick, E. and K. Nibali, Current Processes for Enrolling Medicare/Medicaid Dual Eligibles in Medicare Savings Programs and Efforts to Increase Enrollment. 2005.

93. Sears, J., Comparing beneficiaries of the Medicare savings programs with eligible nonparticipants. Social Security Bulletin, 2001. 64(3): p. 76-80.

94. Hsu, J.F. et al., Medicare Beneficiaries' Knowledge Of Part D Prescription Drug Program Benefits And Responses To Drug Costs. JAMA : The Journal Of The American Medical Association, 2008. 299(16): P. 1929-1936.

95. Czajka, J.J. et al. Survey estimates of wealth: A Comparative Analysis And Review Of The Survey Of Income And Program Participation. 2003, Mathematica Policy Research: Washington, DC.

96. Robert Wood Johnson Foundation, Comparing Federal Government Surveys that Count Uninsured People in America. 2005, Robert Wood Johnson Foundation.

97. U.S. Department of Health and Human Services. Understanding Estimates of the Uninsured: Putting the Differences in Context. 2005.

98. Card D et al. Using Discontinuous Eligibility Rules to Identify the Effects of the Federal Medicaid Expansions on Low Income Children. Review of Economics and Statistics, 2004. 86(3): p. 752-766.

99. DM Cutler et al. The Effect Of Medicaid Expansions On Public Insurance, Private Insurance, And Redistribution. The American Economic Review, 1996.

100. Lisa Dubay, G.K., Expanding Public Health Insurance to Parents: Effects on Children's Coverage under Medicaid. Health Services Research, 2003. 38(5).

101. Ettner, S.L., Medicaid Participation Among The Eligible Elderly. Journal of Policy Analysis and Management, 1997. 16(2): p. 237-255.

102. Zuckerman, S., B. Shang, and T. Waidmann, Medicare Savings Programs: Analyzing Options for Expanding Eligibility. Inquiry, 2009. 46(4): p. 391-404.

103. Alexander Strand, K.R., Paul S. Davies, Measurement Error in Estimates of the Participation Rate in Means-Tested Programs: The Case of the US Supplemental Security Income Program for the Elderly. 2009, U.S. Social Security Administration.

104. Richard, D.C., Nonparticipation in the SSI Program by the Eligible Elderly. Southern Economic Journal, 1985. 51(3): p. 891-897.

105. Briesacher, B. et al., Out-of-Pocket Burden of Health Care Spending and the Adequacy of the Medicare Part D Low-Income Subsidy. Medical Care, 2010.48(6): 503-509.

106. Dubay, L., Children's Eligibility for Medicaid and SCHIP: A View from 2000. 2002, Urban Institute.

107. Sommers, A.S., et al., Dynamics in Medicaid and SCHIP Eligibility Among Children In SCHIP's Early Years: Implications For Reauthorization. Health Affairs, 2007. 26(5): p. w598.

108. Davidoff, A., G. Kenney, and L. Dubay, Effects Of The State Children's Health Insurance Program Expansions On Children With Chronic Health Conditions. Pediatrics, 2005. 116(1): p. e34.

109. Kronebusch, K. and B. Elbel, Simplifying Children's Medicaid and SCHIP. Health Affairs, 2004. 23(3): p. 233.

110. Davern, M.R. et al. Kathleen The Effect of Income Question Design in Health Surveys on Family Income, Poverty and Eligibility Estimates. Health Services Research, 2005. 40(5p1): p. 1534-1552.

111. Bound, J., The Extent of Measurement Error in Longitudinal Earnings Data: Do Two Wrongs Make a Right? The Journal of Labor Economics, 1991. 9(1).

112. Meyer, B.D. and J.X. Sullivan, Measuring The Well-Being Of The Poor Using Income And Consumption. Journal Of Human Resources, 2003. 38(Journal Article): p. 1180-1220.

113. Rice T et al. Who Will Be Denied Medicare Prescription Drug Subsidies Because of the Asset Test? American Journal of Managed Care, 2006. 12(1): p. 46–54.

114. Hwang, A., S. Rosenbaum, and B.D. Sommers, Creation Of State Basic Health Programs Would Lead To 4 Percent Fewer People Churning Between Medicaid And Exchanges. Health Affairs, 2012. 31(6): p. 1314-1320.

115. Sommers, B.D., et al., Reasons For The Wide Variation In Medicaid Participation Rates Among States Hold Lessons For Coverage Expansion In 2014. Health Affairs, 2012. 31(5): p. 909-919.

116. Hurd, M., F.T. Juster, and J.P. Smith, Enhancing the quality of data on income: Recent innovations from the HRS. Journal of Human Resources, 2003. 38(3): p. 758.

117. Gresenz, C.R., et al., Take-Up of Public Insurance and Crowd-Out of Private Insurance under Recent CHIP Expansions to Higher Income Children. Health Services Research, 2012:

118. Moon, M. et. al., Options for Aiding Low-Income Medicare Beneficiaries. Inquiry : A Journal Of Medical Care Organization, Provision And Financing, 1998. 35(3): p. 346-356.

119. Barents, G., A profile of QMB-eligible and SLMB-eligible Medicare beneficiaries. 1999.

120. Swartz, K., Interpreting the Estimates From Four National Surveys Of The Number Of People Without Health Insurance. Journal Of Economic And Social Measurement, 1986. 14(3): p. 233-242.

121. Ku, L., M.R. Ellwood, and J. Klemm, Deciphering Medicaid Data: Issues And Needs. Health Care Financing Review, 1990. p. 35-45.

122. Bitler, M.P., J. Currie, and J.K. Scholz, WIC Eligibility And Participation. Journal of Human Resources, 2003. 38: p. 1139-1179.

123. Finegold, K. and L. Giannarelli, TRIM3 Simulations of Full-Year Uninsured Children and their Eligibility for Medicaid and SCHIP. Urban Institute, Washington, DC.(June 14), 2007.

124. Moffitt, R.A. and J.K. Scholz, Trends in the level and distribution of income support. NBER Working Paper, 2009.

125. Cutler, D.M. and J. Gruber, Does Public Insurance Crowd Out Private Insurance. The Quarterly Journal Of Economics, 1996. 111(2): p. 391-430.

126. Currie, J. and J. Gruber, Health Insurance Eligibility, Utilization Of Medical Care, And Child Health. The Quarterly Journal of Economics, 1996. 111(2): p. 431-466.

127. Currie, J. and J. Gruber, Saving babies: The Efficacy And Cost Of Recent Changes In The Medicaid Eligibility Of Pregnant Women. Journal of Political Economy, 1996. 104(6): p. 1263-1296.

128. Yelowitz, A.S. et. al., Public Policy And Health Insurance Choices Of The Elderly: Evidence From The Medicare Buy-In Program. Journal of Public Economics, 2000. 78(3): p. 301-324.

129. Shore-Sheppard, L.D., et al., Stemming The Tide? The Effect Of Expanding Medicaid Eligibility On Health Insurance Coverage. Health Care, 2008. 8(2): p. 6.

130. Erik Meijer et. al., Using Matched Survey and Administrative Data to Estimate Eligibility for the Medicare Part D Low Income Subsidy Program. 2010.

131. Meijer, E.K. et. al. Estimates of Potential Eligibility for Low-Income Subsidies Under Medicare Part D. 2009, RAND Corporation: Santa Monica, CA.

132. CBO, A Detailed Description of CBO's Cost Estimate for the Medicare Prescription Drug Benefit. 2004, Congressional Budget Office: Washington, DC.

133. Goldman, D.P. et. al., Methodological biases in estimating the burden of out-of-pocket expenses. Health Services Research, 2001. 35(6): p. 1357-65; discussion 1365-70.

134. The Henry J. Kaiser Family Foundation. Low-Income Assistance Under the Medicare Drug Benefit. 2006.

135. The Henry J. Kaiser Family Foundation. Overview of Medicare Part D Organizations, Plans and Benefits By Enrollment in 2006 and 2007. 2007, The Henry J. Kaiser Family Foundation.

136. US Office Government Accountability, Medicare Part D Low-Income Subsidy Additional Efforts Would Help Social Security Improve Outreach and Measure Program Effect. 2007.

137. Newhouse, J.P. et. al., Free For All?: Lessons From The RAND Health Insurance Experiment. 1993: Harvard Univ Press.

138. Pauly, M.V., Medicare Drug Coverage And Moral Hazard. Health Affairs, 2004. 23(1): P. 113.

139. CMS, Medicare and You 2012: The Official U.S. Government Medicare Handbook. 2011.

140. Summer, L., Increasing Participation in Benefit Programs for Low-income Seniors. 2009: Commonwealth Fund.

141. The Henry J. Kaiser Family Foundation. The Medicare Prescription Drug Benefit: Fact Sheet. 2011.

142. Q1Group, 2012 Medicare Part D Outlook. 2012, Q1Group LLC.

143. CMS, Medicare Current Beneficiary Survey, Overview. 2010, The Centers for Medicare and Medicaid Services.

144. Current Population Survey. 2010, U.S. Census Bureau

145. US Census Bureau, Guidance About Income Sources. 2010.

146. US Census Bureau, Money Income in the United States. 1998.

147. Hardin, J. et. al., Generalized Linear Models And Extensions. 2007: Stata Corp.

148. The Henry J. Kaiser Family Foundation, State Health Facts. 2010

149. Gibson, T.B. et. al., The Effects Of Prescription Drug Cost Sharing: A Review Of The Evidence. The American Journal of Managed Care, 2005. 11(11): p. 730-740.

150. Poisal, J.A. and G.S. Chulis, Medicare Beneficiaries And Drug Coverage. Health Affairs (Project Hope), 2000. 19(2): p. 248-256.

151. Poisal, J.A. and L. Murray, Growing Differences Between Medicare Beneficiaries With And Without Drug Coverage. Health Affairs (Project Hope), 2001. 20(2): p. 74-85.

152. Steinman, M.A., L.P. Sands, and K.E. Covinsky, Self-Restriction Of Medications Due To Cost In Seniors Without Prescription Coverage. Journal Of General Internal Medicine, 2001. 16(12): P. 793-799.

153. Klein, D., C. Turvey, And R. Wallace, Elders Who Delay Medication Because Of Cost: Health Insurance, Demographic, Health, And Financial Correlates. The Gerontologist, 2004. 44(6): P. 779-787.

154. Mojtabai, R. and M. Olfson, Medication Costs, Adherence, And Health Outcomes Among Medicare Beneficiaries. Health Affairs (Project Hope), 2003. 22(4): P. 220-229.

155. Gross, D.J., et al., Out-Of-Pocket Health Spending By Poor And Near-Poor Elderly Medicare Beneficiaries. Health Services Research, 1999. 34(1 Pt 2): P. 241-254.

156. Kocot, L. Medicare Part D: Is It Working for Low Income Seniors? in Testimony, Special Committee on Aging,United States Senate. 2007.

157. Hoadley J, S.L., Hargrave E, Cubanski J, Neuman T, Analysis of Medicare Prescription Drug Plans in 2011 and Key Trends since 2006. 2011, The Henry J. Kaiser Family Foundation.

158. Commission, M.P.A., Report to the Congress: Medicare Payment Policy. 2011. p. 317-337.

159. Ketcham, J.D. and K.I. Simon, Medicare Part D's Effects On Elderly Patients' Drug Costs And Utilization. Am J Manag Care, 2008. 14(11).

160. Madden, J.M., et al., Cost-Related Medication Nonadherence And Spending On Basic Needs Following Implementation of Medicare Part D. JAMA : the journal of the American Medical Association, 2008. 299(16): p. 1922-1928.

161. CMS, Part D Payment and Risk Adjustment. 2005.

162. Engelhardt, G. and J. Gruber, Medicare Part D and the Financial Protection of the Elderly. NBER Working Paper Series, 2010. w16155.

163. Folland, S., A. Goodman, and M. Stano, The Economics of Health and Health Care. Vol. 6. 2007.

164. Bruno, J.J. and J.J. Ellis, Herbal Use Among US Elderly: 2002 National Health Interview Survey. The Annals of Pharmacotherapy, 2005. 39(4): p. 643-648.

165. Complementary and Alternative Medicine Use Among Elderly Persons: One-Year Analysis Of A Blue Shield Medicare supplement. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2000. 55(1): p. M4-M9.

166. Buccaneer, Chronic Condition Data Warehouse Part D Data User Manual 2010.

167. Centers for Medicare and Medicaid Services, Medicare Advantage Rates & Statistics. 2010.

168. Centers for Medicare and Medicaid Services, Part D Risk Adjustment Model. 2007.

169. Zuckerman, I., et al., Validation of a Method For Identifying Nursing Home Admissions Using Administrative Claims. BMC Health Services Research, 2007. 7(1): p. 202.

170. RTI International, RTI Spatial Impact Factor Data. 2012, RTI International.

171. HealthCare Foundation, The Medicare Drug Benefit: Impact on Nursing Facilities. 2005, California HealthCare Foundation: Oakland, CA.

172. Medicare Rights Center, Expanding Eligibility for Medicare Savings Programs: The Case for New York State. 2007, Medicare Rights Center.

173. McDonnell, K., Income of the Elderly Population Age 65 and Over, 2005. Employee Benefit Research Institute Notes, 2007. 28(5): p. 2-6.

174. Chapman, J. and M. Ettlinger, Social Security and the Income of the Elderly. 2005.

175. Thomas, H., et al., Trends in the Economic Status of the Elderly, 1976–2000. Social Security Bulletin, 2001. 64(3).

176. Social Security Administration., Outreach to Low-Income Medicare Beneficiaries – Extra Help and Medicare Savings Programs. 2011.