HEALTH CARE AND HUMAN SERVICES POLICY, RESEARCH, AND CONSULTING—WITH REAL-WORLD PERSPECTIVE

Health Practitioner Bonuses and Their Impact on the Availability and Utilization of Primary Care Services

Final Report

Prepared for: *Assistant Secretary for Planning and Evaluation, Department of Health and Human Services*

Submitted by: *The Lewin Group*

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Executive Summary

Overview

In this study, funded by The Assistant Secretary for Planning and Evaluation (ASPE), we analyze the impact of three different health practitioner incentives on the supply of primary care services: (1) the Medicare primary care incentive payment (PCIP); (2) the physician shortage area (PSA) bonus; and (3) the health professional shortage area (HPSA) bonus. Section 5501(a) of The Affordable Care Act authorized a quarterly incentive payment program to augment the Medicare payment for primary care services when furnished by primary care practitioners beginning in 2011 and ending in 2015. Medicare has been paying a HPSA bonus since 1987. Initially, the HPSA bonus was paid to physicians providing care in rural geographic HPSAs; in 1991 it was extended to services provided by physicians in urban geographic HPSAs. Subsequently, section 413a of the Medicare Modernization Act put in place an additional 5 percent bonus payment for physicians practicing in PSAs. PSAs were those counties and rural zip codes in MSAs with the lowest physician to population ratios. The purpose of these incentives is to increase the supply of provider services, both in general and for evaluation and management (E&M) in particular. In the case of the PCIP, it is to increase the supply of primary care services in Medicare. In the case of the PSA and HPSA bonuses, it is to increase the supply of services in certain locations designated as underserved.

- We first consider the PCIP program. Under the PCIP program, eligible providers in designated primary care specialties are offered a 10 percent reimbursement premium for primary care services. The study addresses the following broad empirical issues surrounding the Medicare PCIP program.
- Experience to date with the Medicare primary care incentive payment in terms of the aggregate number of recipients and the distribution of those recipients by specialty and by geographic area.
- Proportion of primary care providers who qualify for the bonus and the characteristics of those primary care providers.
- Volume of eligible claims submitted by the PCIP eligible providers and the impact of Medicare PCIP policy on the primary CARE services provided and other outcome measures of interest.

To explore these topics, we used a customized data set constructed at the provider level. This data set included all the claims submitted by the entire universe of Medicare providers each year from 2005 to 2011. Subsequently, each provider was linked by National Provider Identification number (NPI) to Provider360 data (available from Lewin Group's parent company Optum Inc.) and the AMA Physician Master File to add provider characteristics such as provider demographics (e.g., age, gender), provider designation, medical school, and practice location. We also added geographic location-specific variables from the Area Resource File (ARF) based on the practice location information of providers. The main advantage of this pooled data set is the ability to track providers over time and capture changes in their volume of services in response to financial incentives.

We use a difference-in-difference (DID) approach to identify the effect of the financial incentives associated with the Medicare PCIP policy on key outcomes of interest. This method entails: (1) inclusion of a treatment group which is likely to be affected by the PCIP policy and a relevant comparison group not likely to be affected by the policy; (2) controls for year-specific effects common to both groups; and (3) an interaction of the treatment group and the year effects to capture the distinct impact of the policy on the treatment group. The model also controls for provider demographics and regional characteristics. One advantage of the DID estimation approach is that it enables us to disentangle the net impact of the 10 percent PCIP policy from changes that coincided with the PCIP policy affecting both the treatment and comparison group.

Policy makers have long been concerned about patient access to health care, particularly primary care, in underserved or shortage areas. We also focus on two additional financial incentive programs: Health Professionals Shortage Area (HPSA) bonus and Physician Shortage Area (PSA) bonus implemented in an attempt to improve access in shortage areas. These programs offer a higher rate of reimbursement in Medicare for eligible providers should they provide services in designated shortage areas. More specifically, we examine the following issues surrounding HPSA and PSA bonus:

- The distribution of HPSA bonus recipients; the overlap between HPSA and Medicare primary care incentive payment (PCIP), and the overlap between the HPSA and PSA bonus recipients.
- Impact of HPSA bonus on the number of primary care providers and subsequent impact on the volume of primary care services.
- Impact of PSA bonus on the number of primary care physicians and subsequent impact on the volume of primary care services.

Finally, we examine the existing evidence from the literature on the variation in Medicaid reimbursement rates relative to the Medicare rates to inform the impact of the Medicaid parity provision in the ACA. We describe the variation in Medicaid reimbursement rates relative to the Medicare rates, both for primary care and for all services, across US states during the period 2008-2012. Based on the empirical results from the PCIP analysis, we perform an exercise to simulate the effect of a 10 percent increase in the Medicaid-to-Medicare fee index on the proportion of US office-based physicians accepting new Medicaid patients across all states.

Key Findings

1. *Impact of the Medicare Incentive Payment for Primary Care Providers (PCIP)*

Number of Medicare Providers:

- Our estimates suggest that the number of Medicare providers with a PCIP bonus-eligible specialty and at least one PCIP eligible claim increased annually by about 2.8 providers per county per year due to the Medicare PCIP bonus policy. This represents a sizeable increase of almost 19 percent since there were about 15 providers per county per specialty per year under a PCIP bonus eligible specialty during the 2005-2011 period. When restricted to primary care physicians with a PCIP eligible specialty, the estimated increase in the number of physicians is approximately 10 percent in response to the PCIP policy (i.e., elasticity of the number of primary care physicians with respect to the payment is about 1).[1]

[1] The increase in the number of physicians with a PCIP eligible specialty attributable to the policy is about 2 per county per year. This is almost 10 percent of the average number of primary care physicians in a given PCIP eligible specialty per county per year (average is almost 19). Therefore, given that PCIP policy provides 10

Evaluation & Management (E&M) Eligible Claims

The estimated impact of the PCIP policy on the volume of primary care services, measured by the volume of claims, is somewhat mixed.

More specifically, there were more PCIP eligible E&M claims submitted per provider in a particular claim type: 25 minute office visits for established patients. Specifically, on average, there was a 7 percent increase in the number of 25 minute office visits claims due to the PCIP policy. Thus, the implied elasticity of the number of 25 minute office visits with respect to the incentive payment is about 0.7. Hence, it appears that the PCIP may have induced a substitution toward slightly longer visits for established patients.

For PCIP eligible E&M claims in general, the estimates from the DID model indicate that, on average, primary care providers with PCIP-eligible specialties submitted fewer claims (per provider per year) related to PCIP-eligible E&M services in response to the Medicare PCIP policy.[2,3]

The positive impact of the PCIP bonus policy on the volume of E&M claims associated with 25 minute office visits for established patients is much stronger for providers near the PCIP eligibility threshold.[4] For the primary care providers near the PCIP eligibility threshold, there was almost a 15 percent increase in the number of claims for 25 minute visits due to the PCIP policy.

Allowed Charges for E&M Services

- We estimated no significant incentive payment impact on allowed charges per provider for the full sample of providers. However, for the sample of providers who were near the PCIP eligibility threshold in 2009[5], we found that per provider charges increased by about $5,611 annually in response to the policy. This estimated effect represents about 9.3 percent of the mean allowed charges ($60,235) per provider per year (i.e., the implied elasticity of allowed charges, which do not include the bonus payment, with respect to the payment is about 0.93).

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percent incentive payment, the implied elasticity of the number of physicians in PCIP eligible specialty with respect to the payment is about 1.

[2] Not all primary care providers are eligible for Medicare primary care incentive payments. In summary, primary care physicians (with internal medicine, family practice, pediatrics and geriatrics specialty) who have at least 60 percent of the practitioner's allowed charges under the Medicare physician fee schedule (excluding hospital inpatient care and emergency department visits) are for primary care services. The PCIP eligible primary care services are defined by specific E&M codes. Medicare PCIP is also provided to physician assistants, nurse practitioners and clinical nurse specialists who also meet the similar eligibility criteria.

[3] Note that total eligible claims increased. Claims per provider declined potentially because additional providers were induced to submit eligible claims.

[4] For the purpose of our analysis we consider the primary care physicians (with the PCIP eligible specialty) who have 50 percent-65 percent of their services for PCIP eligible E&M services (defined by specific E&M codes) to be near the eligibility threshold. We apply the similar method to select non-physicians (physician assistants, nurse practitioners and clinical nurse specialists) near the eligibility threshold.

[5] The determination of the eligibility of providers in the first year (2011) of the PCIP is based on the extent of their PCIP eligible services in 2009. Besides, the announcement of the PCIP program was made in 2010. Thus, we assumed that the providers with Medicare PCIP eligible specialties would be potentially responsive to the PCIP program as early as year 2010 and alter their behavior. Subsequently, it is more meaningful to examine providers who were near the PCIP eligibility threshold in 2009 which is the year just before the policy effect is expected to influence.

2. Impact of the Physician Shortage Area (PSA) bonus

Number of Medicare Providers

- The number of providers with PSA bonus-eligible specialties was estimated to increase by about 1 in PSA areas during the PSA period compared to the number of providers in non-PSA areas. This represents a sizeable increase as there were about 6 primary care providers on average in PSA areas.

E&M-Eligible Claims

- We found that, on average, physicians with bonus-eligible specialties who were located in PSA areas were estimated to have about 50 more claims submitted per year during the PSA period compared to providers with the same specialty who were located in non-PSA areas. Given that these physicians have, on average, about 644 claims per year for primary care E&M services, the impact of PSA bonus is not negligible.

Allowed Charges for E&M Services

- Our estimates indicate that, on average, physicians with PSA bonus-eligible specialties located in PSA areas did not experience a statistically significant increase in total annual allowed charges per provider per year for E&M services compared to those in non-PSA areas.[6]

3. Impact of the Health Professional Shortage Area (HPSA) Bonus

E&M Eligible Claims

- We focused only on the behavior of primary care physicians who are eligible for a HPSA bonus. We found that on average Medicare primary care physicians tend to submit about 17 more E&M claims annually specifically due to the gain of full HPSA status.[7]

Allowed Charges for E&M Services

- Medicare primary care physicians who are located in counties that ever lost primary care HPSA status tend to have about $1,380 more allowed charges annually before the location lost full HPSA status.

Conclusions

The Affordable Care Act includes two key provisions regarding reimbursement to primary care providers): (a) it provides a 10 percent incentive payment under the Medicare PCIP program to eligible providers (effective January 1, 2011); and (b) it raises the Medicaid primary care reimbursement rate at least up to 100 percent of the Medicare rate.

We find that as a result of the Medicare incentive payment the number of Medicare PCPs has increased on average by about 2.8 providers per county annually in 2010 and 2011. Also, the number of primary care physicians with PCIP eligible specialty increased by about 10 percent in

[6] Although the number of E&M claims went up due to the PSA bonus, it may be that within E&M services some services experienced an increase in allowed charges due to the PSA bonus while others experienced a decrease, accounting for the overall lack of impact.

[7] Health Resource and Services Administration (HRSA) publishes Area Health Resource File (ARF) that includes HPSA status for each county within the US. For the purpose of our analysis we focus on primary care HPSA status. The ARF data classifies counties as full primary care HPSA if the whole county is considered as a HPSA.

response to the 10 percent incentive payment under the PCIP policy (i.e., elasticity of the number of primary care physicians with respect to the incentive payment is about 1). Eligible claims for some types of PCIP eligible E&M services and associated allowed charges have also increased. For example, on average, there was a 7 percent increase in the number of claims for 25 minute office visits due to the PCIP policy. On the other hand, in response to the PCIP policy, there was a 9.3 percent increase in the average allowed charges (for eligible services) among primary care providers with PCIP eligible specialties.

The reader should exercise some caution in interpreting these results, however. The behavioral response to the PCIP was observed in our data only for one year. The relatively short period may have resulted in insufficient time for a full provider behavioral response. In addition, the legislation provided for a program of only limited duration. Some providers may have chosen, explicitly or implicitly, not to change their behavior for a program of limited duration.

In addition, we find that Medicare providers were attracted to PSA areas through the PSA bonus, and submitted 7.8 percent more E&M claims annually during the PSA period. Gaining HPSA status also generated an additional 17 E&M claims submitted by primary care physicians with HPSA bonus-eligible specialties.

The reader is again encouraged to exercise some caution in interpreting the results for the PSA bonus. Because the criteria for the bonus include the actual supply of providers, there is a risk that the results may be biased. Though the methods we employ attempt to minimize the potential impact of this type of bias, we cannot be completely sure that the results are unaffected by this.

Finally, we document the variation in Medicaid reimbursement rates relative to the Medicare rates, both for primary care and for all services, across US states during the period 2008-2012, using the existing body of evidence. Using the empirical results from our PCIP analysis, we also perform an exercise to simulate the effect of a 10 percent increase in the Medicaid-to-Medicare fee index on the proportion of US office-based physicians accepting new Medicaid patients across all states. The simulation suggests that a 10 percent increase in Medicaid-to-Medicare fee ratio, would increase the US average of office-based primary care physicians accepting new Medicaid patients from 66.2 percent to 72.8 percent. Again, however, caution is warranted in a literal interpretation of this result, as it is based on an extrapolation from a different program.

Introduction and Purpose Of The Study

The Assistant Secretary for Planning and Evaluation (ASPE) has contracted with The Lewin Group to examine the role of physician bonus and supplemental payment programs in increasing the supply of primary care providers (PCP) and the access of patients to their services.

The Congressional Budget Office has estimated that the implementation of the Patient Protection and Affordable Care Act (ACA) of 2010 will increase the number of nonelderly people who have health insurance—by about 13 million in 2014, 20 million in 2015, and 25 million in each of the subsequent years through 2024 (CBO, 2014).[8] Because those with insurance typically use more services than those without insurance, this increase in coverage will most likely result in additional pressure on a health care delivery system.[9] To address

[8] CBO Report (February, 2014): http://www.cbo.gov/sites/default/files/cbofiles/attachments/45010-breakout-AppendixB.pdf

[9] Manning WG, Newhouse JP, Duan N, Keeler EB, Benjamin B, Liebowitz A, et al. (1988). *Health insurance and the demand for medical care. Evidence from a randomized experiment*. Santa Monica, CA: RAND Corporation.

concerns about maintaining an adequate supply and distribution of primary care services, the ACA includes provisions that provide temporary financial incentives to primary care providers:

1. Section 5501 provides that from January 1, 2011 through December 31, 2015, under Medicare, eligible primary care practitioners will receive a 10 percent supplemental payment for primary care services they provide as defined by existing Evaluation and Management (E&M) codes under the new Medicare Primary Care Incentive Program (PCIP).

2. Section 1202 of the Act provides that for the period January 1, 2013 to December 31, 2014 under Medicaid, primary care services provided by primary care physicians must be paid at rates no less than Medicare rates for primary care physicians.

The Medicare primary care incentive payment is available to the eligible primary care practitioners for services provided under selected categories of E&M codes. An eligible primary care practitioner is a physician, nurse practitioner, clinical nurse specialist or physician assistant who satisfies the following criteria: (i) enrolled in Medicare with primary specialty designation of family practice, internal medicine, pediatrics and geriatrics; and (ii) at least 60 percent of the practitioner's allowed charges are for primary care services.[10] This temporary 10 percent incentive payment is made on a quarterly basis. PCIP recipients with a family medicine Medicare specialty designation received an average incentive payment of $3,450 ($212,987,540/ 61,728) during the first year of the program.[11] This payment is equivalent to a two percent ($3,450/$201,512) increase in annual income. [12]

In addition, Medicaid payment rates for primary care services delivered by primary care physicians must be no less than Medicare rates for the same services in 2013 and 2014.[13] Given the variability of Medicaid payments across states, this could be a substantial boost in payments for physicians in some states and less so in others. Medicare has been providing bonus payments to physicians in designated shortage areas to make these areas more attractive for physician practices. The Health Professional Shortage Area (HPSA) bonus and the Physician Shortage Area (PSA) bonus are specifically intended to address the geographic distribution of physicians.

The main purpose of this report is to present the key findings from our examination of the proposed research questions, the main data sources used for the empirical analysis, the methodologies used to identify the impact of payment incentives and detailed discussion of our analytical findings.

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10 - Allowed charges refer to all charges under the physician fee schedule excluding hospital inpatient care, drug, laboratory, and emergency department visits (source:. http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Downloads/PCIP-2011-Payments.pdf)

11 - Source: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Downloads/PCIP-2011-Payments.pdf

12 - ACA Medicare PCIP: Practitioners (MDs and Non-MDs) with primary care specialty designation meeting a threshold of 60 percent of primary care services*will receive 10 percent bonus on the Medicare paid amount from CY 2011 to CY 2016, $558 million in 2011 translates to an average of 2 percent increase in annual income for primary care physicians.

13 - The Administration is proposing to extend this payment through Calendar Year 2015 and make it available to primary care nurse practitioners and physician assistants who practice independently. (add citation to 2015 Budget in Brief when it becomes available.)

The report covers the three main categories of the empirical analysis:

1. Examine the magnitude and the distribution of Medicare primary care incentive payments, and quantitatively estimate the impact of the bonus on the supply of PCPs and their services;
2. Assess the geographic distribution of HPSA bonus recipients, understand the overlap between HPSA and Medicare primary care incentive payment (PCIP), and overlap between the HPSA and PSA bonus recipients, and quantitatively estimate the impact of the bonuses on the supply of PCPs and their services;
3. Explore any evidence of the impact of changes in state Medicaid primary care - reimbursement rates on the supply of primary care services. -

A substantial portion of the empirical undertaking entailed analyzing existing Medicare claims data to understand the magnitude of these supplemental payments under Medicare and to estimate their impact on the supply of PCPs and their services. In this report we provide a detailed description of the data we use, our analytical approach and a thorough discussion of our analytical findings. The discussion in the report is organized as follows: section II presents findings from the review of relevant existing literature; in section III, we lay out the empirical methodology and main evidence related to the impact of the Medicare 10 percent primary care incentive payment; section IV describes the empirical analysis of the HPSA and PSA bonuses; section V presents the findings regarding the impact of higher primary care physician fees under Medicaid; finally, section VI is the conclusion.

Literature Review

The Lewin Group has reviewed the existing key health and labor economics literature for evidence regarding the potential impact of financial incentives on the supply of health care providers and services. The objectives of the literature review were to: (1) document the likely quantitative range of the effects of earnings increases (in the form of bonuses or other financial incentives) on the supply of primary care providers and services nationally or in underserved areas, and (2) explore the likely impact of the increase in Medicaid reimbursement rates for primary care providers on the volume of these providers and their services under Medicaid. This work can contribute to the broader understanding of provider behavior and the type and level of financial incentives that are likely to achieve the desired supply responses.

The literature that directly examines the Medicare bonuses and resultant impact on the supply of primary care providers and services is very limited. To address this limitation we expand our focus to include the labor economics literature. This broadened search then includes studies that address the behavioral impact of earnings on medical workforce. In what follows, we discuss the major findings from the existing literature on the effects of financial incentives (such as Medicare bonuses and increased Medicaid reimbursement rates) on primary care workforce and services. Overall, the scope of the literature review can be classified under the following categories:

1. Effects of earnings on: (a) specialty choice by physicians; (b) the labor supply of physicians and nurses in terms of work hours and labor force participation; and (c) the volume of services;
2. Effects of financial incentives on the supply and retention of primary care providers in designated underserved areas (HPSA/PSA) and states' experiences thereof;

3. Impact of increases in Medicaid reimbursement rates on the supply of primary care providers and the volume of patient care under Medicaid on a state by state basis, as well as systemic effects.

There is considerable concern regarding a potential future primary care physician shortage and potential constriction of access to primary care. The availability of primary care is particularly important for public payer programs, such as Medicaid and Medicare. A recent Medicare Payment Advisory Committee (MedPAC) data book indicates that six percent of Medicare beneficiaries were looking for a new primary care physician in 2011. In addition, among those who tried to get an appointment with a new physician in 2011, 35 percent reported having difficulties.[14]

It is worth noting that several studies (Bodenheimer et al, 2007; Vaughn et al, 2010) illustrated the large income gap between primary care providers and other specialties. Therefore, whether a very small increase in annual income, through the Medicare PCIP, would significantly influence provider behavior remains unclear. In addition, the time limited nature of the provisions may prove to be a major deterrent to a change in provider behavior. Any evidence around time-limited bonus programs will likely show only a partial behavioral response from the targeted population. Lower bound take up rates should be expected in these programs because medical students and early career providers are unlikely to base career choices on temporary policy changes.

Historically, the Medicaid program has reimbursed physicians at a much lower rate than Medicare, paying just 66 percent of Medicare rates on average (Cunningham, 2011). Cunningham (2011) also documents that due to the low Medicaid reimbursement rates in several states fewer physicians accept Medicaid patients. In 2013 and 2014, ACA increases Medicaid reimbursement rates for certain services provided by primary care physicians to 100 percent of Medicare rates. Given the variability of Medicaid payments across states, this will be a substantial boost in payments for physicians in some states and less so in others. Current differential payment levels across states and any changes in payments over time can be exploited to examine the effect of raising Medicaid primary care reimbursement rates on the provision of primary care providers and services.

The discussion of the literature review is organized as follows: section A reviews the literature on the effect of earnings on the supply of primary care providers and services; section B discusses the evidence regarding the impact of financial incentives for primary care providers in underserved areas; section C examines the empirical evidence on the impact of state-specific changes in Medicaid reimbursement rates; and section D concludes with a summary of the major findings from the literature and their implications for understanding the allocative effects of bonus payments and other financial incentives.

A. Effect of Earnings on the Supply of Primary Care Services and Providers: Role of Medicare Primary Care Bonuses

The ACA stipulates multiple programs with the aim of increasing the supply and utilization of primary care services. These programs all operate on the assumption that financial incentives, specifically directed toward increased earnings, are an effective way to promote an increase in primary care services and primary care providers. While these assumptions are based upon established economic theory, the evidence as to the programs' effectiveness in practice is mixed.

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[14] MedPAC " A Data Book: Health Care Spending and the Medicare Program," June 2012, p. 97.

While there is general consensus that expected earnings are a key driver of medical specialty choice (Bazzoli 1985; Nicholson and Propper 2011; Nicholson 2002; Vaughn et al. 2010), the evidence regarding the effectiveness of programs designed to attract medical students in certain specialties is inconclusive. Vaughn et al. (2010) argue that programs designed to affect the number of medical students choosing primary care have largely failed while others (Fournier & Henderson 2005; Lynch 1998; Ramsey 2001) argue that these programs have had a wide range of results that can be attributed to each programs' individual composition.

The effect of earnings on labor supply in relation to the healthcare workforce is also a complex issue. There is wide consensus that increased earnings lead to an increase in the labor supply of health services providers (Askildsen and Baltagi 2002; Baltagi 2005; Rizzo and Blumenthal 1994), but the reported magnitude of this increase in labor supply varies widely. Values reported for the wage elasticity of the primary care labor supply range from 0.23 to 0.8. Furthermore, the effect of income on retirement decisions of physicians is not well understood.

Finally, the effect of earnings on the volume of primary care services is a related but distinct issue. Much like its counterparts, the effect of earnings on the volume of services is recognized to be significant and positive, but reported effects range widely: from a 10 percent reduction in Medicare fees leading to 1.8 percent to 6.6 percent reduction in the volume of office visits to 10 percent higher fees for primary care services raising the primary care E&M visits by 8.8 percent (Hadley et al. 2009; Reschovsky et al. 2012).

1. *Effects of Earnings on Specialty Choice by Physicians*

While the estimated effect of earnings on specialty choice is present and significant, the magnitude of this income effect and its relative importance as compared to other factors in deciding a specialty is contentious. Recent data from the residency match program in the US reveals that among 16,875 US Medical school senior applicants in 2012 about 35.5 percent were matched to primary care specialties such as internal medicine, family practice and pediatrics.[15] In 2010 the proportion matched to primary care (internal medicine, family practice and pediatrics) was 34.1 percent of 16,427 US Medical school senior applicants.[16] Between 1995 and 2006, the total number of physician residents in the US in primary care training programs increased by 6 percent, from 38,753 to 40,982 (Exhibit 1). Physician residents in specialty care increased by about 8 percent during the same period.

Exhibit 1. Number of Physicians in Residency Programs[17]

Type of Resident	Number of Resident Physicians		Percentage Change
	1995	2006	
Primary Care Residents	38,753	40,982	5.75
Specialty Care Residents	59,282	63,897	7.78
All Physician Residents	97,416	104,526	7.30

[15] Source: NRMP Results and Data-2012 Main Residency Match (http://www.nrmp.org/data/resultsanddata2012.pdf)
[16] US Medical school seniors who are matched into internal medicine can subspecialize, later on, in non-primary care specialty such as cardiology, endocrinology, oncology etc.
[17] Steinwald B. Primary Care Professionals: Recent Supply Trends, Projections, and Valuation of Services. Statement in Testimony before the Senate Committee on Health, Education, Labor, and Pensions. Washington (DC): GAO; 2008. Available from: http://www.gao.gov/new.items/d08472t.pdf

Nicholson and Propper (2011) argue that the rate of return to medical training and specialization is the key driver of choosing medical occupation and the choice of specialty within the area of medicine. The gap in median income between primary care physicians and specialists is well-publicized. For instance, using cross-sectional earnings data from 2008 Vaughn et al. (2010) report that the average primary care physician could expect to earn $2.5 million over his lifetime, net of income taxes, living expenses and education costs, versus $5.2 million for a cardiologist. Berenson et al. (2007) report that, according to the Medical Group Management Association (MGMA), between 2000 and 2004 median physician income for all primary care increased by 9.9 percent while average incomes of all non-primary care specialists increased by 15.8 percent. Arguably, given the income gap, raising the payment rate for primary care services relative to other services would impact the number of primary care physicians and raise the amount of primary care services they provide. Moreover, if the reimbursement rates vary by geographic region, this strategy can also affect the geographic distribution of services of primary care services.

In a related study, Bodenheimer (2007) attempts to explain this disparity in incomes. The author notes that the Resource-Based Relative Value Scale, which was initially designed to reduce the inequality between fees for office visits and for procedures, has failed to reduce the primary care–specialty income gap. He finds that this failure is due to four factors: (1) the volume of diagnostic and imaging procedures has increased more rapidly than the volume of office visits; (2) the process of updating the relative values units (RVUs) [18] associated with covered procedures is heavily influenced by the recommendations of the Relative Value Scale Update Committee (RUC), a majority of whose membership are specialists; (3) Medicare's formula for controlling physician payments penalizes primary care physicians; and (4) private insurers tend to pay for procedures at higher rates than office visits relative to Medicare. They conclude that the program was designed with the correct motives but ultimately was weak and cannot achieve its purpose as currently formulated. Furthermore, incentives that favor specialists remain in the private market.

Nicholson (2002) also provides econometric evidence that the disparity in the expected earnings between primary care and other specialties has a significant influence on medical students' decisions to choose primary care or another specialty. He observes that there is a persistent excess supply of residents to most specialties with relatively high lifetime earnings and a persistent excess demand for residents in primary care with relatively low lifetime earnings. His main contribution is to examine how differences in expected earnings affect the number of students who desire to enter a specialty rather than the number who actually enter the specialty. The study finds that the income elasticity ranges from 1.03 in family practice/pediatrics to 2.20 in radiology.[19] In other words, a 1 percent increase in the lifetime earnings of primary care providers, such as family practitioners, will increase the number of students ranking family practice as the most preferred choice by 1 percent which can be translated into an increase of equal magnitude in the supply of family practitioners.

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[18] RVU is a key component of the formula used under Medicare Physician Fee Schedule (PFS) to calculate payment rates for an individual service. There are three different RVUs: work RVU, practice expense (PE) RVU and malpractice (MP) RVU. Work RVU reflects the relative time and intensity associated with Medicare PFS service; PE RVU reflects the costs of maintaining a practice; and MP RVU reflects the cost of malpractice insurance. Source: http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/medcrephysfeeschedfctsht.pdf

[19] Earlier studies of J.W. Hay ("Physicians' specialty choice and specialty income", *Econometrics of Health Care*, edited by G. Duru and J. Paelinck, Netherland Klwer Academic, 1991) and J. Hurley ("Physician choices of specialty, location and mode", *Journal of Human Resources*, No. 26, 1991, pp. 47-71) did not account for uncertainty in entry to a specialty. However, they find that medical students are substantially responsive to expected income. These studies report income elasticities that range from 1 to 3.

However, there are studies that report comparatively less impact of expected earnings on the decision to choose primary care. Bazzoli (1985) found that medical students are more likely to choose primary care when the expected earnings are relatively large, but the effect is quite small. More specifically, a $10,000 (about 20 percent of the mean earnings in 1981) increase in the expected earnings in primary care relative to the non-primary care yields a 1.4 percentage point increase in the probability of choosing primary care.

Gagne and Leger (2005) have studied the specialty choice decision of Canadian physicians who practiced between 1989 and 1998. They find that a 9.1 percent reduction in relative fee-per-consultation for a general practitioner in Quebec and Saskatchewan, for example, would lead to a 0.4 percent reduction in the proportion of medical students entering general practice. The largest response is observed in Manitoba where the proportion of medical students entering general practice is estimated to decrease by 2.29 percent as a result of a 9.1 percent reduction in relative fee-per-consultation. The implied responsiveness of specialty choice to changes in earnings from this study and from other studies discussed in this section is summarized in **Exhibit 2**.

Vaughn et al. (2010) bolster this point by noting that programs designed to affect the number of medical students choosing primary care have largely failed because of the programs' inability to affect relative incomes. By estimating career wealth accumulation across specialists, primary care physicians, physician assistants, business school graduates, and college graduates, the authors try to elucidate the true difference between payment of physicians and non-physicians, and between specialists and generalists within the physician group. They note that this result is to be expected as programs have done little and continue to do little to affect the disparity in expected lifetime earnings between primary care physicians and specialists. The authors also find that for a primary care physician's lifetime earnings to equal those of a cardiologist the primary care physician would have to receive a bonus of $1.1 million upon completion of medical school.

Sivey and Scott (2012) use an econometric approach to address the question of the effect of lifetime earnings on training specialty choice based on a sample of Australian postgraduate doctors. Using a generalized multinomial logit model the authors find a statistically significant positive impact of earnings on the probability of choosing general practice training versus specialty training. Subsequently, they use the same model to simulate the effect of a $50,000 increase in annual earnings of general practitioners (GPs) on the probability of junior doctors choosing GP training. Specifically, the simulation result suggests that $50,000 additional earnings for GPs (a 27.8 percent increase over their current salary of $180,000) would lead to a 26.3 percent increase in the propensity of junior doctors to choose GP training. Therefore, the implied earnings elasticity of the propensity to choose GP training is 0.95, which is consistent with previous findings (Nicholson 2002).

Exhibit 2. Summary of Responsiveness of Specialty Choice to Changes in Earnings (Earnings Elasticity)

Study/Article	Description	Earnings Elasticity
Nicholson (2002)	Elasticity of ranking Family Practice/ Pediatrics as the 1st specialty choice with respect to lifetime earnings (among US medical school residents)	1.03
Nicholson (2002)	Elasticity of ranking Radiology as the 1st specialty choice with respect to lifetime earnings (among US medical school residents)	2.20
Gagne and Leger (2005)	Elasticity of proportion of medical students (in 8 Canadian provinces) entering General Practice with respect to relative-fee-per-consultation	0.044 to 0.25
Sivey and Scott (2012)	Elasticity of probability of junior doctors (in Australia) choosing General Practice with respect to annual earnings	0.95
Hogan and Bouchery (2010)	Elasticity of percentage of male US medical school Internal Medicine graduates choosing Cardiology subspecialty with respect to annual compensation	2.50

Note: earnings elasticity gives the percentage change in the outcome measure of interest (e.g., proportion of - students ranking family practice or radiology as the 1st choice) due to 1 percent change in earnings. -

In an unpublished piece, Hogan and Bouchery (2010) estimate a multinomial logit model of the choices of internal medicine residents to remain in internal medicine and practice primary care, or to obtain a fellowship for further training in one of nine subspecialties of internal medicine and ultimately practice in that subspecialty.[20] The authors find that a 1 percent increase in earnings from one of the career paths, holding earnings in other specialties constant, increases entrants of male U.S medical graduates into that the examined specialty (Cardiology) by about 2.5 percent, but increases female entrants by about only 0.3 percent. They also find that increases in the length of additional training required for a subspecialty have a negative effect on the number of US medical graduates pursing that subspecialty and reduces the probability that US medical graduates pursue the specialty, but increases the probability that international medical school graduates pursue that subspecialty.[21]

Expected lifetime earnings are not the only factor that influences decision making during specialty choice. Medical students assign a low level of prestige to a primary care career compared to other specialties. Students surveyed associate primary care with low income expectation, low class rank and high educational debt (Henderson, 1996). Students often enter medical school with a positive perception of primary care, but by the time they reach their fourth year they are increasingly likely to disagree with the assertions that primary practice is prestigious, adequately compensated, and allows more control over working hours (Lynch, 1998). It appears that students' positive perceptions concerning primary care may change as they experience the more realistic professional demands on primary care physicians that can develop during medical school and as they observe their peers and role models, both within primary care and outside.

[20] Paul F. Hogan and Ellen Bouchery, " A Model of Subspecialty Choice for Internal medicine Residents," prepared by The Lewin Group for the American College of Cardiology. 2010.

[21] After simulating the impact of decreasing cardiology training requirements from three years to two, the study finds that one-year decrease in training requirements would increase the percentage of male, U.S. medical school graduates choosing cardiology from 17.1 percent to 18.2 percent.

2. Effects of Earnings on Labor Supply of Health Care Workforce

Consistent with the economic theory a large number of studies find evidence in support of a positive correlation between earnings and the labor supply of the health care workforce. This is in contrast to much earlier studies that relied only on aggregate time series data on physician services and fees to conclude that physician labor supply functions were backward-bending and physicians responded negatively to wage increases.[22] For instance, Steiger et al. (2010) observe that inflation-adjusted physician fees (weighted average of Medicare and private sector fees) decreased substantially between 1995 and 2005. The timing of the reduction in fees closely matched the observed decline in non-resident physician work hours. The study finds that the mean hours worked per week by physicians practicing in the US decreased by almost 7 percent between 1996 and 2008. Additionally, by 2006, physician fees were 25 percent lower than their inflation-adjusted 1995 levels. More recent studies, which use micro data to estimate traditional labor supply equation, generally find a small positive elasticity of physicians' work hours with respect to wage increases. For instance, Rizzo and Blumenthal (1994) use the instrumental variable approach to estimate the unbiased effect of physician's wage on the annual hours the physician spends on patient care. Their results based on all physicians suggest that a 10 percent increase in the wage rate yields a 2.7 percent increase in the physician's annual work hours (i.e., wage elasticity of 0.27). When restricted to self-employed male physicians, they find a wage elasticity of 0.23. However, for female physicians they find a higher elasticity, with a 10 percent increase in the wage rate leading to a 4.9 percent increase in annual work hours. This work is generally supported by Baltagi et al. (2005) who find that a 10 percent wage increase would lead to a 3 percent increase in physician labor supply among hospital employed male physicians in Norway. Baltagi et al. (2005) note that the magnitude of the wage elasticity in this case may be relatively small because of hospital employed physicians' tendency to earn a lower wage relative to self-employed physicians. [23]

There are few studies that examine the effect of earnings on a physician's decision to retire. Using micro data from Norway over the period of 1990-1992, Herneas et al. (2000) estimated a model to predict retirement behavior and simulated the effect of financial incentives on retirement decisions among those who were eligible to retire early (during 1990 - 1992) and who worked full-time in 1990. In their simulation, the annual pension from 1993 onwards is increased by 7.2 percent if the retirement eligible individuals continue to work full-time through 1992. This increase is equivalent to a 72.3 percent increase of the annual disposable pension.[24] The simulation result suggests that the average estimated probability of continuing to work full-time throughout 1992 will increase by almost 100 percent (from 38.4 percent to 70.6 percent) in response to the 72.34 percent hike in annual disposable pensions described above.[25] In other words, in the absence of any pension hike after 1993, only 38.4 percent of physicians working full time in 1990 would still work full time through 1992. However, if pension is raised by 72.3 percent from 1993 onwards for those who would continue to work full time through 1992, the

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[22] For an in-depth exposition of the empirical evidence and lack of support for a backward-bending physician labor supply, pleas e see Handbook of Health Economic, Vol 2, Chapter 14, Section 3.10

[23] The nature of labor supply for Physicians and nurses differ greatly. There are some studies on the effect of wages on the labor supply of nurses. For example, Askildsen and Baltagi (2002) estimates a wage elasticity of nurses' supply of labor between 0.7 and 0.8 depending upon the method of estimation. The authors argue that while theirs is a larger effect than other estimations have suggested it is still not a large effect relative to other professions. They also note that contract structure and type of work being performed significantly impact labor supply decisions and should not be ignored.

[24] Wealth is defined as the discounted value of future annual disposable pensions and the increase in wealth is evaluated at the means of the data.

[25] The expected remaining lifetime was then set at 18 years, which is close to the actual average for people in the relevant age groups in 1992.

simulation shows that 70.6 percent of physicians working full time in 1990 would still do so through 1992. They also estimated that the same financial incentives will lower the average estimated probability of partial retirement in 1992 (of retirement eligible workers) by about 54.7 percent (from 36.2 percent to 16.4 percent). Additionally, they find that other decisive factors influencing retirement decisions are the level of education, income, and marital status.

3. *Effects of Earnings on the Volume of Primary Care Services*

The effect of earnings on the volume of primary care services is related to the previous questions but is a distinct issue that incorporates the ability of providers to impact the demand for services as a result of changes in their income. Dummit (2008) argues that, as the largest single payer, Medicare affects physician practice revenues directly through its payments and indirectly through its fee schedule, which many private payers use. Lower compensation for primary care physicians is one of the reasons that these specialties are less desirable. Reschovsky et al. (2012) report that over the past decade, Medicare fees and spending for specialist services (such as diagnostic tests and procedures) have gone up more rapidly than fees for E&M services, which primary care providers (PCPs) typically provide. Those higher payments have contributed to faster growth in specialist services than in E&M patient visits. Commercial insurers and state Medicaid plans often build their fee schedules on Medicare's, further widening the income gap between PCPs and other physician specialists, and contributing to the shrinking number of medical students choosing to enter primary care. In this section we review how improvements in Medicare fees can influence the volume of health care services provided under Medicare.

Hadley et al. (2009) estimate the relationship between Medicare fees and the volume of eight specific services provided by physicians using data for 13,000 physicians from 2000-2001 and 2004-2005 Community Tracking Study Physicians Surveys. Since the fee schedule is one of the few policy tools that Medicare potentially has available to influence service volume, it is critical to have a better understanding of how changes in Medicare fees affect Medicare service volume. Their study finds that a 10 percent reduction in Medicare fees leads to 1.8 percent to 6.6 percent reduction in the volume of office visits (of various degrees of complexity). They argue that physicians may be more likely to respond to fee cuts by limiting their acceptance of new Medicare patients, rather than limiting visits by established patients.

Clemens and Gottlieb (2014) examine the changes in physicians' reimbursement rates under Medicare before and after year 1997 when consolidation of geographic regions across which Medicare adjusts physician payments led to area specific price shocks. The study measures health care supply of all services using RVU. They find that health care supplied to Medicare patients (RVUs per patient) exhibits a relatively large long run elasticity of around 1.5 with respect to reimbursement rates. Their results are mostly driven by the stronger positive elasticity among elective procedures (e.g., eye and orthopedic procedures). When restricted to the analysis of the supply of E&M services their estimates lack precision and they find statistically insignificant short (1997-98) and long run (2001 to 2005) impact of the price shock on the supply of E&M services. However, the medium run (1999 and 2000) elasticity is precisely estimated to be 0.97 for E&M. They argue that the observed responses imply that the overall composition of services shifts toward more elective procedures as reimbursement rates increase. Finally, the number of patients and physicians per patient are almost unaffected by the change in the reimbursement rates.

Reschovsky et al. (2012) simulate the effect of a permanent 10 percent fee increase for primary care E&M services under Medicare. Their estimated primary care supply model suggests that higher primary care fees lead to increases in both the likelihood that PCPs will treat Medicare beneficiaries and, more importantly, the quantity of E&M services PCPs provide to Medicare patients. According to their analysis higher fees (10 percent increase permanently) for primary care beginning in 2011 raise the primary care E&M visits by 8.8 percent.

Thus, the likely range of changes in the volume of primary care visits in response to a long-term increase in Medicare primary care fees appears to be wide. Based on Hadley et al. (2009) and Reschovsky et al. (2012), a 10 percent increase in Medicare fees for primary care can potentially increase the volume of primary care visits in the range of 1.8 percent to 8.8 percent. However, due to the short-term nature of the Medicare PCIP (only 5 years) the observed impact of the incentive payment on the volume of E&M visits may be closer to the lower bound.

B. Financial Incentives for Primary Care Providers in Underserved Areas

Access to health care in areas with insufficient health professionals has been an ongoing source of concern among policy makers. Expansion of health insurance coverage through the implementation of the ACA is likely to stimulate the demand for primary care in general, including underserved areas. Health Resources and Services Administration (HRSA) designates such areas HPSAs. These geographic areas meet a defined threshold of primary care physician to population ratio. Since 1987 Medicare has been paying bonuses to physicians providing primary care in rural HPSAs. In 1991 the bonus payment was increased from 5 to 10 percent and eligibility extended to services provided by physicians in urban HPSAs. Thus, this particular form of bonus payment has been in place for almost 25 years. Section 413(a) of the Medicare Modernization Act of 2003 put in place an additional 5 percent bonus payment for physicians practicing in Physician Scarcity Areas (PSAs). PSAs were those counties and rural zip codes in metropolitan statistical areas (MSAs) that represented the 20 percent of the Nation’s population with the lowest physician to population ratios. These areas often coincided with geographic HPSAs so that physicians practicing in those areas received a 15 percent additional bonus payment during 2005-2008 when the PSA bonuses were in effect (i.e., from January 2005 through June 2008).

In this section we review the literature related to the volume of these bonus programs and their potential effects on primary care services and providers. Programs to address this issue have historically been implemented with the assumption that financial incentives to practice in rural areas are effective in addressing the health professional shortage in given areas. This assumption is largely validated by the literature, with the effect of financial incentives shown to influence the distribution of physicians and health professionals. Importantly, the literature generally suggests a multifaceted approach to incentives, financial or otherwise. Many of the most successful programs evaluated below use recruitment of medical students with specific demographic markers to influence the distribution of physicians. Financial incentives have a broad range of reported specialty choice elasticities that range from 0.01 to 0.95. These discrepancies may also be somewhat determined by the type of financial incentive (e.g., grant, loan, postgraduate bonus).

In an early article on the HPSA bonus, Shugarman et al. (2001) estimate that, in 1991, the total amount of HPSA bonus was almost 31.6 million dollars. Their estimate shows that 58.3 percent of the total HPSA bonus payment went to the rural HPSAs; while the remaining 41.7 percent went to urban HPSAs. They also find that the total bonus payment grew to reach about 106 million dollars in 1996, but then gradually declined to almost 77 million dollars in 1998. The proportion of rural HPSA bonus decreased to 51.1 percent.

In a more recent study, Shugarman and Farley (2003) examined the trends in HPSA bonus payments for primary care specialties (family practice, general practice and internal medicine) under Medicare over the period of 1992-1998 using Medicare claims data for non-metropolitan area beneficiaries. They argue that the bonus payments largely targeted primary care. They find that in 1992 the payments for primary care services represented 29.7 percent of the total Medicare bonus payments for physician services to rural Medicare beneficiaries. The proportion gradually went up to 37 percent in 1998. Their analysis also showed that in 1992 payments for primary care services represented 14 percent of total basic Medicare payments for physician services and this share rose to 18.6 percent by 1998. However, 55.9 percent of all Medicare HPSA bonus payments for services to beneficiaries in non-metropolitan areas were made to primary care physicians. This proportion declined gradually to 49.7 percent in 1998. The authors claim that low levels of bonus payments in general, coupled with the documented declines in those amounts since 1994, may have undermined their future potential to support physicians practicing in rural areas. Their findings suggest that physicians were not claiming the extra payments that were available to them. Factors that could be contributing to such low uses of bonus payments include the extent to which physicians know about the payments, perceived value of the bonus to physicians, effects of administrative procedures on the ease of receiving them and concerns about the risk of audits. Nevertheless, their study highlights the role of bonuses in improving the payments and the supply of primary care services in HPSAs.

The literature regarding the effect of financial incentives in underserved areas on the choice of practice location of physicians is relatively scarce. Chou and Lo Sasso (2009) examined the impact of local characteristics on the practice location choices for newly trained physicians in New York between 1998 and 2003. Their empirical results suggest that PCPs without educational debt are attracted to HPSAs. In other words, they estimate that the propensity of choosing a location by a PCP is higher if the location is designated as an HPSA. However, the estimated propensity is lower if physicians have larger educational debt. Their study, however, addresses the effect of the HPSA status in general rather than any specific effect of the amount of HPSA bonuses.

In a review of rural incentive programs Sempowski et al. (2004) compare rural recruitment and retention programs in the United States against those in other countries (notably Canada and New Zealand). The authors look specifically at Return of Service (ROS) commitments wherein financial incentive is provided though assistance with medical school payment in return for a commitment to serve in a rural area. The authors note that programs offering financial incentives in exchange for ROS commitments to rural or underserviced areas have achieved their primary goal of short term recruitment. However, the authors note that in the US the lenient buyout opportunities have hindered the programs and limited their effectiveness. Sempowski et al. (2004) argue that the programs in Canada and New Zealand may have greater success with retention as compared to the US programs because the programs in Canada and New Zealand have a multi-faceted approach that includes the use of financial incentives along with prudent recruitment strategies.

Bolduc et al. (1996) provide a theoretical framework of physician's choice of location. They develop a model to assess the effect of various incentive measures introduced in Quebec (Canada) on the geographical distribution of physicians across 18 regions during 1976-1988. The study specifically examines general practitioners' choice of initial practice locations in Quebec. The utility of a particular alternative depends on, among other things, a measure of expected discounted value of lifetime earnings associated with this alternative. It is through changes in this variable that the impact of various income-based physician-location programs is simulated. Before 1982 there were substantial variations in the population to general practitioner (GP) ratio across different regions of Quebec. In order to redress geographic imbalances in the distribution of physicians the Quebec government introduced the Differential Remuneration Program (DRP) in 1982 that raised the fees (relative to the base fees to general practitioners in underserved regions compared to the regions with relatively lower population to GP ratios. Among other incentive measures, annual study grants of $10,000 have been offered (since 1982), tied to a commitment to work in these underserved regions during a number of years equal to the number of grants received. A settlement grant program has also been available, since 1984, for physicians who choose to practice in these regions. This program provides an annual allowance for a maximum of 4 years. It varies from $5,000 to $10,000 (nontaxable) for a physician paid by unit of service, depending on the shortage of physicians in the locality. Whereas the differential remuneration program influences location choices through differential pricing of physicians' services by location, the grant program affects location choices through a lump sum increase in income for a short duration (4 years).

Bolduc et al. (1996) find that on average, a 10 percent increase in the general practitioner fees for medical services in a region increases the propensity of a beginning GP to work in this region by 7 percent. Thus the implied elasticity of location choice probability with respect to fee increases is about 0.7. However, this elasticity varies across regions: it is higher in remote regions (with a maximum of 1.28). On the other hand, on average, the elasticity of location choice probability with respect to non-labor incomes, such as study grants, is estimated to be about 1.11. In other words, a 10 percent increase in the study grants tied to a commitment to work in the underserved regions, leads to an 11.1 percent increase in the probability of GPs choosing these underserved regions as their starting practice location. However, their findings largely depict redistribution of GPs across regions within Quebec rather than showing any increase in the total number of GPs in Quebec.

Despite differences in the institutional framework between the US and Canada, the findings from Bolduc et al. (1996) provide some valuable insights into the potential effects of financial incentives that vary across locations. The remaining important issue is to identify how bonus payments affect the annual earnings of physicians in HPSAs. Only then, based on findings from the literature, can one assess the potential impact of the earnings shock in HPSAs on primary care physicians' choice of practice location. Holmes (2005) addresses this question directly. Using a database containing the location of physicians at 5-year intervals the author compares the locations chosen by alumni and non-alumni of programs within the United States charged with increasing physician supply in underserved areas. This analysis provides insight into the types of students that choose to enroll in programs such as the National Health Service Corps (NHSC). The author notes that participation in this program consists disproportionately of minorities from private, expensive schools. This suggests that scholarships (and hence the lack of debt burden) may be an influential factor in participation in the NHSC. The multinomial logit model employed by Holmes (2005) shows that students which graduate from an institution with a focus on primary care are also more likely to enroll in the NHSC. Using this model, Holmes (2005) concludes that the elimination of the NHSC program would lead to a 10-11 percent decrease in the supply of recent graduates in underserved communities.

Rabinowitz et al. (2001) examine the history and results of The Physician Shortage Area Program (PSAP) of Jefferson Medical College (Philadelphia, PA). The PSAP is intended to address the shortage of primary care physicians in rural Pennsylvania. The authors' analysis uses a cross section of Jefferson Medical College Graduates from 1978 to 1993 to determine which characteristics are predictive of becoming a rural primary care physician (PCP). Of the characteristic variables collected in the data, freshman year plans for family practice, being in PSAP, having a NHSC scholarship, male sex, and taking elective senior family practice rural preceptorship were independently predictive of primary care in a rural area. However, among non-PSAP graduates with two key selection characteristics of PSAP students (having grown up in a rural area and freshman year plans for family practice) were 78 percent as likely as PSAP graduates to be a rural primary care physician, and 75 percent to remain rural PCPs. The authors note that this result suggests the most influential area of the program is the admissions component, not the financial component. Supporting evidence for this conclusion is provided by

Brooks (2002) who found that rural upbringing and specialty preference were most strongly correlated with recruitment of physicians to rural areas. Growing up in a rural area along with the student's expressed plan to become a primary care physician were associated with a 36 percent likelihood of a graduate practicing in a rural area compared with 7 percent for individuals without these preferences.

Although most studies found that there was no correlation with age, gender, race, or marital status (Horner, 1993; Looney, 1998; Rabinowitz, 1999) a few studies determined that men have a greater likelihood of rural practice than women (Fryer, 1997; West, 1996). However, women PSAP graduates were more than twice as likely as non-PSAP women to practice in rural areas (31.7 percent versus 12.3 percent) (Rabinowitz, 2011). Importantly, none of these articles list financial incentives as an important factor in recruitment and retention of primary care physicians in rural areas.

C. Impact of the Increase in Medicaid Reimbursement Rate Relative to the Medicare Rate

The availability of primary care is particularly important for public payer programs, such as Medicaid and Medicare. Historically, Medicaid has been the lowest payer for primary care services relative to Medicare, paying just 66 percent of Medicare rates on average.[26] Cunningham et al. (2009) report that fewer physicians accept new Medicaid patients in response to the low Medicaid reimbursement rates in several states. Zuckerman et al. (2009) describe that in 2008 average primary care physician fees under Medicaid ranged from 57 percent of the national average in Rhode Island to 226 percent of national average in Alaska. They also find that after a strong Medicaid fee growth during 1998-2003, Medicaid fees fell relative to inflation during 2003-2008. Despite the slowdown in overall fee growth, Medicaid fees for primary care services kept pace with inflation. ACA increases Medicaid reimbursement rates for certain services provided by primary care physicians to 100 percent of Medicare rates in 2013 and 2014. Given the variability of Medicaid payments across states, this could be a substantial boost in payments for physicians in some states and less so in others.

The findings in this section focus on the comprehensive effect of a relative rate increase, both on services provided and patient's utilization of those services. While evidence is mixed, the literature indicates significant effects of increased Medicare reimbursement on both the provision and utilization of primary care services. Reported elasticities range between 0.41 in national estimates to -0.06 in some state level analyses. This broad range suggests varying evidence and a need for greater examination given the importance of this question.

1. Systemic Change in Medicaid Reimbursement Rates in All States

Systemic Medicaid changes have the potential to alter the primary care environment across all states. Cunningham (2011) considers a regression-based approach to identify the causal effect of increases in Medicaid reimbursement rates relative to the Medicare rate on the propensity of primary care physicians accepting new Medicaid patients. He reported, prior to the 2012 Supreme Court decision (National Federation of Independent Business et al. vs Sebelius et al.[27]), that once the ACA is implemented Medicaid eligibility will expand to cover as many as 16 million more poor and low-income adults by 2019 (an increase of more than 25 percent). To

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[26] Small, D.M. and T. McGinnis, (2012): "Leveraging the Medicaid Primary Care Rate Increase: The Role of Performance Measurement": *Center for Health Care Strategies, Inc*.

[27] U.S. Supreme Court's decision in the case challenging the constitutionality of the Affordable Care Act (ACA: http://www.supremecourt.gov/opinions/11pdf/11-393c3a2.pdf

meet the resultant surge in demand for primary care services, ACA provides financial incentives to encourage higher participation of primary care physicians in Medicaid. Specifically, the ACA raises the Medicaid reimbursement rates for certain services provided by primary care physicians up to 100 percent of Medicare rates in 2013 and 2014. This study uses primary care physicians from the HSC 2008 Health Tracking Physician Survey and exploits the existing state level variation in Medicaid reimbursement rates (as a percentage of the Medicare rate). The author groups the states in three categories (low, medium and high) based on PCPs to population ratios.

This study shows that in 2008 the average Medicaid reimbursement rate for low-PCP states was about 81.6 percent of the Medicare rate; while for medium and high-PCP states the average rates were 64.3 percent and 54.8 percent, respectively. The national average of the Medicaid reimbursement rate was 66.2 percent of the Medicare rate. Cunningham (2011) examines the effects of Medicaid reimbursement rates on PCP acceptance of Medicaid patients, while accounting for differences in physician practice, patient and health care market characteristics. The results show that higher Medicaid reimbursement rates are associated with a greater probability of PCPs accepting all or most new Medicaid patients, although the effects are relatively modest. For PCPs, a 10-percentage point increase in the Medicaid/Medicare fee ratio for primary care is associated with only a 2.1-percentage-point increase in PCP Medicaid patient acceptance. The study reports that the national average Medicaid reimbursement rate relative Medicare in 2008 was at 66.2 percent and the national average acceptance rate of new Medicaid patients by PCPs was 41.5 percent. Therefore, the implied elasticity of accepting primary care patients with respect to the payment rate is about 0.33.[28] In other words, if the Medicaid fee relative to the Medicare rate goes up by 10 percent then the acceptance of new Medicaid patients by PCPs goes up by 3.3 percent. Excluding pediatricians, the effect of reimbursement on Medicaid acceptance is slightly higher: the implied elasticity of accepting primary care patients with respect to the payment rate is about 0.41. In the context of the parity in Medicaid and Medicare reimbursement rate under the ACA, empirical findings by Cunningham (2011) can serve as a benchmark for the likely positive effect of higher Medicaid reimbursement rates on the access to primary care services.

Other studies bolster this finding. Shen and Zuckerman (2005) study the effects of Medicaid payment generosity on access and care for adult and child Medicaid beneficiaries. The authors use data comparing the experiences of Medicaid beneficiaries with groups that should not be affected by Medicaid payment policies (the uninsured) using a difference-in-differences model. Shen and Zuckerman (2005) find that higher payments do increase the probability of having a usual source of care and the probability of having at least one visit to a doctor or other health professional. Specifically, they find that a one unit increase (equivalent to a 10 percent increase) in the payment generosity index[29] leads to a 1.5 percentage point increase in the probability of having a usual source of care and a 1.6 percentage point increase in having at least one visit to a health professional.[30] Importantly, payment generosity was noted to have no effect on the probability of receiving preventive care or the probability of having unmet needs. The authors argue that this weak association between increased payments and utilization of services is due to the higher correlation between payment increases and participation by physicians, with a secondary effect on utilization.

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[28] Implied Elasticity is (2.1/41.5)/(10/66.2) or 0.33. After excluding Pediatricians the acceptance rate of Medicaid patients among PCPs is about 38.5 percent and a 10-percentage point increase in the Medicaid/Medicare fee ratio for primary care is associated with only a 2.4-percentage-point increase in PCP Medicaid patient acceptance. Therefore, the implied elasticity is (2.4/38.5)/(10/66.2) or 0.41.

[29] The Medicare payment generosity index is defined as the Medicare capitation rate in a county divided by the median Medicare capitation rate in the nation in a given year. Average is defined to be 10.

[30] These can be interpreted as elasticities. Implied elasticity would be 0.15 and 0.16 respectively.

2. State-specific Experience on Changes in Medicaid Reimbursement Rates

To better understand the mechanism by which systemic changes in the Medicaid system will be implemented and the broad range of environments affected it is informative to review Medicaid changes at the state level. Zuckerman et al. (2004) illustrate that Medicaid physician fees increased, on average, by 27.4 percent between 1998 and 2003, with primary care fees growing the most. On average, the cumulative percentage change in the Medicaid primary care fee was about 41.2 percent between 1998 and 2003. The authors note that there was considerable variation in primary care fees across states. Seven states (District of Columbia, Georgia, Indiana, Kentucky, Maine, Rhode Island, and South Dakota) left primary care fees almost unchanged, while two states (Iowa and New York) raised them by more than 100 percent. States with the lowest relative fees in 1998 increased their fees the most, but almost no states changed their position relative to other states or Medicare, since Medicare rates also increased over the period. Subsequently, the study finds that primary care physicians' acceptance of Medicaid patients in high-fee states was about 18 percentage points higher than the low-fee states (61 percent versus 43 percent) in 1997; while in 2001 the gap is reduced to 11 percentage points (58 percent versus 47 percent). The national average of primary care physicians' acceptance of most or all new Medicaid patients was 53 percent in 1997 and 54 percent in 2001. Moreover, large fee increases (e.g., low-fee states experienced the largest fee change on average) were associated with primary care physicians' greater willingness to accept new Medicaid patients: the rate of primary care physicians' acceptance of new Medicaid patients in these low-fee states went up from 43 percent in 1997 to 47 percent in 2001. Although their study shows some evidence that a Medicaid fee increase is associated with increased Medicaid participation among primary care physicians, it does not provide a direct link between Medicaid reimbursement rates relative to Medicare and physicians' acceptance of Medicaid patients.

Bindman et al. (2003) examine California in particular and focus on the relationship between Medicaid fee increases and the prevalence of managed care in the Medi-Cal system. The authors note that in August of 2000 a fee increase raised physician Medicaid reimbursement from an average of 57.7 percent to 65.2 percent of the average Medicare payment in California. This amounts to a fee increase for a typical office visit from approximately $18 to $24. The study used cross-sectional surveys in 1996 and 2001 on both primary care physicians and specialists. Controlling for physician demographics and specialties the authors found no increase in Medi-Cal participation. Their study notes that between 1996 and 2001, despite payment increases, the number of Medi-Cal primary care physician equivalents dropped from 57 to 46 per 100,000 patients.[31]

Mukamel et al. (2012) address the effect of similar financial incentives in California's Medicaid system but from the standpoint of nurse staffing levels. Using separate models for three staffing types, RNs, LPNs, and CNAs, the authors determined that financial incentives were only a significant factor in increasing hours per resident day (hprd) for RNs. They note that expected nursing home reimbursement rate increases in 2008 were associated with increased RN staffing levels in 2006. They estimate the effect at around a 2-minute increase (0.035 hrpd) for each $10 increase in payment rate. This amounts to a 10 percent increase in staffing over 2005 base levels. The authors explain that this relatively small increase in staffing might be partially explained by the financial incentives original intent that is, to influence labor expenditures and

[31] A physician equivalent is defined as one full time physician providing full time working hours per week (40 hrs) in a given specialty. For example, a physician who provides 20 hours of Family Medicine is counted as 0.5 of a physician equivalent in Family Medicine.

not directly influence staffing levels. The authors note there may have been a change in wages and benefits for all three groups, but that it was not measured in this study.

Finally, Coburn et al. (1999) examined the effect of Medicaid fee changes on physician participation and enrollee access in Maine and Michigan using multiple natural experiments. The authors found that changes in Medicaid fees observed in either state over any observed period had no substantial impact on either physician participation or enrollee access and utilization.[32] In one case in Maine, after an increase of 47.5 percent in Medicaid reimbursement rates, primary care physician participation fell by 1 percent (from 477 to 471).[33] After a second increase of 24.5 percent, participation increased by only 2 percent.[34] This result is mirrored in Michigan where participation increased by only 2 percent after a reimbursement increase of 7.9 percent and decreased by 0.6 percent after a cut of 16.6 percent and fell again by 0.2 percent after a restoration of 19.6 percent. The authors note that these small changes in physician participation hold even when adjusting for lagged responses in both cases. The authors found similar results when examining the utilization of services. Using ambulatory care as a proxy for utilization of services in general, the authors found that changes in the proportion of beneficiaries with at least one visit in a month and in the average number of visits by beneficiaries with at least one visit are not in a direction consistent with the fee changes and are all very small in magnitude. The authors note that these results also do not change when estimated in the long run. However, a major confounding factor in these results, as the authors note, is the relative size of Medicaid payment rate increases compared to those of the private sector fees. The authors state that most gains relative to the private market were quickly eroded.

Conclusions

In order to inform our empirical estimation, the Lewin Group has explored the health and labor economics literature to understand the nature and the size of the impact of any financial incentives on the labor supply behavior of PCPs and the resultant impact on the availability of primary care services. The main objective of this review is to document the prior empirical evidence of the impact of financial incentives on raising the supply of primary care workforce, the volume of services, impact on medical graduates' propensity to participate in primary care, PCPs' retirement decision, etc. This review also evaluates the past evidence on the effect of bonuses shortage areas and their effectiveness in redistributing and retaining primary care workforce. Finally, the review of the literature also focuses on the state-specific experiences with changes in their respective Medicaid payment rates for primary care and the resultant impact on the supply of PCPs, their rate of acceptance of Medicaid patients and the volume of primary care services such as office visits or visits for E&M services.

Affecting the choice of specialty by a medical student is one way by which the supply of primary care services may be increased. Several studies (e.g., Nicholson, 2002; Sivey and Scott, 2012) find that the propensity of medical graduates choosing primary care as their specialty would go up by 9.5-10 percent in response to a 10 percent increase in their earnings (i.e., earnings elasticity of 0.95-1.0). Thus even if bonus payments have the potential to influence the inflow of

[32] The study has given due consideration to the changes in Medicaid payment relative to the payments by other payers. The authors use the ratio of Medicaid payments to charges as an index of changes in relative payments. They have also confirmed with Blue Cross Blue Shield (BCBS) of Michigan (which serves 49 percent of the state's health insurance market) that BCBS's payments-to-charge ratio for all physician services did not change substantially.

[33] The corresponding relative fee change (i.e., Medicare relative to charges) is 40.2 percent.

[34] The corresponding relative fee change (i.e., Medicare relative to charges) is 25.8 percent.

medical students into primary care, the magnitude of that impact would depend largely on the size of actual bonus payments relative to PCPs' earnings and how long such payments are in place. These two factors will determine the contribution of the Medicare bonus to the life-time earnings of primary care providers.

Another way to affect the supply of primary care services is to provide financial incentives for existing providers with the aim of increasing their labor supply. Past research (e.g., Rizzo and Blumenthal, 1994; Baltagi et al., 2005) estimates that a 10 percent increase in wage earnings would yield a 2.3–3 percent increase in their annual work hours. This low wage elasticity suggests that influencing the supply of primary care labor with direct fee increases alone is likely to be costly. The increased fee payments will also likely have an effect on the volume of primary care services. However, compared to the wage elasticity, the change in volume of services in response to fee increases is relatively low. Empirical evidence from the literature (e.g., Hadley et al., 2009; Reschovsky et al., 2012) suggests that a 10 percent change in Medicare fees would change the volume of office visits or E&M related visits by 1.8 to 8.8 percent in the same direction.

The numerical estimates of the effect of financial incentives in underserved areas on the choice of practice location of physicians in the US are relatively scarce. An important study based on Canadian data finds that on average, a 10 percent increase in the general practitioner (GP) fees for medical services in a region increases the propensity of a beginning GP to work in this region by 7 percent (Bolduc et al., 1996). Thus the implied elasticity of location choice probability with respect to fee increases is about 0.7. Several studies highlight the role of bonuses in improving the payments and the supply of primary care services in HPSAs in the US. However, estimating the true contribution of bonuses in underserved areas in boosting physicians' earnings would require additional research.

Past research on state-specific increases in Medicaid and their resultant impact is relatively sparse. However, several studies find a positive correlation between the Medicaid reimbursement rate and acceptance rate of Medicaid patients among PCPs. Cunningham (2011) finds that the effect of increase in Medicaid reimbursement rate on the propensity of accepting primary care patients is positive but small in magnitude. Coburn et al. (1999) finds positive impact of Medicaid fee changes on physician participation and enrollee access in Maine and Michigan; while Bindman et al. (2003) did not find significant effect of Medicaid fee increase on the participation rate of primary care physicians in California.

Despite several empirical results regarding the potential magnitude of the effect of different financial incentives, the estimated effect of Medicare bonuses or improvement in Medicaid reimbursement rates under ACA may not be substantial. This is primarily due to the size and the temporary nature of these positive earnings shocks. The empirical evidence on the effect of this type of short-term pay increase is almost non-existent in the literature. However, the ranges of the effects of long-term earnings shocks from our review of the literature can inform policy makers about the likely magnitude of the impacts of these income-augmenting policies for PCPs if they are sustained for a longer duration.

Modeling the Impact of Medicare Incentive Payment for Primary Care Providers

A. Study Design Overview

The Medicare primary care incentive is available to eligible primary care practitioners for services provided under selected categories of E&M. An eligible primary care practitioner is a physician, nurse practitioner, clinical nurse specialist or a physician assistant who satisfies the following criteria:

1. Enrolled in Medicare with a primary specialty designation of family practice, internal medicine, pediatrics or geriatrics; and

2. At least 60 percent of the practitioner’s allowed charges under the Medicare physician fee schedule (excluding hospital inpatient care and emergency department visits) are for primary care services.

This temporary payment is available for primary care services furnished by an eligible primary care practitioner on or after January 1, 2011 and before January 1, 2016. The payment is made on a quarterly basis and it amounts to 10 percent of the payment amount for the Part B-covered primary care services furnished by the eligible provider.

Based on data regarding all the Medicare PCIP recipients in 2011 and 2012 we observe that in 2011 there were 162,342 providers that received the PCIP, with the majority of physicians specialized in family medicine and internal medicine (Exhibit 3). Also, nurse practitioners account for more than half of non-physician recipients in both 2011 and 2012. Finally, there was an increase in the number of physician PCIP recipients across all eligible specialties in the second year the payment was in effect. The number of all eligible types of non-physician PCIP recipients also increased. These estimates are consistent with the statistics reported by CMS[35].

Exhibit 3: Number of PCIP Recipients under Medicare by Specialty, 2011-2012

Specialty	Year 2011	Year 2012
Physicians	**121,140**	**133,880**
Internal Medicine	54,062	62,554
Family Medicine	63,227	66,560
Pediatrics	2,711	3,426
Geriatrics	1,140	1,340
Non-Physicians	**41,202**	**51,432**
Clinical Nurse Specialist	466	,
Nurse Practitioner	27,698	33,940
Physician Assistant	13,038	16,899
Total	**162,342**	**185,312**

Note: Actual PCIP recipients; eligibility based on conditions 2 years prior to the PCIP payment year.

The specific PCIP-eligible services and their corresponding Current Procedural Terminology (CPT) codes are as follows: (1) office and other outpatient visits (99201 through 99215); (2) nursing facility, domiciliary, rest home, or custodial care (99304 through 99340); and (3) home services (99341 through 99350).

Medicare claims data include the Healthcare Common Procedure Coding System (HCPCS) corresponding to each claim submitted by providers. Since level I of HCPCS codes is comprised of CPT codes, HCPCS codes associated with claims can be used to determine bonus-eligible E&M services.

35 Source: Center for Medicare and Medicaid Services (http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Downloads/PCIP-2011-Payments.pdf)

The key questions that we examined using the Medicare data include:

- What is the aggregate number of Medicare PCIP recipients?
- What proportion of primary care providers qualify for the PCIP?
- What are the characteristics of primary care providers who qualify for the PCIP?
- How many eligible claims were submitted by PCIP eligible providers?
- What is the impact of Medicare incentive payments on services provided, patients seen, providers accepting Medicare, and other related outcome measures?

B. Data Sources and Variables

1. Main Data Sets

To explore these topics, we used a customized data set constructed at the provider level. This data set includes all the claims submitted by the entire universe of Medicare providers in each year from 2005 to 2011. The content of this customized data set is similar to the Limited Data Set (LDS) version of the Medicare Carrier File (which is also known as the Physician/Supplier Part B Claims) available from CMS Research Data Assistance Center (RESDAC). Subsequently, in the discussion that follows we will refer to the customized claims level data set for all Medicare providers as the Provider Carrier File (PCF). Most of the claims in our PCF are from non-institutional providers, such as physicians, physician assistants, clinical social workers, and nurse practitioners. Key variables in this file include:

- Procedure codes (HCPCS) corresponding to each claim
- Provider total allowable charges associated with all claims
- Provider specialty, place of service, and geographic location (such as zip code)

We constructed a provider level pooled data set (PPD) from the claims level data in the PCF over the period 2005-2011. This pooled data set includes information such as provider specialty, volume of primary care services (based on HCPCS codes), volume of PCIP eligible services, distribution of providers by volume of services, their annual Medicare allowed charges, their geographic location, and other related information, over a longer time horizon. In addition, the original PCF included a National Provider Identifier (NPI) for each provider. Subsequently, each provider was linked by NPI to Provider360 data (available from Lewin Group's parent company Optum Inc.) and the AMA Physician Master File to add provider characteristics such as provider demographics (e.g., age, gender), provider designation, medical school, practice group information, specialty and practice location. We also added geographic location specific characteristics by linking the provider level data with the Area Resource File (ARF) based on the practice location information of providers. The ARF data are maintained by the Health Resources and Services Administration (HRSA). The main advantage of this pooled data set is the ability to track providers over time and capture changes in their volume of services in response to Medicare payment incentives using a pre-and-post analysis design.

2. Trends in Key Outcome Variables

We were interested in estimating the impact of the PCIP on the supply of PCPs and patients' access to their services. We measured improvements in access to care by studying changes in the volume of primary care services provided and the number of PCP providers. Both the supply of PCPs and volume of services are measures of access to care previously used in the literature.[36] In addition, we investigated the impact of the PCIP on the allowed charges associated with eligible E&M claims.

Primary Care Providers with PCIP Eligible Specialties

First, we examined the trend in the number of eligible providers submitting Medicare claims. An increase in the number of primary care providers relative to the population is expected to improve access to primary care. As shown in Exhibit 4, the number of PCPs accepting Medicare patients increased steadily over the study period with an approximate 40 percent increase in the number of providers treating Medicare patients from 2005 to 2011. This trend is common to all four physician specialties under study.[37] In addition, the number of non-physician practitioners more than doubled over this period. This significant increase in the number of non-physician providers, especially nurse practitioners, has been documented elsewhere.[38]

Exhibit 4: Number of Primary Care Providers under Medicare by Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians	138,356	147,771	165,150	173,018	178,784	185,070	191,930
Internal Medicine	69,391	74,411	83,117	87,090	90,291	93,904	97,526
Family Medicine	61,438	65,205	72,247	75,132	77,536	79,891	82,298
Pediatrics	6,539	7,045	8,527	9,447	9,543	9,757	10,555
Geriatrics	988	1,110	1,259	1,349	1,414	1,518	1,551
Non-Physicians	46,634	53,823	68,297	80,041	88,569	97,789	109,353
Clinical Nurse Specialist	1,784	1,934	2,188	2,304	2,370	2,446	2,508
Nurse Practitioner	23,610	27,450	35,286	42,144	46,973	52,472	59,505
Physician Assistant	21,240	24,439	30,823	35,593	39,226	42,871	47,340
Total	184,990	201,594	233,447	253,059	267,353	282,859	301,283

Volume of E&M PCIP Eligible Claims

Our second measure of supply of primary care services is the volume of claims submitted by primary care providers for E&M services. As presented in Exhibit 5, the volume of E&M claims submitted by physicians increased by roughly 9 percent between 2005 and 2008. E&M claims took a slight dip in 2009, increased in 2010, and then stabilized in 2011 at roughly the levels in 2008. The same general increasing trend applied to each of the four eligible physician specialties, with the exception of geriatrics, which experienced a constant and substantial increase in E&M claims of 52 percent over the study period. Internal medicine physicians provided the majority of services, generating more than 50 percent of E&M claims each year over the study period. Family physicians are the second largest group of providers to supply

[36] For instance, see Stensland et al. 2013.

[37] In 2005 almost half of the primary care providers (PCPs) were male, but the share of male PCPs declined to almost 40 percent in 2011 (Exhibit B.1, Appendix B). On the other hand, the share of PCPs aged 55 and above among all male PCPs increased from 24 percent in 2005 to 37.5 percent in 2011 (Exhibit B.1, Appendix B). As observed in Appendix Exhibit B.1, the physician population appears to be aging. The share of male physicians aged 65 and above underwent the largest increase recently, from 18.6 percent in 2010 to 21 percent in 2011 (Exhibit B.9a, Appendix B). A similar increasing trend is also observed among female physicians aged 55 and above (Exhibit B.9b, Appendix B). Finally, in the case of non-physicians, we observe the same steady increase in the share of providers aged 55 and above for both male and female providers (Exhibit B10-11, Appendix B).

[38] Source: GAO (2008) – "Primary care Professionals. Recent Supply Trends, Projections, and Valuation of Services " GAO 08-472T.

E&M services, representing about 40 percent of the total, followed by geriatricians and pediatricians.

Consistent with the increase in the number of non-physicians documented above, we observe an even more dramatic increase in the total number of E&M claims submitted by non-physicians (clinical nurses, nurse practitioners and physician assistants). The volume of E&M claims more than doubled over the study period, from roughly 9 million in 2005 to more than 20 million in 2011.

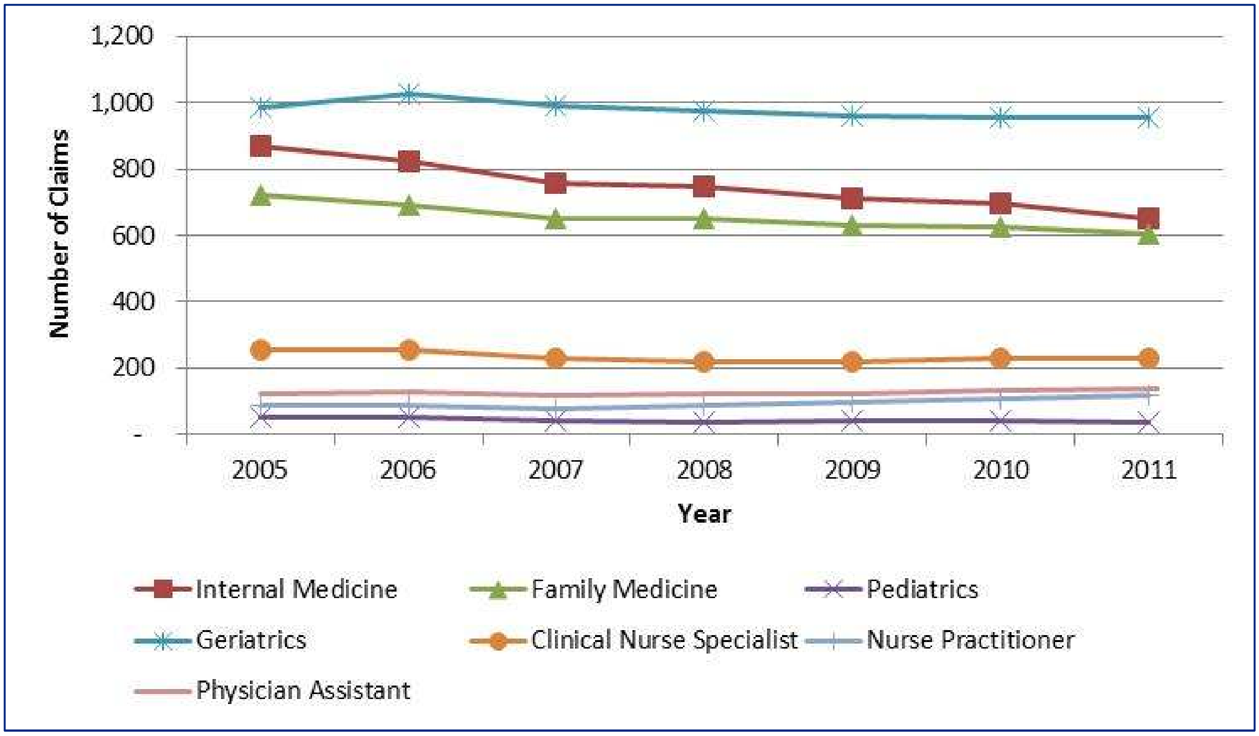
Exhibit 5: Total Number of PCIP Eligible E&M Claims submitted by All PCPs under Medicare by PCP Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians	**105,943,390**	**107,978,615**	**111,700,420**	**115,408,741**	**114,881,401**	**117,265,160**	**115,329,828**
Internal Medicine	60,279,101	61,222,893	63,082,429	64,946,744	64,244,760	65,447,440	63,698,392
Family Medicine	44,352,228	45,264,171	47,011,232	48,776,874	48,891,712	49,977,085	49,767,310
Pediatrics	334,997	352,594	360,508	365,170	387,636	391,312	377,604
Geriatrics	977,064	1,138,957	1,246,251	1,319,953	1,357,293	1,449,323	1,486,522
Non-Phys.	**8,885,528**	**10,366,281**	**11,979,963**	**13,710,969**	**15,376,840**	**18,008,471**	**20,477,006**
Clinical Nurse Specialist	6,083,315	7,068,153	8,117,610	9,212,329	10,298,679	11,987,059	13,561,380
Nurse Practitioner	153,463	165,033	168,030	200,074	228,899	260,618	296,206
Physician Assistant	2,648,750	3,133,095	3,694,323	4,298,566	4,849,262	5,760,794	6,619,420

With both the aggregate number of E&M claims and the number of providers rising over time, we further explore the change in the volume of claims per provider over time. In other words, we examined whether the increase in the aggregate number of claims could be due to the increase in claims per provider or whether it is just due to the increase in the number of providers.

Inspection of Exhibit 6 reveals that in the case of all physicians the average number of eligible E&M claims per provider in 2011, was lower than in 2005. For instance, the average number of eligible E&M claims for internal medicine was 653 in 2011 compared to the higher value of 869 in 2005. The decreasing trend in average claims per physicians may be due to the increase in the number of PCPs in the absence of a substantial increase in the patient population.

Exhibit 6: Average Number of PCIP Eligible E&M Claims per PCP under Medicare by Specialty, 2005-2011



Finally, in the case of non-physicians, there was an overall increase in the average number of E&M claims submitted by physician assistants (PA), nurse practitioners (NP) and clinical nurse specialists (CNS) after 2009 (see Exhibit B2, Appendix B). For example, the number of claims per PA increased from 125 in 2005 to almost 140 in 2011. On the other hand, the number of claims per NP was 253 in 2005, then declined to 219 in 2009 and then increased to about 228 in 2011. The increase in the average number of claims submitted suggests that the dramatic increase in services provided is due to both an increase in the number of providers and in the number of services provided by each non-physician. The average number of claims per PCIP recipients by specialty and the average allowed charges per PCIP recipients by specialty are presented in Appendix B Exhibit 12 and 13 respectively.

Allowed Charges for PCIP Eligible E&M Claims

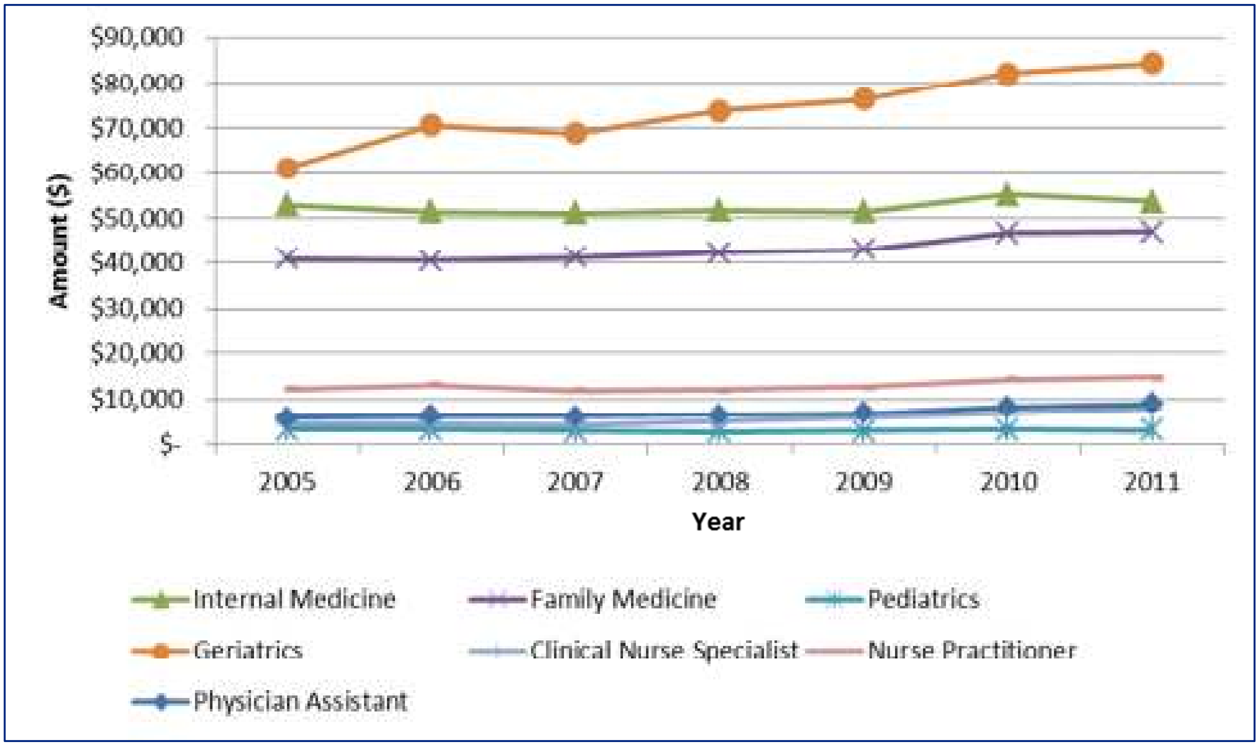
So far, we have focused on the level of E&M services provided, measured in terms of number of claims and the number of providers. Next, we turn to the dollar value associated with E&M claims measured using allowed charges. As shown in Exhibit 7, the total allowed charges (in million dollars) for eligible E&M claims increased for all providers over the period of analysis. Overall, total allowed charges increased by 58 percent, with internal medicine and family medicine physicians accounting for most of this increase. It is also noteworthy that the value of claims submitted by non-physicians increased substantially over the same period, by a factor between 2 and 3.

Exhibit 7: Total Allowed Charges (in million $) for the PCIP Eligible E&M Claims submitted by All PCPs under Medicare, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians	**$6,271**	**$6,575**	**$7,343**	**$7,813**	**$8,119**	**$9,079**	**$9,274**
Internal Medicine	$3,671	$3,830	$4,251	$4,506	$4,644	$5,182	$5,231
Family Medicine	$2,520	$2,645	$2,982	$3,183	$3,340	$3,742	$3,881
Pediatrics	$20	$21	$23	$24	$26	$30	$30
Geriatrics	$61	$78	$87	$100	$108	$125	$131
Non-Physicians	**$416**	**$517**	**$617**	**$743**	**$871**	**$1,114**	**$1,316**
Clinical Nurse Specialist	$287	$358	$421	$507	$592	$749	$878
Nurse Practitioner	$8	$9	$9	$11	$14	$17	$20
Physician Assistant	$122	$150	$187	$225	$265	$349	$418
Total	**$6,687**	**$7,091**	**$7,960**	**$8,556**	**$8,990**	**$10,193**	**$10,589**

As shown in Exhibit 8, the average allowed charge per PCP for E&M claims increased slightly for internal medicine physicians and pediatricians after 2009 (also see Appendix B Exhibit B2). The average value of E&M claims increased for the other PCPs, but not as fast as the total value of these claims. Given the moderate increase in the average allowed charges for E&M claims, the substantial increase in the aggregate allowed charges is likely due to the increase in the number of claims, which in turn, as discussed above may be driven by the increase in the number of providers. Another important observation is that although the average number of claims submitted by physicians declined over the 2005-2011 period, the average allowed charges remained the same or even increased. This observed increase in allowed charges per provider, despite the documented decline in the number of claims, may reflect changes in the composition of services that physicians are providing. We hypothesize that this change in the composition is due to an increase in the supply of services that take more time and which are typically associated with higher charges. We explore this hypothesis in the following section.

Exhibit 8: Average Allowed Charges ($) for the PCIP Eligible E&M Claims per PCP under Medicare by Specialty, 2005-2011



Finally, we constructed the proportion of practitioner's allowed charges under the Medicare fee schedule (excluding hospital inpatient admission and emergency room visits) that are for PCIP eligible primary care services. As observed in Exhibit 9, for both physicians and non-physicians, the proportion of services that are PCIP eligible varies across specialties and is in general steadily increasing over the observation period. However, compared to primary care physicians, the non-physicians experienced a much larger percentage change in the share of allowed charges that are associated with PCIP eligible services.

Exhibit 9: Share of Allowed Charges for PCIP Eligible E&M Claims by Specialty,2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	58.3%	59.0%	61.1%	60.9%	61.2%	65.1%	63.2%
Family Medicine	69.2%	69.9%	72.4%	72.2%	72.5%	75.0%	73.4%
Pediatrics	28.9%	37.6%	43.9%	42.6%	44.6%	51.7%	48.0%
Geriatrics	75.4%	84.5%	85.1%	85.8%	85.5%	87.9%	86.7%
Non-Physicians							
Clinical Nurse Specialist	23.9%	24.9%	25.8%	29.9%	33.3%	36.4%	40.7%
Nurse Practitioner	61.6%	64.9%	64.7%	66.3%	66.6%	70.8%	71.5%
Physician Assistant	50.6%	51.4%	52.9%	53.4%	54.3%	59.8%	59.1%

*Note: the proportions are of allowed charges for all Medicare claims (excluding hospital inpatient, ER, drug and lab)

While the proportion of services that are PCIP eligible is increasing over the observation period, the opposite is true for the proportion of E&M claims (Exhibit 10). Consistent with the decrease in the aggregate number of E&M claims documented above, we observe that the share of E&M claims out of the total Medicare claims is also slightly decreasing over the period. For example, in the case of providers specializing in internal medicine, the share decreased from 41.1 percent in 2005 to 37.5 percent in 2011.

Exhibit 10: Share of PCIP Eligible E&M Claims by Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	41.1%	41.1%	40.1%	39.3%	37.3%	38.3%	37.5%
Family Medicine	43.2%	43.0%	41.9%	40.9%	38.6%	39.2%	38.4%
Pediatrics	30.9%	33.8%	34.7%	34.7%	33.0%	34.2%	34.1%
Geriatrics	64.8%	69.6%	67.7%	64.1%	61.0%	60.0%	60.3%
Non-Physicians							
Clinical Nurse Specialist	27.2%	26.2%	25.9%	27.6%	28.8%	30.9%	32.9%
Nurse Practitioner	55.8%	56.7%	54.8%	51.9%	48.5%	50.3%	50.0%
Physician Assistant	45.5%	46.1%	45.0%	43.8%	41.0%	43.4%	43.1%

Note: the proportions are calculated out of all Medicare claims (excluding hospital inpatient, ER, drug and lab)

The trends in primary care services and providers discussed above, apply in general to the more restricted sample of PCIP recipients (Exhibits B4-7 in Appendix B). When we limit the number of providers to 2011 PCIP recipients we observe a slight decrease in the average number of eligible claims submitted by physicians (Exhibit B5, Appendix B) and an overall increase in the average allowed charges over the study period (Exhibit B6, Appendix B).

C. Econometric Framework

We used the provider-level data to address the key research questions related to the Medicare PCIP. We estimated several regression-based models using the DID method to obtain consistent estimates of the PCIP policy effect.[39] In order to implement the DID model, we:

1. Form a group of providers (treatment group) who are likely to be affected by the PCIP program, including the following specialties: family practice, internal medicine, pediatrics and geriatrics;
2. Identify a natural relevant comparison/control group (other non-primary care - practitioners) who are not likely to be affected by the PCIP; -
3. Assess the changes in our key outcomes of interest for the treatment group relative to the control group before and after the PCIP policy is in effect.

We estimate the following econometric model to identify the effect of Medicare PCIP program on the magnitude of primary care E&M services:

[39] An alternative estimation method is a pre-post analysis, but if there are unobserved factors that affect the magnitude of E&M services supplied by any provider (primary or non-primary care) and the effect of these unobserved factors varies over time, a pre-post model would not yield an unbiased incentive effect.

$$S_{it} = \alpha + \beta * T_i + \theta * Post_t + \delta * Post_t * T_i + X'_{it} * \gamma + \varepsilon_{it}$$

We let S_{it} be the volume of eligible E&M services provided by provider *i* in period *t*; T_i is an indicator for treatment group that takes the value 1 if the provider is a PCP, and zero otherwise; the variable $\mathrm{Post_t}$ is an indicator variable taking the value of 1 in the years when the PCIP policy is likely to impact the behavior of the providers and 0 otherwise; the vector $\mathrm{X_{it}}$ includes provider characteristics, such as age and gender. The term ε_{it} represents the net influence of random unobserved factors affecting E&M services. Importantly, the estimated coefficient δ (the coefficient of the interaction term between the treatment group indicator and the post-PCIP policy period indicator) in equation (1) represents an unbiased estimate of the effect of the Medicare primary care incentive payment on the volume of primary care E&M services. The derivation of this estimated effect is presented in Appendix C (C.1). A similar methodology can be applied to estimate the effect of the incentive payment on other outcomes of interest.

The choice of the control group for the DID model was based on several criteria. Ideally, we would have included providers with non-eligible specialties who also supplied E&M services. In order to determine some preferred comparison group providers we:

1. Evaluated the frequency of PCIP eligible and non-eligible providers by (primary) specialty available in the Provider360 dataset after merging that data set with the list of NPIs of 2011 PCIP recipients.
2. Examined the volume of claims related to evaluation and management (E&M) services by specialty, based on 2009 Medicare claims by service and specialty.
3. Chose, based on the volume of claims and the number of providers, 8 PCIP non-eligible specialties. These PCIP non-eligible specialties are: (1) Psychiatry & Neurology; (2) Obstetrics & Gynecology; (3) Urology; (4) Ophthalmology; (5) Pathology; (6) Psychologist; (7) Podiatrist; and (8) Optometrist. Total number of PCIP eligible claims submitted by these providers with PCIP non-eligible specialties is presented in Appendix B Exhibit B14.

D. Main Results

The estimation of DID regression models is based on the number of eligible providers; the volume of claims for PCIP eligible E&M services and the allowed charges/payments associated with those claims. The volume of E&M claims and payments analyzed here excludes those for hospital inpatient, ER, drug and laboratory services. As we explain above, Medicare providers with a PCIP-eligible specialty (i.e., family practice, internal medicine, geriatrics, pediatrics, NP, PA and clinical nurse specialists) that have at least one Medicare claim are included in the "treatment" group. These are the providers who are likely to be affected by the Medicare PCIP policy. Given that the announcement of the PCIP program was made in 2010,[40] we assumed that the providers with Medicare PCIP eligible specialties would be potentially responsive to the

[40] Source: *Patient Protection and Affordable Care Act ("PPACA"; Public Law 111–148)*. For our analysis we report a single estimate of PCIP impact under each regression model where year 2010 and 2011 are considered as the post-policy periods. We performed several sensitivity analyses to investigate if the estimated impact is significantly different between 2010 and 2011; we also checked if the results change once we consider 2011 as the only post period. Based on such detailed analysis we did not find any systematic evidence that the estimated impact is different between these two years and they are not sensitive to the choice of post-policy period.

incentive as early as year 2010. Therefore, years 2010 and 2011 represent the post-policy period.

The DID regression models were estimated using several sub-samples: (1) all providers; (2) only providers that appear in all 7 years of data (roughly 44 percent of all providers); (3) providers who were near the PCIP eligibility criteria in 2009 (i.e., restricted to providers who had the share of total Medicare claim payments -- allowed charges-- between 50 percent and 65 percent for PCIP eligible E&M services. About 15 percent of all providers in the sample met this restriction.

In Exhibit 11 we summarize the average volume of PCIP eligible E&M claims and the allowed charges/payments associated with those claims by select patient category and CPT code for providers in the "treatment" group. Comparing the first and last columns, we observe that providers near the 60 percent eligibility threshold generate more E&M claims, on average, compared to the average PCP accepting Medicare (895 vs. 590).

Exhibit 11: Number of PCIP Eligible E&M Claims and Mean Allowed Charges per Provider per Year by Types of Claims for Providers with PCIP Eligible Specialty, 2005-2011

	All Providers	Providers in All Years	Providers Near Eligibility
Analysis Sample			
Number of Unique Providers with PCIP Eligible Specialty	264,141	129,587	17,081
Annual Average Number of PCIP Eligible E&M Claims per provider			
All E&M Claims	**590**	**752**	**895**
New Patient Claims	19	21	25
Established Patient Claims	487	628	813
Other Claims	84	103	57
Claims in 3 Major CPT Codes			
Established Patients (15 mins.)	243	315	403
Established Patients (25 mins.)	177	227	282
Established Patients (40 mins.)	20	25	34
Annual Average Allowed Charges for PCIP Eligible E&M Claims per Provider			
All E&M Payments	$40,208	$51,016	$60,235
New Patient Payments	$1,941	$2,223	$2,661
Established Patient Payments	$32,409	$41,764	$53,755
Other Payments	$5,858	$7,029	$3,819
Payments in 3 Major CPT Codes			
Established Patients (15 mins.)	$13,613	$17,635	$22,712
Established Patients (25 mins.)	$15,217	$19,524	$24,581
Established Patients (40 mins.)	$2,313	$2,976	$4,051

Note: Summary of PCIP eligibility criteria. Primary care physicians (with internal medicine, family practice, pediatrics and geriatrics specialty) who have at least 60 percent of the practitioner's allowed charges under the Medicare physician fee schedule (excluding hospital inpatient care and emergency department visits) are eligible for primary care services. The PCIP eligible primary care services are defined by specific E&M codes. Medicare PCIP is also provided to physician assistants, nurse practitioners and clinical nurse specialists who meet the similar eligibility criteria. For the purpose of our analysis we consider the PCPs (with the PCIP eligible specialty) who have

50 percent-65 percent of their services for PCIP eligible E&M services (defined by specific E&M codes) in 2009 are considered to be near the eligibility threshold.

For the control group, the number of providers, the volume of their Medicare claims for E&M services and the associated allowed charges for the providers with the PCIP non-eligible specialties are presented in Exhibit 12. As expected, providers in the control group generated much fewer E&M claims compared to providers in the treatment group. Specifically, providers in the control group supplied less than half the volume of E&M services compared to providers in the treatment group (i.e., 296 vs. 590).

Exhibit 12: Number of PCIP Eligible E&M Claims and Mean Allowed Charges per Provider per Year by Types of Claims for Providers with PCIP Non-Eligible Specialty, 2005-2011

	All Providers	Providers in All Year
Analysis Sample		
Number of Unique Providers with PCIP Non-Eligible Specialty	108,302	70,583
Annual Average Number of PCIP Eligible E&M Claims per Provider		
All E&M Claims	**296**	**333**
New Patients Claims	35	38
Established Patients Claims	243	276
Other Claims	18	19
Claims in 3 Major CPT Codes		
Established Patients (15 mins.)	129	146
Established Patients (25 mins.)	47	53
Established Patients (40 mins.)	5	6
Annual Average Allowed Charges for PCIP Eligible E&M Claims per Provider		
All E&M Payments	**$18,618**	**$20,868**
New Patients Payments	$3,421	$3,724
Established Patients Payments	$14,108	$15,975
Other Payments	$1,089	$1,169
Payments in 3 Major CPT Codes		
Established Patients (15 mins.)	$7,321	$8,288
Established Patients (25 mins.)	$4,048	$4,578
Established Patients (40 mins.)	$641	$711

1. Impact of PCIP Policy on Number of Eligible Providers

We examined the changes in the number of providers with a Medicare PCIP eligible specialty in a county who have at least one claim for PCIP eligible services to identify the potential impact of the PCIP policy on these providers. Exhibit 13 shows the results from the DID regression models in which we use the number of providers in a county and in a specific year as the outcome variable (Model 1), the number of physicians in each county and year (Model 2); and the number of non-physicians (i.e., NP, PA and CN). The key variable in each model is the interaction between the indicator for PCIP eligible specialty and the indicator for the period after 2009.

In Model 1, the first estimated coefficient suggests that on average the number of Medicare providers with a PCIP eligible specialty and at least one PCIP eligible claim increased by about 2.8 providers per county in each year after 2009 due to the Medicare PCIP. This represents an economically meaningful increase given that on average there were about 15 providers per county per year in a PCIP eligible specialty during the sample period. This increase (almost 19 percent) in the number of providers in PCIP eligible specialties may be the primary reason for the estimated reduction in the number of E&M claims per provider due to the PCIP policy.

In addition, when we restrict the estimation to physicians (Model 2), the increase in the number of physicians with a PCIP eligible specialty attributable to the policy is about 2 per county per year. This is almost 10 percent of the average number of primary care physicians in a given PCIP eligible specialty per county per year (average is almost 19). Furthermore, the estimated policy impact in Model 3 indicates that the number of PCIP eligible non-physicians increased by over 3.6 providers per county per year. Thus, all three models confirm that the introduction of the PCIP policy generated an increase in the number of PCIP eligible providers above and beyond the general increasing time trend. Subsequently, this increased number of providers may have resulted in the reduction in the average number of E&M claims submitted by these Medicare providers after 2009.[41]

Exhibit 13: Impact of Medicare PCIP on the Number of PCPs with Medicare Claims for PCIP Eligible Services (2005-2011)

Dependent Variable: Number of Providers per county	All Providers (1)	Physicians Only (2)	Non-Physicians Only (3)
PCIP Elig. Specialty Indicator	42.47*	34.00*	27.21*
	(3.133)	(3.647)	(2.078)
Elig. Specialty Ind x Post 2009	2.759*	1.950*	3.632*
	(0.444)	(0.674)	(0.375)
Post 2009	2.929*	1.884*	2.895*
	(0.455)	(0.541)	(0.304)
Median Income ($10k)	1.591*	2.218*	1.061*
	(0.385)	(0.468)	(0.206)
Percent in poverty	0.254*	0.339*	0.210*
	(0.0479)	(0.0587)	(0.0285)
Population (10k)	0.536*	0.607*	0.317*
	(0.0280)	(0.0339)	(0.0128)
Percent Population over 65	-0.307*	-0.196*	-0.234*
	(0.0363)	(0.0452)	(0.0238)
Unemployment Rate	-0.518*	-0.510*	-0.400*

41 We have also estimated similar models for the primary care providers who have any Medicare claims (not necessarily under PCIP eligible services) and the estimated effects of the PCIP policy are slightly larger in those cases. These additional results are included in Appendix B Exhibit B 15. In addition we have estimated similar models of providers who met the 60% PCIP eligibility threshold in each year (2005-2011). As expected, the estimated impact of PCIP policy on the number of primary care providers is relatively lower for this restricted set of providers. However, if we focus on this restricted set of providers then we are likely to lose those providers who may have been induced to provide PCIP eligible services in response to the policy, but may not have reached the 60% threshold. Similarly we would lose the information on the providers who have reduced the proportion to below 60%. The estimated results on this restricted set of providers are presented in Appendix B Exhibit B16.

Dependent Variable: Number of Providers per county	All Providers (1)	Physicians Only (2)	Non-Physicians Only (3)
	(0.0461)	(0.0557)	(0.0324)
Intercept	-49.70*	-59.88*	-30.06*
	(3.489)	(3.996)	(2.344)
Specialty Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
N	140,192	107,526	95,647
Adj. R-sq.	0.310	0.338	0.365

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent. The number of observation is based on the number of counties, the number of years, and the number of provider specialties in each model (i.e., physicians include 4 primary care specialties and non-physicians include 3 sub-specialties). -

The PCIP policy could impact the number of Medicare providers submitting PCIP eligible claims through several channels. First, the policy may induce an established PCP to start to treat Medicare patients (new or established patient) under PCIP eligible services that they may not have done before. In addition, the policy may also encourage new providers, fresh out of their completion of residency training, to provide PCIP eligible services under Medicare. Lastly, one can also argue that the PCIP policy may encourage providers with a PCIP non-eligible specialty to switch to a PCIP-eligible specialty and increase their chance to receive the incentive payment. This last scenario could be especially relevant for internal medicine sub-specialties such as cardiology, pulmonary disease, nephrology, and endocrinology, which are not PCIP-eligible although the internal medicine specialty is PCIP-eligible. Without judging whether such specialty switching is a desired outcome under the PCIP policy, we first examine to what extent such switching of specialty is prevalent in our dataset; and second, whether such phenomenon is large enough to influence the impact of the PCIP policy on the number of providers who submit at least one Medicare claim under PCIP eligible services.

Based on our 2005-2011 claims data we have estimated that during the post-PCIP policy period (2010 and 2011) there are about 30,864 new primary care physicians (family practice, internal medicine, pediatrics and geriatrics) and 27,927 new primary care non-physicians who have submitted at least one claim under Medicare. (Note that, in this accounting, we do not attempt to distinguish between "new" providers who were induced by the PCIP to participate, and providers that would have entered the Medicare program anyway.) Based on our Medicare data we have estimated that 3,057 physicians with at least one Medicare claim switched their specialty to a PCIP eligible specialty during the post-policy period. Over 50 percent (1,645) of these specialty switches are switches into internal medicine, mainly from internal medicine sub-specialties. The number of specialty switchers is substantially smaller than the number of total new Medicare physicians with a PCIP eligible specialty in the post-policy periods. Thus, switching of specialty could not account for the estimated impact of the PCIP policy on the number of primary care physicians.

Based on our claims data we estimate that during the post-PCIP policy period (2010 and 2011) there are 17,662 new primary care physicians (family practice, internal medicine, pediatrics and geriatrics) who have submitted at least one PCIP eligible claim. Additionally, we have estimated from published sources that during the post policy period there are about 10,000 residency positions filled under primary care, annually, from 2009 to 2011.[42] If the Medicare PCIP policy attracts part of these providers under Medicare to provide PCIP eligible services, then such evidence would be consistent with our estimated impact of the PCIP policy in Exhibit 13.

Exhibit 14 shows the impact of the PCIP policy on the number of providers accepting new Medicare patients (Model 1) and on the number of new Medicare providers (Model 2). The estimated coefficient on the main variable of interest — the interaction between the PCIP eligibility indicator and the post-2009 indicator — suggests that, due to the PCIP policy, on average the number of PCPs accepting new Medicare patients increased by about 1 provider per county per year for a given PCIP eligible specialty. This estimated impact is not negligible given that there are about 9 Medicare PCPs for a given primary care specialty who accept new Medicare patients per county per year during the sample period.

Similarly, Model (2) in Exhibit 14 shows the impact of the PCIP policy on the number of new Medicare providers who have submitted Medicare claims for PCIP eligible services. The estimated coefficient on the main variable of interest suggests that due to the PCIP policy, on average, the number of new Medicare primary care providers with at least one claim submitted for PCIP eligible services increased by 0.148 per county per year for a given PCIP eligible specialty. Given that, on average, there are about 1.4 new Medicare primary care providers per county per year in a PCIP eligible specialty with at least one PCIP eligible claim during the sample period, the estimated impact is again not negligible.

Exhibit 14: Impact of Medicare PCIP on the Number of Providers Accepting New Medicare Patients and the Number of New Primary Care Providers under Medicare with Claims for PCIP Eligible Services (2005-2011)

	Number of Providers Accepting New Medicare Patients (1)	Number of New Medicare Providers (2)
PCIP Elig. Specialty Indicator	28.19*	4.367*
	(1.959)	(0.297)
Elig. Specialty Ind x Post 2009	**0.883***	**0.148***
	(0.345)	(0.0440)
Post 2009	1.605*	0.293*
	(0.369)	(0.0460)
Median Income ($10k)	1.455*	0.0508
	(0.295)	(0.0445)
Percent in poverty	0.143*	0.0160*
	(0.0366)	(0.00545)
Population (10k)	0.351*	0.0482*
	(0.0204)	(0.00328)
Percent Population over 65	-0.177*	-0.0443*
	(0.0295)	(0.00436)
Unemployment Rate	-0.314*	-0.0512*
	(0.0374)	(0.00544)
Intercept	-34.32*	-3.926*

[42] Estimates include the following primary care specialties: family practice, internal medicine (including pediatrics), pediatrics. Source: National Resident Matching Program, Results and Data: 2011 Main Residency Match. National Resident Matching Program, Washington, DC. 2011.

	Number of Providers Accepting New Medicare Patients (1)	Number of New Medicare Providers (2)
	(2.461)	(0.330)
Specialty Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes
N Adj. R-sq.	140,192 0.250	121,084 0.255

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent.

2. Impact of PCIP Policy on Number of Claims for E&M Services

The DID estimates from the model using the volume of E&M claims as the outcome variable are presented in Exhibit 15. The estimated coefficient of that interaction term in the first column of Exhibit 15 (i.e., column (1)) indicates that in response to the Medicare PCIP policy PCPs with PCIP eligible specialties reduced their number of PCIP eligible E&M claims by about 52 on average.[43] This represents a reduction in the volume of claims per provider of a little less than 9 percent. Furthermore, we estimate that on average providers with PCIP eligible specialties had about 187 more E&M claims submitted under Medicare during the sample period than the providers with PCIP non-eligible specialties. Also, for the providers with both PCIP eligible and non-eligible specialties the average number of E&M claims submitted went down by 70 claims after 2009.

In addition, we find that as the number of primary care providers per 10,000 population increases, the number of claims per provider decreases. Finally, the volume of claims per provider increases with the provider's age and with the increase in the size of the Medicare population. The effect of unemployment on the number of E&M claims per provider is also positive and statistically significant.

When the sample is restricted to providers who were near the PCIP eligibility threshold in 2009 (column (3)), the estimated reduction in the number of claims per provider due to the PCIP policy is smaller, only about 33 claims.[44] The reduction in the number of claims per provider in response to the PCIP policy may appear counterintuitive. However, the total number and value of claims may still increase as a result of the policy, as long the number of providers with a PCIP

[43] The post-post policy period in our analysis comprises of two years: 2010 and 2011. We have also estimated the impact of the PCIP policy on the volume of claims and other outcomes discussed later for each post-policy year separately and the effects in these two years are not statistically different for a given outcome of interest.

[44] We focus on the primary care providers who are near the PCIP eligibility threshold because these providers are at the margin to improve the volume of their PCIP eligible services by incurring a relatively low cost and gain the PCIP incentive payment (i.e., marginal benefit is much higher relative to the marginal cost). Therefore, we would expect the impact of PCIP policy (if there is any) would be more substantial among the providers near the eligibility threshold. However, if we only focus on those who met the 60% criteria then we would lose the behavioral changes among the providers who are below the threshold may have tried to reach the 60% threshold in response to PCIP. This may bias the PCIP impact. By focusing only on those providers who met the 60% eligibility criteria, we would face the typical problem of selection bias. Hence, focusing on those providers who are near the eligibility threshold circumvents this problem but captures the essence of the hypothesis that we are referring to. In addition, we have estimated several models with different ranges (50%-65%, 50%-70%, 55%-65% and 40%-80%) of the proportion of allowed charges on PCIP eligible primary care services and tested the sensitivity of our results. At least for the first three ranges mentioned, we find that results are not sensitive to those three ranges. However, once we broaden the analysis to 40-80%, the estimated impact is in between the effects we observed for all providers and the providers in 50-65% threshold (as expected). Also the mean value of this proportion in the sample is about 53%.

eligible specialty increases at a higher rate than the decline in the number of claims submitted per provider. Thus, a reduction in the number of claims per provider should not be interpreted as evidence of decreased access to primary care services if the number of providers is increasing at the same time.

Exhibit 15: Impact of Medicare PCIP Policy on PCIP Eligible E&M Claims (2005-2011)

Dependent Variable: PCIP Eligible E&M Claims per Provider	Analysis Sample		
	(1) E&M Claims	(2) E&M Claims (Providers in All Years)	(3) E&M Claims (Near Eligib. '09)
PCIP Elig. Specialty Indicator	186.9*	116.6*	117.6*
	(12.93)	(18.38)	(12.46)
Elig. Specialty Ind x Post 2009	**-51.73***	**-36.96***	**-32.59***
	(1.814)	(2.412)	(5.762)
Post 2009	-74.42*	-77.27*	-37.28*
	(2.692)	(3.423)	(3.155)
Age	8.450*	6.980*	2.241*
	(0.0450)	(0.0637)	(0.0547)
Male	165.7*	198.9*	90.39*
	(0.965)	(1.243)	(1.162)
Urban	-39.78*	-51.01*	-49.00*
	(1.712)	(2.153)	(2.190)
Median Income ($10k)	-7.296*	-5.815*	0.0475
	(0.886)	(1.137)	(1.057)
Percent in poverty	-4.678*	-4.105*	1.523*
	(0.222)	(0.283)	(0.272)
Population (10k)	-0.107*	-0.134*	-0.0710*
	(0.00441)	(0.00576)	(0.00531)
Percent Population over 65	17.84*	20.72*	18.44*
	(0.256)	(0.319)	(0.322)
Unemployment Rate	13.07*	17.66*	6.838*
	(0.425)	(0.560)	(0.522)
Primary Care Phy./pop10k	-0.156*	-0.172*	-0.258*
	(0.00716)	(0.0102)	(0.0146)
PC Non-phy./pop10k	-0.452*	-0.627*	-0.208*
	(0.0154)	(0.0234)	(0.0228)
Intercept	-346.10*	-303.30*	-114.60*
	(16.69)	(22.63)	(17.34)
Specialty Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
N	2,014,835	1,397,760	746,845
Adj. R-sq.	0.222	0.241	0.380

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent.

3. *Impact of PCIP Policy on Allowed Charges for E&M Services*

The estimated effect of the PCIP policy on the allowed charges associated with the E&M claims is, in general, positive and statistically significant (Exhibit 16). While we estimate no significant policy impact on charges for our full sample of providers (Model 1), we do find a significant policy effect when we restrict the sample to those providers most likely to change their behavior in response to the PCIP, i.e., the providers that were near eligibility. More specifically, for the sample of providers who were near the PCIP eligibility threshold in 2009 (i.e., Model 3), the estimated coefficient of the interaction term in the last column of Exhibit 16 shows that in response to the Medicare PCIP policy on average the allowed charges of primary care providers with a PCIP eligible specialty increased by about $5,611. The estimated effect represents about 9.3 percent of the mean allowed charges ($60,235) per provider per year for the providers with PCIP eligible specialties who were near the eligibility threshold in 2009. This estimated effect on the allowed charges in response to a 10 percent Medicare PCIP program suggests an implied elasticity of the allowed charges per provider per year with respect to the payment is about 1 (i.e., 9.3%/10%). The effect is smaller if we restrict the sample to all the providers who submitted E&M claims under Medicare in all seven years. The mean allowed charges per provider per year for these providers were $51,016. Thus, due to the Medicare PCIP policy they experienced an additional 5.6 percent increase ($2839/$51,016) in allowed charges. One caveat surrounding these results is that since the actual Medicare payment may be smaller in magnitude compared to the allowed charges, the increase in actual Medicare payments may be lower than our estimated increases in allowed charges.

Exhibit 16: Impact of Medicare PCIP Policy on Allowed Charges for PCIP Eligible E&M Claims (2005-2011)

Dependent Variable: Allowed Charges for PCIP Eligible E&M Claims per Provider (E&M Payments)	Analysis Sample		
	(1) E&M Charges	(2) E&M Charges (Providers in All Years)	(3) E&M Charges (Near Eligib. '09)
PCIP Elig. Specialty Indicator	7474.1*	1138.2	751.8
	(1077.6)	(1583.2)	(1047.5)
Elig. Specialty Ind x Post 2009	**59.44**	**2839.3***	**5610.9***
	(132.8)	(176.9)	(420.6)
Post 2009	828.5*	1209.0*	2418.0*
	(183.5)	(232.7)	(212.0)
Age	550.1*	409.9*	123.4*
	(3.093)	(4.324)	(3.721)
Male	11067.6*	13157.1*	6103.1*
	(68.97)	(87.80)	(80.71)
Urban	-1043.5*	-1509.7*	-1971.9*
	(111.6)	(138.9)	(139.4)
Median Income ($10k)	867.8*	1273.7*	978.7*
	(61.78)	(78.72)	(71.47)
Percent in poverty	-247.3*	-180.4*	134.3*
	(14.70)	(18.62)	(17.50)
Population (10k)	-2.646*	-3.481*	-0.464
	(0.322)	(0.416)	(0.384)

Dependent Variable: Allowed Charges for PCIP Eligible E&M Claims per Provider (E&M Payments)	Analysis Sample		
	(1) E&M Charges	(2) E&M Charges (Providers in All Years)	(3) E&M Charges (Near Eligib. '09)
Percent Population over 65	1242.7*	1419.4*	1215.0*
	(17.64)	(21.77)	(21.70)
Unemployment Rate	1217.5*	1592.8*	756.7*
	(29.98)	(38.69)	(36.32)
Primary Care Phy./pop10k	-7.423*	-7.227*	-14.33*
	(0.503)	(0.703)	(0.952)
PC Non-phy./pop10k	-34.12*	-48.36*	-17.18*
	(1.082)	(1.629)	(1.540)
Intercept	-37177.8*	-33786.2*	-15834.7*
	(1292.7)	(1814.7)	(1320.8)
Specialty Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
N	2,014,835	1,397,760	746,845
Adj. R-sq.	0.222	0.246	0.367

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent.

So far, we have found that the PCIP program resulted in increased allowed charges for E&M services per provider despite some decline in the corresponding number of E&M claims. We have already discussed that one potential reason for the decline in the average volume of claims could be due the increase in the number of providers under PCIP eligible specialties that can be specifically attributed to the PCIP policy. However, the question still remains regarding a shift in the composition of services that may have resulted in increased allowed charges or payments despite the decline in the number of claims per provider.

In order to gain a deeper understanding of this issue we estimate the impact of the Medicare PCIP policy on each key component of E&M services (Exhibit 17). More specifically, we examine the impact of the policy on the volume of claims associated with services for new patients, established patients, and E&M claims for all other services. E&M claims associated with services for established patients account for more than 80 percent of all the E&M claims (and allowed charges) submitted by providers with PCIP eligible specialties.[45] Furthermore, 15 and 25 minute visits account for 40 percent and 30 percent of all E&M claims for established patients, respectively. Moreover, the 25 minute visits account for a slightly higher share of allowed charges, i.e., 38 percent, relative to 34 percent for 15 minute visits.

In Exhibit 17, we present the estimated impact of the PCIP on the average number of E&M claims per provider, for three relevant samples of providers. We find that the introduction of the Medicare PCIP policy reduced the average number of E&M claims submitted for both new and established patients. The estimated impact suggests that, on average, the number of E&M claims per provider for 15 minute visits declined by an additional 46 among PCIP-eligible providers compared to non-eligible providers. Similarly, results using the sample of all providers

[45] For the providers near the PCIP eligibility threshold, this share of E&M claims is almost 90 percent.

suggest that E&M claims per provider for 25 minute visits increased by an additional 13 among PCIP-eligible providers compared to non-eligible providers. When we restrict the sample to providers near the PCIP eligibility threshold in 2009, the decline for E&M claims for 15 minutes visits due to PCIP policy is about 57 claims; while the E&M claims associated with 25 minute visits increased by about 42 claims due to the PCIP policy.

Exhibit 17: Estimated Impact of Medicare PCIP Policy on the Number of PCIP Eligible E&M Claims (2005-2011)

Estimated coefficient of variable "Elig. Specialty Ind x Post 2009" from each DID Model

Dependent Variable	Analysis Sample		
	All	Providers in All Years	Providers Near Eligibility '09
All E&M Claims	-51.73*	-36.96*	-32.59*
New Patient Claims	-13.54*	-15.91*	-11.72*
Established Patient Claims	-35.25*	-20.91*	-22.24*
Other Claims	-2.941*	-0.150	1.369
Claims by Duration (Minutes)			
New Patient Visits			
10	0.0673*	0.0850*	0.0551*
20	0.160*	0.0269	0.209+
30	-5.102*	-5.894*	-4.607*
45	-7.697*	-8.930*	-6.854*
60	-0.966*	-1.194*	-0.528*
Established Patient Visits			
5	-3.926*	-3.621*	-6.227*
10	1.611*	1.702*	-2.487*
15	-45.54*	-47.16*	-56.49*
25	12.57*	26.79*	41.55*
40	0.0347	1.382*	1.417*

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent.

The above findings raise the question of whether the policy-induced net decrease in the number of E&M claims will be reflected in the corresponding allowed charges. To answer this question we estimated the potential impact of the PCIP policy on the allowed charges associated with the each component of the E&M claims (Exhibit 18).

The estimated impact of the PCIP policy on allowed charges associated with 15 minute visits for established patients suggests that, on average, the policy additionally reduced the total allowed charges by about $1,577 per provider per year after 2009. However, the estimated policy induced reduction in allowed charges is smaller for providers near the PCIP eligibility threshold, i.e., a reduction of about $602.

Moreover, the PCIP policy additionally increased the total annual allowed charges by about $2,740 per provider, after 2009, for 25 minute visits for established patients. This is a substantial increase considering that providers with PCIP eligible specialties had about $15,217 in allowed charges per year for 25 minute visits for established patients. The impact is even larger once the sample is restricted to providers near the PCIP eligibility threshold: increase in total annual allowed charges by about $6,807, a 28 percent increase. Similarly, allowed charges associated with all E&M services for all established patients increased substantially, by about $6,544 or 12 percent, for providers near the PCIP eligibility threshold. In the case of all providers, the estimated increase in total annual allowed charges for established patients was $1,245 per provider. We find that the PCIP policy resulted in increased Medicare allowed charges across all providers with PCIP eligible specialties. This increase in allowed charges is likely to have also resulted in increased payments for these primary care E&M services.

Exhibit 18: Estimated Impact of Medicare PCIP on the Allowed Charges for PCIP Eligible E&M Claims (2005-2011)

Estimated coefficient of the variable "Elig. Specialty Ind x Post 2009" from each DID Model

Dependent Variable	Analysis Sample		
	All	Providers in All Years	Providers Near Eligibility '09
All E&M Payments	59.44	2839.3*	5610.9*
New Patient Payments	-1910.9*	-2206.5*	-1602.4*
Established Patient Payments	1244.6*	3905.9*	6543.9*
Other Payments	725.8*	1140.0*	669.4*
Payments by Duration (Minutes)			
New Patient Payments			
10	0.951	1.407+	0.706
20	-17.10*	-28.91*	-12.37+
30	-544.5*	-620.3*	-492.2*
45	-1184.5*	-1359.4*	-1033.1*
60	-165.8*	-199.3*	-65.51*
Established Patient Payments			
5	-75.15*	-70.66*	-122.3*
10	-34.12*	-35.94+	-118.3*
15	-1577.2*	-1095.2*	-601.7*
25	2740.4*	4670.9*	6807.0*
40	190.6*	436.7*	579.2*

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent.

Analyzing the Impact of Financial Incentives for Primary Care Providers in Shortage Areas

A. Background

Access to health care in underserved areas has been an ongoing source of concern among policy makers. A 2013 CRS report for the congress ("Physician Supply and the ACA" by E.J. Heisler) indicates that the expansion of health insurance coverage under the ACA is likely to stimulate the demand for primary care in general, and also in the underserved areas. HRSA designates certain underserved areas as primary care Health Profession Shortage Areas (HPSAs). These areas meet a defined threshold of physicians to population ratio.[46] HPSA designations are currently limited to primary medical care HPSAs, dental HPSAs, and mental health HPSAs. In this section we focus on only primary care HPSAs. All non-federal Doctors of Medicine (M.D.) and Doctors of Osteopathy (D.O.) providing direct patient care and who practice principally in one of the four primary care specialties - general or family practice, general internal medicine, pediatrics, and obstetrics/gynecology - will be counted under the definition of primary care HPSA. As previously noted, since 1987, Medicare has been paying bonus payments, initially five percent, to physicians providing care in rural geographic HPSAs. In 1991 the bonus payment was increased to 10 percent and eligibility extended to services provided by physicians in urban geographic HPSAs. Thus, this particular form of bonus payment has been in place for almost 25 years. Although the HPSA bonus is available to non-primary care providers, such as dentists and mental health care providers, for the purpose of this study we focus only on primary care providers eligible for primary care HPSA bonus.

Section 413a of the Medicare Modernization Act put in place an additional 5 percent bonus payment for physicians practicing in Physician Scarcity Areas (PSAs)[47]. PSAs were those counties and rural zip codes in MSAs with the lowest physician to population ratios. These areas often coincided with geographic HPSAs so that physicians practicing in those areas received a 15 percent additional bonus payment during 2005-2008 when the PSA bonuses were in effect.

Some key points to note regarding the PSA bonus are the following:

- Medicare paid the 5 percent PSA bonus on a quarterly basis, and the bonus was based on what Medicare actually paid, not the Medicare-approved payment amount;
- The same service could be eligible for the PSA bonus and the HPSA bonus;
- The payment was based on where the service is performed, not on the address of the beneficiary;

[46] Health Professionals Shortage Areas (HPSAs) are based upon criteria set forth under Section 332 of the Public Health Service Act. HPSAs are defined to include 1) urban and rural geographic areas, 2) population groups, and 3) facilities with shortages of health professionals. HPSA designations are currently limited to primary medical care HPSAs, dental HPSAs, and mental health HPSAs; in the past, similar designations identified shortages in a wide variety of health professions, including podiatry, pharmacy, and veterinary medicine (Salinsky, 2010). For primary care HPSAs, one of the following two conditions must prevail within the area: a) a ratio of population to full-time-equivalent primary care physician of at least 3,500:1; or b) a ratio of population to full-time-equivalent primary care physician of less than 3,500:1 but greater than 3,000:1 and an unusually high need for primary care services or insufficient capacity of existing primary care providers.

[47] The expiration of the PSA bonus in 2008 was likely a result of Medicare expenditures being capped by law. In House Bill HR 6331 of 2008, the cut was equivalent to 10.6 percent. In order to avoid the 10.6 percent loss, PSA designations were allowed to expire, which automatically led to the expiration of the PSA bonus. Source: http://www.graham-center.org/online/etc/medialib/graham/documents/medicare-payment/ma.Par.0001.File.tmp/ma.pdf

- The PSA bonus was paid on services rendered on or after January 1, 2005 through June 30, 2008;

Only the physician designations of General Practice, Family Practice, Internal Medicine, and Obstetrics/Gynecology were paid the bonus for the ZIP code areas designated as primary care PSAs. All other physician provider specialties were eligible for the specialty PSA area bonus for the ZIP codes areas designated as specialty PSAs.[48] Once again for the purpose of this study we focus only on the primary care physicians with PSA bonus eligible specialties.

Our main claims-level data includes a variable that indicates the location of each provider. Additionally, CMS provides the list of HPSA and PSA areas. In this section we review the PSA geographic areas and the extent of overlap with HPSAs. Physicians practicing in these overlap areas received a 15 percent additional bonus payment during 2005-2008 when the PSA bonuses were in effect.

In the exhibits below we present the distribution of primary care providers across HPSA and PSA areas. Due to limited data, we do not present provider counts for HPSA areas prior to 2007 while the PSA bonus was no longer in place after 2008. Moreover, we do not use data from 2011 for the DID analysis as it will include the confounding effect of Medicare PCIP.[49] Although the PSA bonus does not apply to non-physicians, we report the number of non-physicians in PSA areas (in italics) for comparison purposes.

We consider only those counties that have a full rather than partial primary care HPSA designation. In 2011, we identified 1279 full HPSA counties covering 40 percent of the total US population. Exhibits 19 & 20 show the distribution of PCPs and 2011 PCIP recipients across HPSA and PSA areas over the 2005-2011 period.

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[48] Dentist, Podiatrists, Optometrists, and Chiropractors were not eligible for PSA bonus. Source: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HPSAPSAPhysicianBonuses/PSA.html. For zip codes that are not in CMS PSA zip code list the bonus payment cannot be made automatically. In these cases physicians have to check whether the county where service is provided is included in CMS PSA county list. If the county is included in the PSA county list then physicians need to include "AR" modifier in their claims to collect PSA bonus.

[49] If a region switched its HPSA status in 2011 which is also the first year Medicare PCIP was available, econometrically it would be difficult to disentangle the effects of these two changes. The indicator variables showing change in HPSA status and availability of PCIP would be perfectly collinear.

Exhibit 19: Distribution of Primary Care (PC) Providers by HPSA and PSA Regions

	2005		2006		2007		2008		2009		2010		2011	
PC Physicians	***Total***	***%***	***Total***	***%***	***Total***	***%***	***Total***	***%***	***Total***	***%***	***Total***	***%***	***Total***	***%***
All Providers	***138,356***	***100***	***147,771***	***100***	***165,150***	***100***	***173,018***	***100***	***178,784***	***100***	***185,070***	***100***	***191,930***	***100***
*in HPSA**	x	x	x	x	72,804	44.1	77,656	44.9	79,620	44.5	82,101	44.4	81,855	42.6
*in PSA***	14,446	10.4	15,336	10.4	17,026	10.3	17,323	10	N/A	N/A	N/A	N/A	N/A	N/A
Both in HPSA & PSA	x	x	x	x	6,267	3.8	6,461	3.7	N/A	N/A	N/A	N/A	N/A	N/A
PCIP 2011 Recipients	***93,886***	***100***	***99,359***	***100***	***108,966***	***100***	***115,050***	***100***	***121,140***	***100***	***117,490***	***100***	***114,002***	***100***
*in HPSA**	x	x	x	x	46,578	42.7	50,451	43.9	52,871	43.6	50,762	43.2	47,458	41.6
*in PSA***	9,771	10.4	10,282	10.3	11,290	10.4	11,605	10.1	N/A	N/A	N/A	N/A	N/A	N/A
Both in PSA & HPSA	x	x	x	x	3,927	3.6	4,143	3.6	N/A	N/A	N/A	N/A	N/A	N/A
PC Non-Physicians														
All Providers	***46,634***	***100***	***53,823***	***100***	***68,297***	***100***	***80,041***	***100***	***88,569***	***100***	***97,789***	***100***	***109,353***	***100***
*in HPSA**	x	x	x	x	28,248	41.4	33,148	41.4	36,700	41.4	40,411	41.3	43,902	40.1
*in PSA***	5,221	11.2	5,894	11	7,379	10.8	8,301	10.4	N/A	N/A	N/A	N/A	N/A	N/A
Both in HPSA & PSA	x	x	x	x	2,919	4.3	3,270	4.1	N/A	N/A	N/A	N/A	N/A	N/A
PCIP 2011 Recipients	***18,681***	***100***	***21,456***	***100***	***27,188***	***100***	***34,363***	***100***	***41,202***	***100***	***37,756***	***100***	***35,380***	***100***
*in HPSA**	x	x	x	x	11,310	41.6	14,279	41.6	17,150	41.6	15,614	41.4	14,256	40.3
*in PSA***	2,328	12.5	2,603	12.1	3,214	11.8	3,802	11.1	N/A	N/A	N/A	N/A	N/A	N/A
Both in PSA & HPSA	x	x	x	x	1,273	4.7	1,527	4.4	N/A	N/A	N/A	N/A	N/A	N/A

Note: *HPSA includes only full HPSA areas (data from Area Resource File and HPSA status data are not available prior to 2007). **PSA status after 2008 is not applicable as 2008 was the final year of the PSA bonus.

Around 40 percent of all primary care providers supplied services in primary care HPSA counties while roughly 10 percent did so in PSA counties. The extent of overlap between these two designations amounts to approximately 3 to 4 percent of providers working in dual-designation areas. We do not observe important differences in these distributions between all providers and PCIP recipients. The same general observations apply to the two most represented specialties, i.e., family practice and internal medicine (Exhibit 20).

Exhibit 20: Distribution of the Number of Internal Medicine and Family Practice Physicians by HPSA and PSA regions

Practice Area	2005	2006	2007	2008	2009	2010	2011
Internal Medicine							
All Physicians	69,391	74,411	83,117	87,090	90,291	93,904	97,526
in HPSA*	x	x	38,011	40,382	41,411	43,461	43,188
in PSA**	5,428	5,770	6,390	6,521	N/A	N/A	N/A
in HPSA & PSA	x	x	2,304	2,372	N/A	N/A	N/A
PCIP 2011 Recipients	43,188	45,502	49,451	51,813	54,062	52,576	51,007
in HPSA*	x	x	22,166	23,824	24682	24113	22,537
in PSA**	3,423	3,585	3,915	4,009	N/A	N/A	N/A
in PSA & HPSA	x	x	1,303	1,386	N/A	N/A	N/A
Family Practice							
All Physicians	61,438	65,205	72,247	75,132	77,536	79,891	82,298
in HPSA*	x	x	29,652	31,700	32,602	32,954	32,834
in PSA**	8,673	9,168	10,181	10,361	N/A	N/A	N/A
in HPSA & PSA	x	x	3,776	3,921	N/A	N/A	N/A
PCIP 2011 Recipients	48,448	51,377	56,622	59,902	63,227	61,584	59,931
in HPSA*	x	x	22,979	24,971	26,284	24,998	23,450
in PSA**	6,220	6,546	7,199	7,417	N/A	N/A	N/A
in PSA & HPSA	x	x	2,561	2,695	N/A	N/A	N/A

Note: *HPSA includes only full primary care HPSA areas (data from Area Resource File and HPSA status data are not available prior to 2007). **PSA status after 2008 is not applicable as 2008 was the final year of the PSA bonus.

In the case of non-physicians, in 2008, around 40 percent were practicing in primary care HPSA areas (Exhibit B.8 in Appendix B). Nurse practitioners and physician assistants alike were distributed almost equally between shortage and non-shortage areas in 2008. The same is true whether we look across all providers or only 2011 PCIP recipients.

B. Impact of the PSA Bonus on Primary Care Supply

Since the PSA bonus was in effect from 2005 to 2008, we applied a DID estimation method to identify the effect of elimination of PSA bonus on the following outcome variables: number of eligible providers, practitioners' volume of services, and their total payments. We used the provider level data on the number of E&M claims and allowed charges associated with those claims from 2005 to 2011. The data from 2005 to June, 2008 show the scenarios in the pre-elimination (of PSA bonus) period and the data from 2009 to 2010 provide outlook on the post-elimination period. Data from 2011 will not be used for the DID analysis as it will include the confounding effect of the Medicare PCIP bonus. The sample is restricted to physicians with the following PSA bonus eligible primary care specialties: family practice, internal medicine and OB-GYN.

Equation (1) below shows the econometric model we estimated to assess the impact of PSA bonus policy:

$$S_{it} = \alpha + \beta * T_i + \theta * PRE_t + \delta * PRE_t * T_i + X'_{it} * \gamma + \tau_t + \varepsilon_{it} \quad (1)$$

The model in equation (I) is specified based on the provider level data in each year. Here, the dependent variable, S_{it} , is the volume of primary care (E&M) services provided by primary or non-primary care practitioner *i* at time *t*; T_i is an indicator for the treatment group that takes a value of 1 if the provider is in a primary care PSA area and zero otherwise; PRE_t is an indicator variable taking the value of 1 if the services are provided during 2005-2008 period (when PSA bonus program was in effect) and zero otherwise; the vector X_{it} includes variables reflecting the provider characteristics, features of their geographic locations etc., and τ is a time-specific fixed effect term. The term ε_{it} represents random unobserved factors affecting services.

If elimination of the PSA bonus was associated with a reduction in the volume of primary care E&M services provided by practitioners in those areas, then we should expect the estimated value of δ to be positive. A positive estimated value of δ would imply higher volume of services during the period when the PSA bonus was in effect. In addition, the interpretation of the first four terms in equation (I) is as follows:

- $(\alpha + \beta + \theta + \delta)$ = the average number of E&M claims during the PSA period (*PRE*), for providers located in the PSA regions;
- $(\alpha + \beta)$ = the average number of E&M claims during the Post-PSA period, for providers located in the PSA regions;
- $(\theta + \delta)$ = the difference in the average number of E&M claims between the PSA and Post-PSA period, for providers located in the PSA regions;
- θ = the difference in the average number of E&M claims between the PSA and Post-PSA period, for providers regardless of location.

Exhibit 21 shows the results from the estimated DID model to identify the impact of the PSA bonus policy on the supply of primary care services. We found that on average providers with PSA bonus eligible specialties irrespective of location were estimated to have about 153 more claims submitted during the PSA period compared to the post-PSA period. However, bonus-eligible providers located in PSA areas had on average an additional 50 claims per year compared to those located in non-PSA areas. We attribute this additional increase in the volume of primary care E&M services to the PSA bonus policy. On the other hand, we do not find a statistically significant impact of the PSA bonus policy on the total annual allowed charges per physician (column 2).

Exhibit 21: Impact of PSA Bonus on the Number of E&M Claims under Medicare, 2005-2010

	Number of E&M Claims(1)	Allowed Charges for E&M Claims ($)(2)
Location PSA PC Indicator (PSAPC)	70.55*	5622.0*
	(6.177)	(415.4)
PSA Year Indicator (2005-2008)	152.6*	870.9*
	(4.405)	(296.4)
PSAPC* PSA Year Ind.	**49.84***	**-241.2**
	(7.276)	(476.5)
Age	13.76*	884.5*
	(0.0757)	(5.104)
Male	206.9*	13495.2*
	(1.453)	(102.6)
Urban	-31.92*	-42.30
	(2.892)	(184.9)
Median Income ($10k)	-10.47*	926.7*
	(1.430)	(97.66)
Percent under poverty	-6.671*	-352.7*
	(0.359)	(23.32)
Population (10k)	-0.144*	-4.476*
	(0.00680)	(0.483)
Percent Population over 65	19.36*	1389.4*
	(0.424)	(28.15)
Unemployment Rate	15.74*	1337.0*
	(0.720)	(49.64)
Primary Care Phy./mcarepop10k	-0.110*	-2.049*
	(0.0139)	(0.939)
PC Non-phy./mcarepop10k	-0.977*	-75.10*
	(0.0390)	(2.675)
Intercept	-687.2*	-56001.4*
	(18.98)	(1255.6)
Specialty Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes
N	1,006,453	1,006,453
Adj. R-sq.	0.182	0.175

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent. The sample is restricted to only providers with the following PSA eligible specialty: family practice, internal medicine and OB-GYN.

Exhibit 22 shows the results from the estimated DID model to identify the impact of the PSA bonus policy on the number of primary care providers at the zip code level. As explained above, our primary focus is the estimated coefficient of the interaction term between the PSA status indicator of the location of physicians and the PSA period (i.e., 2005-2008). The number of providers with PSA bonus eligible specialties is estimated to increase by about one in PSA areas during the PSA period compared to the number of providers in non-PSA areas. This represents a meaningful increase given that, on average, there are about six primary care providers in PSA areas. We attribute this additional increase in the number of primary care providers to the PSA bonus policy.

Exhibit 22: Impact of PSA Bonus on the Number of Primary Care Providers per County (2005-2010)

	Number of Providers with PSA Bonus Eligible Specialty
Location PSA PC Indicator (PSAPC)	-4.951*
	(0.371)
PSA Year Indicator (2005-2008)	-1.722*
	(0.439)
PSAPC* PSA Year Ind.	**1.149***
	(0.301)
Urban	5.950*
	(0.221)
Median Income ($10k)	0.468*
	(0.150)
Percent in poverty	0.256*
	(0.040)
Population (10k)	0.007*
	(0.001)
Percent Population over 65	0.139*
	(0.033)
Unemployment Rate	-0.037
	(0.057)
Primary Care Phy./mcarepop10k	0.146*
	(0.024)
PC Non-phy./mcarepop10k	0.037*
	(0.017)
Intercept	-5.250*
	(1.522)
Year Fixed Effects	Yes
State Fixed Effects	Yes
N	78,519
R-sq.	0.0856

*Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent. The sample is restricted to only providers with the following PSA eligible specialty: family practice, internal medicine and OB-GYN.

C. Impact of the HPSA Bonus on Primary Care Supply

Access to health care in shortage areas has been an ongoing source of concern among policy makers. Expansion of health insurance coverage through the implementation of the ACA is likely to stimulate the demand for primary care in general, and specifically in these shortage areas. HRSA designates these shortage areas as primary care Health Profession Shortage Areas (HPSAs) using a defined threshold of primary care physicians to population ratio. The HPSA bonus has been in place since 1987 and since 1991 the bonus payment remained at 10 percent of the fees associated with the bonus eligible Medicare claims.[50]

In the absence of any variation in the HPSA bonus percentage in the recent past, we rely on the change in the primary care HPSA status of different counties in the US over the period between 2007 and 2010. In other words we rely on the variation in HPSA status over time and across counties to identify the effect of the policy. We detail the econometric model and exact interpretation of estimated coefficients in Appendix C.2. Our analysis of the Area Resource File indicates that 205 U.S. counties gained primary care HPSA status during 2007-2011 while 257 counties lost their HPSA status.[51] Subsequently, we analyze the changes in the outcomes of interest among primary care providers over time due to changes in the county's HPSA status during this period. It is important to note that although HPSA bonus applies to physicians generally, in this section we only focus on primary care physicians with primary care HPSA bonus eligible specialties described earlier. The primary outcome variables that we analyzed to identify the changes in physicians' practice behavior are the volume of primary care services and total Medicare allowed charges associated with those services, as captured in Medicare claims data. In this framework we have assumed that the HPSA status of an area is exogenous to an individual provider's decision to serve a certain number of patients or provide a given volume of services or any other individual-level outcomes. However, the HPSA status of an area may not be exogenous in models where the outcome of interest is the number of providers relative to the size of population in a given geographic area, at the aggregate level. This is specifically due to the fact that the HPSA status is designated based on the physician- to-population ratio in the area as a whole.

The coefficient of the interaction term between the county primary care HPSA status indicator (HPSAPC) and the indicator of whether the county ever gained the HPSA status shows the additional impact of HPSA status on the average number of claims per physician in column 1 (or payments in column 2) in the counties that ever gained the HPSA status (full model specification detailed in Appendix C.2.). As shown in Exhibit 23, we found that on average Medicare physicians with primary care specialties who are located in counties that ever gained the HPSA status tend to have about 17 more E&M claims submitted annually specifically due to the gain of full HPSA status. The effect is statistically significant at 10 percent significance level. On the other hand, the loss of HPSA status does not seem to have any statistically significant impact on the number of E&M claims.

50 Physicians who furnish services to Medicare beneficiaries in areas designated as primary care geographic HPSAs by HRSA, as of December 31 of the prior year, are eligible for the Medicare HPSA bonus during the current year. Since 2005 the HPSA physician bonus payment has been automatically made to physicians who furnish services to Medicare beneficiaries in a ZIP code on the list of ZIP codes eligible for automatic HPSA bonus payment. This list is updated annually and is effective for services furnished on and after January 1 of each calendar year. Physicians who furnish services to Medicare beneficiaries in a geographic HPSA that is not on the list of ZIP codes eligible for automatic payment must use the AQ modifier, "Physician providing a service in an unlisted Health Professional Shortage Area (HPSA)," on the claim to receive the bonus payment. Services that are submitted with the AQ modifier are subject to validation by Medicare. The bonus is paid quarterly and is based on the amount paid for professional services.

51 Area Resource File (ARF) or Area Health Resource File is an extensive county level database assembled annually by Health Resources and Services Administration (HRSA) from over 50 sources. Source: http://arf.hrsa.gov/

Exhibit 23: Impact of HPSA Bonus on the Number of E&M Claims and Allowed Charges per Physician under Medicare, 2007-2010

	Number of E&M Claims per Physician(1)	Allowed Charges for E&M Claims per Physician ($)(2)
County HPSA PC Indicator (HPSAPC)	-43.86*	-3024.5*
	(2.500)	(172.1)
Ever Gained HPSA Status Indicator (ToHPSA)	-39.91*	-2593.4*
	(6.900)	(459.3)
Ever Lost HPSA Status Indicator (ToNonHPSA)	-61.22*	-5149.6*
	(6.772)	(467.3)
HPSAPC*ToHPSA	**17.41+**	**407.0**
	(9.500)	(649.1)
HPSAPC*ToNonHPSA	**11.37**	**1380.4***
	(8.005)	(550.6)
Age	12.68*	854.4*
	(0.0845)	(5.927)
Male	192.7*	13136.8*
	(1.645)	(120.8)
Urban	-41.87*	-616.7*
	(3.324)	(222.0)
Median Income ($10k)	-6.798*	1034.7*
	(1.636)	(116.2)
Percent under poverty	-5.469*	-300.3*
	(0.416)	(28.38)
Population (10k)	-0.116*	-3.253*
	(0.00808)	(0.591)
Percent Population over 65	21.29*	1544.7*
	(0.481)	(33.61)
Unemployment Rate	20.43*	1650.1*
	(0.803)	(56.55)
Primary Care Phy./mcarepop10k	-0.00218	4.187*
	(0.0126)	(0.881)
PC Non-phy./mcarepop10k	-0.951*	-68.78*
	(0.0362)	(2.535)
Intercept	-594.3*	-57891.4*
	(20.07)	(1384.6)
Specialty Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes
N	743,907	743,907
Adj. R-sq.	0.188	0.184

Note: Robust standard errors are in parentheses; + significance at 10 percent; * significance at 5 percent. The sample is restricted to only providers with HPSA eligible specialty: family practice, internal medicine, pediatrics and OB-GYN.

Next, we focus on the impact of primary care HPSA status on the Medicare allowed charges per physicians associated with E&M claims (Exhibit 23, column 2). Column 2 indicates that Medicare primary care physicians who are located in counties that ever gained HPSA status do not experience significant changes in annual allowed charges per physician for E&M claims specifically due to the gain of full HPSA status. However, Medicare physicians with primary care who are located in counties that ever lost HPSA status tend to have about $1,380 more allowed charges annually when the location has the full HPSA status. This effect is statistically significant at 5 percent significance level.

For our analysis of the impact of HPSA status on the volume of services in terms of E&M claims, we focused only on the behavior of primary care physicians. We found that on average Medicare primary care physicians tend to submit about 17 more E&M claims annually specifically due to the gain of full HPSA status. This may suggest that HPSA bonus may encourage primary care providers to increase access to primary care services. In addition, based on our analysis of allowed charges for E&M Services, we find that the Medicare primary care physicians who are located in counties that ever lost primary care HPSA status tend to have about $1,380 more allowed charges annually before the location lost full HPSA status. Thus, gaining HPSA status is also associated with gain in additional earnings for primary care physicians. Hence, our analysis finds supportive evidence that HPSA bonus may improve access to primary care services in shortage areas.

Finally, when the outcome of interest is the PCP to population ratio at the county level, relying on the change in primary care HPSA status as the primary source of variation to identify an effect of HPSA status poses additional estimation challenges. The phenomena that cause decision makers to change the status may be highly correlated with our outcome of interest. In this sense, the HPSA status would be an endogenous variable in the regression model where the outcome of interest is the number of primary care providers per county. Specifically, this endogeneity problem may bias the effect of HPSA status on the number of primary care physicians toward zero. One potential way to circumvent the issue of endogeneity of the HPSA status above would be to use the instrumental variable (IV) approach. The IV approach relies on the identification of variables, i.e., instruments, that would be correlated with HPSA status and that would affect the provider-to-population ratio only through the HPSA status variable. These IVs will then be used in the regression framework to tease out the unbiased effect of the HPSA status on the provider-to-population ratio. However, IVs are not always readily available. In future, upon availability of appropriate IVs, a more in-depth study can be carried out to resolve the problem of this endogeneity to estimate the unbiased effect of HPSA status on the provider-to-population ratio.[52]

[52] Despite the issue of endogeneity of HPSA status, we analyze the changes in the number of Medicare primary care physicians per 10 thousand Medicare populations and the changes in the absolute number of Medicare primary care physicians over time due to changes in the county's HPSA status during the period of 2007-2011 using the same DID framework laid out earlier. The results from these estimated models are available upon request.

Modeling the Impact of the Increase in Medicaid Reimbursement Rate Relative to the Medicare Rate

A. Study Design Overview

The availability of primary care is particularly important for public payer programs, such as Medicaid and Medicare. Historically Medicaid has been the less generous payer for primary care services relative to Medicare, paying just 66 percent of Medicare rates on average.[53] In this section we first describe the variation in Medicaid reimbursement rates relative to those for Medicare, both for primary care and for all services, across US states during the period 2008-2012; and second simulate the effect of a 10 percent increase in the Medicaid-to-Medicare fee index on the proportion of US office-based physicians accepting new Medicaid patients across all states.

Cunningham et al. (2011) report that fewer physicians accept new Medicaid patients in response to the low Medicaid reimbursement rates in several states. Decker (2012) used data on office-based physicians from the 2011 National Ambulatory Medical Care Survey Electronic Medical Records Supplement to summarize the percentage of physicians currently accepting any new patients. She finds that 69.4 percent of physicians in the sample accepted new patients with Medicaid. This was lower than the percentage accepting new self-pay (91.7 percent), Medicare (83.0 percent), or privately insured patients (81.7 percent). Logit regression model estimates showed that raising Medicaid fees to Medicare levels for all physicians, a 25.8 percentage-point (35 percent) increase in the current average ratio of 74.2, would increase the acceptance rate of new Medicaid patients by 8.6 percentage points (12 percent) - from an average of 69.4 percent across physicians to an average of 78.6 percent.

Zuckerman et al. (2009) reported that in 2008 state-level average primary care physician fees under Medicaid ranged from 57 percent of the national average Medicaid fees in Rhode Island to 226 percent of national average in Alaska. They also found that after strong Medicaid fee growth during 1998-2003, Medicaid fees fell relative to inflation during 2003-2008. Despite the slowdown in overall fee growth, Medicaid fees for primary care services kept pace with inflation. The ACA increases Medicaid reimbursement rates for certain services provided by primary care physicians to 100 percent of Medicare rates in 2013 and 2014. Given the variability of Medicaid payments across states, this could be a substantial boost in payments for physicians in some states and less so in others.

Zuckerman et al (2009, 2012) provided state-level Medicaid-to-Medicare fee indices for 2008 and 2012. These studies show that the national average Medicaid reimbursement rate for primary care services declined from 66 percent of the Medicare rate in 2008 to 59 percent in 2012 (about 10.6 percent decline). However, the national average Medicaid-to-Medicare fee index for all services declined by about 8.3 percent (from 72 percent in 2008 to 66 percent in 2012) during the same period.

Exhibit 24 reveals wide state-to-state variation in the Medicaid fee relative to the Medicare rate in both 2008 and 2012. In several states, including California, Florida, Michigan, New York and Rhode Island, the Medicaid primary care fee in 2012 was less than 50 percent of the Medicare rate. In several other states, including Alaska, Delaware, Montana, North Dakota, Oklahoma and Wyoming, the Medicaid primary care fee was above 90 percent of the Medicare rate in the same year.

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53 Small, D.M. and T. McGinnis, (2012): "Leveraging the Medicaid Primary Care Rate Increase: The Role of Performance Measurement": *Center for Health Care Strategies, Inc*.

There is substantial variation in the percentage change in the Medicaid-to-Medicare fee index across these states, too. During 2008-2012 most of the states, except Maine, Mississippi, New Jersey, New York, North Dakota and DC, experienced a decline in the Medicaid-to-Medicare fee index for all services and for primary care services. Another exception is Minnesota where the Medicaid-to-Medicare fee index for all services declined by 6.6 percent during the same period, but the index for primary care services increased by about 25.9 percent. In Arizona, Georgia, Louisiana, Michigan, Nevada, Virginia and Wyoming the decline in Medicaid-to-Medicare fee index for primary care is more than 15 percent.

Decker (2012) and Cunningham (2011) exploit the state-level variation in the Medicaid reimbursement rates and they examine the impact of an increase in Medicaid fee relative to Medicare on physicians' propensity to accept Medicaid patients.

Cunningham (2011) uses 2008 Health Tracking Physician Survey on 1,748 primary care physicians (PCPs). The empirical analysis includes the estimation of a linear probability regression model of whether a PCP is accepting new Medicaid patients using the state-level Medicaid reimbursement rate relative to Medicare rate as one of the independent variables. The key findings of this study can be summarized as follows:

- Average Medicaid-to-Medicare fee ratio for primary care in 2008 was 66.2 percent.
- On average PCPs accepting all or new Medicaid patients in the US in 2008 was 41.5 percent.
- One percentage point increase in Medicaid-to-Medicare fee ratio increases the - proportion of PCPs accepting Medicaid patients by 0.214. -

Thus, based on the findings in Cunningham (2011) the implied elasticity of accepting primary care patients with respect to the Medicaid-to-Medicare fee is about 0.34.54 In other words, a 10 percent increase in the Medicaid fee relative to Medicare across all states would imply an increase in the acceptance rate of Medicaid patients from 41.5 percent to 42.9 percent nationally. The estimated elasticity also suggests that under Medicaid-Medicare payment parity the national average acceptance rate would go up from 41.5 percent to 48.7 percent.55

The analytical findings presented here can be improved further if the data on proportion of physicians accepting new Medicaid patients in 2012 are available for each state. Similarly, availability of the state-level Medicaid-to-Medicare fee index in 2011 can also refine the simulation results.

[54] The implied elasticity is calculated by The Lewin Group and it is based on the following statistics reported in the study: the national average Medicaid-to-Medicare fee ratio in 2008 (66.2 percent), the national average of PCPs accepting all or new Medicaid patients (41.5 percent) in 2008 and the estimated coefficient of Medicaid-to-Medicare fee ratio (0.214). The estimated coefficient of 0.214 implies that if the Medicaid-to-Medicare fee ratio increases by 1 percent from the national average (i.e. from 66.2 to 66.86) then national average proportion of PCPs accepting Medicaid patients goes up by 0.214*(66.86-66.2) ≈ 0.14. This is about 0.34 percent (100*0.14/41.5) increase in the proportion of PCPs accepting Medicaid patients.
Therefore the implied elasticity = (percent change in proportion of PCPs accepting Medicaid patients) / (percent change in Medicare-to-Medicare fee ratio) = 0.34/1 = 0.34.

[55] Lewin's calculation of the new acceptance rate under Medicaid-Medicare payment parity = [{0.34*(100-66.2)/66.2}+1]*41.5% ≈ 48.7%.

Exhibit 24: Medicaid-to-Medicare Fee Index

States	2008 Medicaid-to-Medicare Fee Index		2012 Medicaid-to-Medicare Fee Index		% Change in Medicaid-to-Medicare Fee Index, 2008-2012	
	All Services	*Primary care*	*All Services*	*Primary care*	*All Services*	*Primary care*
US	**0.72**	**0.66**	**0.66**	**0.59**	**-8.3**	**-10.6**
AL	0.89	0.78	0.78	0.70	-12.4	-10.3
AK	1.40	1.40	1.24	1.27	-11.4	-9.3
AZ	1.06	0.97	0.82	0.75	-22.6	-22.7
AR	0.89	0.78	0.79	0.70	-11.2	-10.3
CA	0.56	0.47	0.51	0.43	-8.9	-8.5
CO	0.86	0.87	0.71	0.74	-17.4	-14.9
CT	0.99	0.78	0.87	0.71	-12.1	-9.0
DE	1.00	1.00	0.97	0.98	-3.0	-2.0
DC	0.58	0.47	0.80	0.80	37.9	70.2
FL	0.63	0.55	0.57	0.49	-9.5	-10.9
GA	0.90	0.86	0.75	0.70	-16.7	-18.6
HI	0.73	0.64	0.62	0.57	-15.1	-10.9
ID	1.03	1.03	0.88	0.89	-14.6	-13.6
IL	0.63	0.57	0.62	0.54	-1.6	-5.3
IN	0.69	0.61	0.62	0.55	-10.1	-9.8
IA	0.96	0.89	0.82	0.77	-14.6	-13.5
KS	0.93	0.94	0.78	0.82	-16.1	-12.8
KY	0.86	0.80	0.77	0.72	-10.5	-10.0
LA	0.92	0.90	0.75	0.75	-18.5	-16.7
ME	0.63	0.53	0.65	0.63	3.2	18.9
MD	0.87	0.82	0.73	0.70	-16.1	-14.6
MA	0.88	0.78	0.77	0.68	-12.5	-12.8
MI	0.63	0.59	0.51	0.46	-19.0	-22.0
MN	0.76	0.58	0.71	0.73	-6.6	25.9
MS	0.87	0.84	0.90	0.90	3.4	7.1
MO	0.72	0.65	0.59	0.57	-18.1	-12.3
MT	1.03	0.96	0.97	0.94	-5.8	-2.1
NE	1.01	0.82	0.87	0.76	-13.9	-7.3
NV	1.04	0.93	0.74	0.68	-28.8	-26.9
NH	0.73	0.67	0.58	0.60	-20.5	-10.4
NJ	0.37	0.41	0.45	0.50	21.6	22.0
NM	1.07	0.98	0.92	0.85	-14.0	-13.3
NY	0.43	0.36	0.55	0.42	27.9	16.7
NC	0.95	0.95	0.82	0.85	-13.7	-10.5
ND	1.02	1.01	1.34	1.35	31.4	33.7
OH	0.69	0.66	0.61	0.59	-11.6	-10.6
OK	1.00	1.00	0.97	0.97	-3.0	-3.0

States	2008 Medicaid-to-Medicare Fee Index		2012 Medicaid-to-Medicare Fee Index		% Change in Medicaid-to-Medicare Fee Index, 2008-2012	
	All Services	*Primary care*	*All Services*	*Primary care*	*All Services*	*Primary care*
OR	0.90	0.78	0.81	0.72	-10.0	-7.7
PA	0.73	0.62	0.70	0.56	-4.1	-9.7
RI	0.42	0.36	0.37	0.33	-11.9	-8.3
SC	0.93	0.86	0.81	0.74	-12.9	-14.0
SD	0.95	0.85	0.76	0.69	-20.0	-18.8
TX	0.74	0.68	0.65	0.61	-12.2	-10.3
UT	0.82	0.76	0.74	0.74	-9.8	-2.6
VT	0.95	0.91	0.80	0.81	-15.8	-11.0
VA	0.90	0.88	0.80	0.74	-11.1	-15.9
WA	0.93	0.92	0.76	0.66	-18.3	-28.3
WV	0.85	0.77	0.80	0.74	-5.9	-3.9
WI	0.85	0.67	0.77	0.60	-9.4	-10.4
WY	1.43	1.17	1.16	0.96	-18.9	-17.9

Source: Zuckerman et al (2009 and 2012); data on Tennessee were not available.

Decker (2012) used data from the 2011 National Ambulatory Medical Care Survey Electronic Medical Records Supplement of 3,979 office-based physicians (PCPs and non-PCPs). The study's empirical analysis included estimation of a logit regression model of whether an office-based physician is accepting new Medicaid patients. A key variable in this analysis was the state-level Medicaid-to-Medicare fee index of 2008[56]. The key findings of this analysis were:

- Average Medicaid-to-Medicare fee ratio for all services (2008) was 72 percent.
- The average office-based physician new Medicaid patient acceptance rate for 2011 was 69.4 percent.
  - Among PCPs the acceptance rate was 66.2 percent; among non-PCPs the acceptance rate was 71.7 percent.
- Based on the logit parameter estimates, she finds that an increase in the fee ratio from 74.2 to 100 would be expected to increase acceptance of new Medicaid patients from 69.4 percent to 78.6 percent.

In other words, a 10 percent increase in Medicaid-to-Medicare fee index for all services across all states would suggest a rise in the acceptance rate from 69.4 percent to 72.3 percent nationally.[57] Thus, the implied elasticity of office-based physicians accepting new Medicaid patients with respect to the Medicaid-to-Medicare fee is about 0.43.[58] The study also finds that,

[56] One of the key limitations of the study is that the Medicaid-to-Medicare fee index is not available for year 2011. There may be substantial difference in state-wide variation in these indices between 2008 and 2011 period. In that case 2008 indices may not explain well the variation in the proportion of physicians accepting Medicaid patients.

[57] Lewin's method of calculating the predicted proportion of accepting new Medicaid patients based on the estimated logit model is explained in Appendix D.

[58] Lewin's method of calculating the predicted proportion of accepting new Medicaid patients based on the estimated logit model is explained in Appendix D. Using that method, a 1 percent change in the 2008 national average

holding other things constant, primary care office-based physicians are about 7.3 percentage point less likely to accept new Medicaid patients. Decker also estimated the impact on the primary care physicians only and she found that the estimated impact is similar to the one reported above for all physicians. More specifically, she found that an increase in the Medicaid-to-Medicare fee ratio for primary care to 100 was predicted to increase acceptance of new Medicaid patients among primary care physicians from 64.7 percent to 71.7 percent.

B. Simulation Exercise

We simulated the effect of a 10 percent increase in the state-level Medicaid-to-Medicare fee indices (for all services) from their 2008 level on the proportion of US office-based physicians accepting new Medicaid patients in each state.[59] A detailed description of the simulation methodology used to predict the proportion of office-based physicians accepting Medicaid patients is presented in Appendix D. The simulation exercise is based on the empirical findings of Decker (2012) and the data on the proportion of US office-based physicians accepting new Medicaid patients for each state reported in the same study.

Exhibit 25 summarizes the predicted proportion of US office-based physicians accepting new Medicaid patients by state. For example, in California the Medicaid-to-Medicare fee ratio in 2008 was substantially lower than the national average. Subsequently, only 57.1 percent of the office-based physicians in California were accepting new Medicaid patients. Based on the simulation we find that a 10 percent increase in the Medicaid-to-Medicare fee index in California (from 0.56 to 0.62) would increase the proportion of office-based physicians accepting new Medicaid patients in California from 57.1 percent to 59.7 percent (about 4.6 percent increase).

Exhibit 25: Proportion of US Office-based Physicians Accepting New Medicaid Patients

States	Medicaid-to-Medicare Fee Index, All Services 2008	% of US office-based physicians accepting new Medicaid patients 2011	Predicted acceptance rate under 10% rise in Medicaid-to-Medicare Fee Index (Based on Decker, 2012) (Non-Linear Projection)
US	**0.72**	**69.4**	**72.2**
AL	0.89	68.5	72.0
AK	1.40	82.1	85.7
AZ	1.06	78.5	81.7
AR	0.89	90.7	92.0
CA	0.56	57.1	59.7
CO	0.86	66.1	69.6
CT	0.99	60.7	65.0
DE	1.00	78.3	81.3
DC	0.58	75.2	77.2

Medicaid-to-Medicare fee index reported in the study (from 74.2 percent to 74.92 percent) increases the proportion of office-based physicians accepting new Medicaid patients from 69.4 percent to 69.7 percent. Therefore, the implied elasticity = (percent change in proportion of PCPs accepting Medicaid patients) / (percent change in Medicare-to-Medicare fee ratio) = ((69.7-69.4)/69.4)/1 = 0.43.

[59] At this point state-level Medicaid-to-Medicare fee index are not available for 2011 and the proportion of physicians accepting new Medicaid patients are not readily available to Lewin by state in any year other than 2011. In future Lewin Group will explore the availability of such data to strengthen the analysis.

States	Medicaid-to-Medicare Fee Index, All Services 2008	% of US office-based physicians accepting new Medicaid patients 2011	Predicted acceptance rate under 10% rise in Medicaid-to-Medicare Fee Index (Based on Decker, 2012) (Non-Linear Projection)
FL	0.63	59.1	61.9
GA	0.90	67.4	71.0
HI	0.73	69.9	72.7
ID	1.03	84.7	87.0
IL	0.63	64.9	67.6
IN	0.69	70.6	73.2
IA	0.96	87.6	89.4
KS	0.93	68.2	71.9
KY	0.86	79.4	81.9
LA	0.92	62.1	66.1
ME	0.63	74.0	76.2
MD	0.87	65.9	69.5
MA	0.88	80.6	83.1
MI	0.63	81.1	82.9
MN	0.76	96.3	96.8
MS	0.87	79.6	82.1
MO	0.72	67.6	70.5
MT	1.03	89.9	91.5
NE	1.01	87.0	89.0
NV	1.04	75.2	78.7
NH	0.73	81.7	83.7
NJ	0.37	40.4	42.1
NM	1.07	86.3	88.5
NY	0.43	61.6	63.5
NC	0.95	76.4	79.5
ND	1.02	94.6	95.5
OH	0.69	72.0	74.5
OK	1.00	67.3	71.3
OR	0.90	79.5	82.1
PA	0.73	68.0	70.9
RI	0.42	68.9	70.6
SC	0.93	84.1	86.3
SD	0.95	94.1	95.0
TN		61.4	
TX	0.74	69.9	72.7
UT	0.82	83.5	85.5

States	Medicaid-to-Medicare Fee Index, All Services 2008	% of US office-based physicians accepting new Medicaid patients 2011	Predicted acceptance rate under 10% rise in Medicaid-to-Medicare Fee Index (Based on Decker, 2012) (Non-Linear Projection)
VT	0.95	78.4	81.3
VA	0.90	76.0	79.0
WA	0.93	76.4	79.4
WV	0.85	80.9	83.3
WI	0.85	93.0	94.0
WY	1.43	99.3	99.5

Note: The predicted proportions are based on the estimated logit model in Decker (2012).

Next we analyzed the implication of our findings from the Medicare PCIP policy analysis in the context of the Medicaid-Medicare payment parity. We have already discussed that, based on our analysis, the number of Medicare primary care providers accepting new Medicare patients increased by almost 10 percent in response to the Medicare 10 percent PCIP policy (Exhibit 14). According to Zuckerman et al (2012) the US average Medicaid-to-Medicare fee ratio for primary care services in 2012 was about 0.59. Thus, Medicaid-Medicare payment parity would imply almost a 70 percent increase in Medicaid fees over the 2012 US average. Further, the findings by Decker (2012) suggest that in 2011 almost 66.2 percent office-based primary care physicians accepted new Medicaid patients.

Given the magnitude of the impact of the Medicare PCIP policy, if the Medicaid-Medicare payment parity policy at least triggers a 10 percent increase in Medicaid-to-Medicare fee ratio, then we would expect the US average of office-based primary care physicians accepting new Medicaid patients to go up to at least 72.8 percent. However, considering the 2012 US average, Medicaid-Medicare payment parity would imply a much bigger percentage increase in payments than 10 percent payment increase under the Medicare PCIP policy. It is challenging to use the estimated impact of PCIP program to extrapolate the impact of Medicaid-to-Medicare parity. This is because (1) in general parity would require a much bigger change in Medicaid-to-Medicare fee ratio (compared to the 10 percent PCIP payment); and (2) our PCIP analysis is limited in the sense that it is not capturing continuous variation in the incentive payment due to the nature of the program. Finally, the actual increase in the absolute value of payment under the Medicare and Medicaid payment policies would depend on the volume of primary care services and the current state Medicaid-Medicare fee index.

Conclusions

The Affordable Care Act includes two key provisions regarding reimbursement to primary care providers: (a) it provides a 10 percent supplemental payment under the Medicare PCIP program to eligible providers (effective January 1, 2011); and (b) it raises the Medicaid primary care reimbursement rate at least up to 100 percent of the Medicare rate. ASPE has contracted with the Lewin Group to examine the role of Medicare PCIP and supplemental payment programs, including the HPSA and PSA incentives, in increasing the supply of primary care providers (PCP) and the access of patients to their services.

We reviewed the health and labor economics literature to understand the nature and the size of the impact of any financial incentives on the labor supply behavior of PCPs and the resultant impact on the availability of primary care services estimated in the existing body of research.

We documented the prior empirical evidence of the impact of financial incentives on raising the supply of primary care workforce, the volume of services, impact on medical graduates' propensity to participate in primary care, PCPs' retirement decision, etc. This review also evaluated the past evidence on the effect of bonuses in shortage areas and their effectiveness to redistribute and retain primary care workforce. Finally, the review of the literature also focused on the state-specific experiences with changes in their respective Medicaid payment rates for primary care and the resultant impact on the supply of PCPs, their rate of acceptance of Medicaid patients and the volume of primary care services such as office visits or visits for E&M services.

To explore these topics, we constructed a provider level data set including all the claims submitted by the entire universe of Medicare providers in each year from 2005 to 2011. We linked Provider360 data (available from Lewin Group's parent company Optum Inc.) and the AMA Physician Master File to add provider characteristics such as demographics (e.g., age, gender), provider designation, medical school and practice location. We also added geographic location specific variables from the Area Resource File (ARF) based on the practice location information of providers.

We find that as a result of the Medicare incentive payment the number of Medicare primary care providers has increased on average annually by about 2.8 providers per county from 2009 to 2011. The number of primary care physicians with PCIP eligible specialty increased by about 10 percent in response to the 10 percent incentive payment under the PCIP policy (i.e., elasticity of the number of primary care physicians with respect to the incentive payment is about 1). Eligible claims for some types of PCIP eligible E&M services and associated allowed charges have also increased. For example, on average, there was a 7 percent increase in the number of 25 minute office visits claims due to the PCIP policy. On the other hand, in response to the PCIP policy, there was a 9.3 percent increase in the average allowed charges (for the eligible services) among primary care provider with PCIP eligible specialties. Our results regarding the PCIP impact should be interpreted with caution due to several reasons. First, we only observe one year after the PCIP was in effect and as data becomes available for the full 2011-2015 period, the magnitude and precision of our estimates may change. Second, given the limited timeframe of this incentive, providers may not be willing to make long-lasting adjustments in their decision to supply primary care services. Finally, as Medicare providers become more familiar PCIP users in time and adjust their behavior, the full impact of the incentive on provider behavior may change.

In addition, we find that Medicare providers were attracted to PSA areas through the PSA bonus, and submitted 7.8 percent more E&M claims annually during the PSA period. Gaining HPSA status also generated an additional 17 E&M claims submitted by primary care physicians with HPSA bonus-eligible specialties. Estimation of HPSA and PSA bonuses impact on primary care supply has been hindered by the existence of biases rising from the fact that the HPSA and PSA designation is a function of the current supply of providers. While we try to mitigate some of these sources of bias, future research is needed to provide a causal estimate of these bonuses.

Finally, we document the variation in Medicaid reimbursement rates relative to the Medicare rates, both for primary care and for all services, across US states during the period 2008-2012, using the existing body of evidence. Using the empirical results from our PCIP analysis, we also perform an exercise to simulate the effect of a 10 percent increase in the Medicaid-to-Medicare fee index on the proportion of US office-based physicians accepting new Medicaid patients across all states. The simulation suggests that a 10 percent increase in Medicaid-to-Medicare fee ratio would increase the US average of office-based primary care physicians accepting new Medicaid patients from 66.2 to 72.8 percent. We caution against using the estimated impact of PCIP program to extrapolate the impact of Medicaid-to-Medicare parity. This is because (1) in general parity would require a much bigger change in Medicaid-to-Medicare fee ratio (compared to the 10 percent PCIP payment); and (2) our PCIP analysis is limited in the sense that it is not capturing continuous variation in the incentive payment due to the nature of the program.

Appendices

Appendix A: Bibliography and Literature Matrix

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Literature Matrix

Study Goal	Results	Data	Type of Study	Reference
Topic: Effect of Earnings on the Supply of Primary Care Services and Providers: Role of Medicare Primary Care Bonuses (Section III)				
Estimate a model where medical students consider entry probabilities when selecting a specialty.	The income elasticity estimates range from 1.03 in family practice/pediatrics to 2.20 in radiology.	Data set with the preferred and realized specialties for 7,200 medical students.	Econometric model (conditional logit)	Nicholson, 2002
Estimated career wealth accumulation across specialists, primary care physicians, physician assistants, business school graduates, and college graduates. Comparing specialists, represented by cardiologists, to primary care physicians in scenarios.	The present value of career wealth from college graduation through age sixty-five was estimated at $5,171,407 for cardiologists, $2,475,838 for primary care physicians, $1,725,171 for MBA graduates, $846,735 for physician assistants, and $340,628 for college graduates. For a primary care physician's lifetime earnings to equal that of a cardiologist the primary care physician would have to receive a bonus of $1.1 million upon completion of medical school.	Data from multiple sources included income, income taxes, living expenses, and graduate school expenses.	Compound interest wealth accumulation model	Vaughn et al., 2010
Determine effect of educational indebtedness on the specialty choices of new physicians, especially in light of the perceived shortage of primary care physicians.	Medical students are more likely to choose primary care when the expected earnings are relatively large. A $10,000 (20 percent of the mean earnings) increase in expected earnings in primary care relative to the non-primary care yields a 1.4 percentage point increase in the probability of choosing primary care.	Data set from American Medical Association's 1983 'Survey of Resident Physicians'.	Econometric model (utility maximization)	Bazzoli, 1985
Estimation of career choice and medical student's decision to specialize given lifetime utility maximization.	In response to 9.1 percent reduction in relative fee-per-consultation for a general practitioner would lead to between a 0.4 percent reduction and a 2.29 percent reduction in the proportion of Medical students entering general practice.	Data from multiple sources. Model estimated from sample of 30,184 physicians who practiced in Canada between 1989 and 1998 and whose year of graduation from medical school is between 1975 and 1991.	Econometric model (multinomial logit)	Gagne and Leger, 2005
Determine the causes of the primary care-specialist income gap; why the Resource-Based Relative Value Scale failed to prevent the income gap.	The RBSVS failed due to four factors: (1) the volume of diagnostic and imaging procedures has increased more rapidly than the volume of office visits; (2) the process of updating fees every five years is heavily influenced by the Relative Value Scale Update Committee, which is composed of a majority of specialists; (3) Medicare's formula for controlling physician payments penalizes primary care physicians; and (4) private insurers tend to pay for procedures at higher rates than office visits relative to Medicare.	Data from multiple sources, income information between 1995 and 2005.	Literature review	Bodenheimer, 2007

Study Goal	Results	Data	Type of Study	Reference
Determine the effects of expected future earnings and other attributes on specialty choice.	Simulated policy changes indicate increasing general practitioners earnings by $50,000, or increasing opportunities for procedural or academic work (specifically limiting the amount of on-call hours) can increase the number of junior doctors choosing general practice by between 8 and 13 percentage points. This implies an earnings elasticity of specialty choice of 0.95.	Data from the Medicine in Australia: Balancing Employment and Life (MABEL) survey.	Econometric model (logit)	Sivey & Scott, 2012
Estimate a model of physician labor supply, focusing on the impacts of wage and non-wage income.	Evidence of significant income effects. For male physicians, the income effect of a wage change on labor supply is negative, with an elasticity of - 0.26. The pure substitution effect of a wage change increases labor supply: a 1 percent increase in wages leads to a 0.49 percent increase in labor supply, controlling for income effects.	Data from the 1987 Practice Patterns of Young Physicians Survey (YPS),	Econometric model (log linear regression)	Rizzo and Blumenthal, 1994
Estimate the labor supply of physicians employed at hospitals in Norway, using personnel register data merged with other public records.	Research indicates a 10 percent wage increase would lead to a 3 percent increase in physician labor supply (wage elasticity of 0.3). The magnitude of the wage elasticity in this case may be relatively small because of hospital employed physicians tendency to have a lower wage than self-employed physicians, though still larger than previous estimates.	Data set used is a sample of 1303 male physicians observed over the period 1993 and 1997.	Econometric model (GMM, system GMM)	Baltagi et al., 2005
Estimate wage elasticities for Norwegian nurses.	40 percent of PCC students returned to New Mexico to practice compared to 32 percent of traditional students	Data includes detailed information on 18,066 individuals over 5 years totaling 56,832 observations between 1993 and 1997.	Econometric model (fixed effects)	Askildsen & Baltagi , 2002
Effect of a permanent 10 percent increase in fees for primary care ambulatory visits on volume of services and cost to Medicare.	Analysis shows the fee increase would increase primary care visits by 8.8 percent, and raise the overall cost of primary care visits by 17 percent. However, these increases would yield more than a six-fold annual return in lower Medicare costs for other services—mostly inpatient and post-acute care—once the full effects on treatment patterns are realized. The net result would be a drop in Medicare costs of nearly 2 percent. These	Data set contains Medicare claims data (2004 to 2006) as well as physician data from the Community Tracking Study (CTS) Physician Survey (2004 to 2005).	Econometric model	Reschovsky et al., 2012
Estimates the relationship between Medicare fees and quantities provided by physicians for eight specific services.	Results show that Medicare fees are positively related to quantity provided for all eight services, and are significantly different from zero and elastic for five. Estimates are that a 10 percent reduction in Medicare fees would lead to 1.8 percent to 6.6 percent reduction in the volume of office visits.	Data set contains 13,707 physicians who responded to surveys in 2000/2001 and/or 2004/2005 and were linked to all Medicare claims for their Medicare patients.	Econometric model (GLM)	Hadley et al., 2009

Study Goal	Results	Data	Type of Study	Reference
Estimate trends in hours worked by US physicians and assess for association with physician fees.	After remaining stable through the early 1990s, mean hours worked per week decreased by 7.2 percent between 1996 and 2008 among all physicians (from 54.9 hours per week in 1996-1998 to 51.0 hours per week in 2006-2008. Excluding resident physicians, whose hours decreased by 9.8 percent the last decade due to duty hour limits imposed in 2003, nonresident physician hours decreased by 5.7 percent	Data set from US Census Bureau Current Population Survey between 1976 and 2008 (N=116733).	Outcomes of a Problem-based learning model (specialty and practice location)	Steiger et al., 2010

Study Goal	Results	Data	Type of Study	Reference
Topic: Financial Incentives for Primary Care Providers in Underserved Areas (Section IV)				
Evaluate effectiveness and developing trends in bonus payments to rural physicians.	In 1991 the total amount of HPSA bonus was almost 31.6 million dollars. Estimates show that 58.3 percent of the total HPSA bonus payment went to rural HPSAs, while the remaining 41.7 percent went to urban HPSAs. They also observed that the total bonus payment grew to reach about 106 million dollars in 1996, but then gradually declined to almost 77 million dollars in 1998. The rural proportion of HPSA bonus payments decreased to 51.1 percent.	Data set includes Area Resource File (ARF) and Medicare Part B claims data for multiple years.	Trend examination	Shugarman et al., 2001
Examine trends in Medicare spending for basic payments and bonus payments for physician services provided to beneficiaries residing in nonmetropolitan counties.	Payments under the Congressionally-mandated bonus payment program accounted for less than 1 percent of expenditures for physician services in nonmetropolitan, underserved counties. Physician payments increased from 1992 to 1998, while bonus payments increased through 1996 but then declined by 13 percent by 1998. The share of bonus payments to primary care physicians declined throughout the decade, but the share for primary care services increased.	Data set includes Area Resource File (ARF) and Medicare Part B claims data for multiple years.	Trend examination	Shugarman and Farley, 2003
Evaluate the effectiveness of programs that provide financial incentives to physicians in exchange for a rural or underserviced area return-of-service (ROS) commitment.	The majority of studies reported effective recruitment despite high buy-out rates in some US-based programs. Increasing Canadian tuition and debt among medical students may make these programs attractive. The one prospective cohort study on retention showed that physicians who chose voluntarily to go to a rural area were far more likely to stay long term than those who located there as an ROS commitment. Multidimensional programs appeared to be more successful than those relying on financial incentives alone.	Limited literature available given quality limitations.	Literature Review	Sempowski et al., 2004
Assess the effect of various incentive measures introduced in Quebec (Canada) to influence the	On average, a 10 percent increase in the general practitioner fees for medical services in a region increases the propensity of a beginning GP to work in this region by 7 percent. Thus the implied elasticity of location choice probability with respect to	Data for physicians come from la Corporation Professionnelle des Medecins du Qu6bec.	Econometric model (spatial autoregressive multinomial	Bolduc et al., 1996

Study Goal	Results	Data	Type of Study	Reference
geographical distribution of physicians	fee increases is about 0.7. However, this elasticity varies across regions: it is higher in remote regions (with a maximum of 1.28). On the other hand, on average, the elasticity of location choice probability with respect to non-labor incomes, such as study grants, is estimated to be about 1.11.	Population data come from Canada Census (various years), and inter-census estimations from le Bureau de la Statistique du Qu6bec (unpublished data).	probit)	
Compare the types of locations chosen by alumni and non-alumni of a United States program charged with increasing physician supply.	Eliminating the program would decrease the supply of physicians in medically underserved communities by roughly 10 percent.	Data from multiple sources, primarily the American Medical Association (AMA) master file for 1981, 1986, 1991, and 1996.	Econometric (multinomial logit)	Holmes, 2005
Examine the history and results of The Physician Shortage Area Program (PSAP) of Jefferson Medical College and identify factors independently predictive of rural primary care supply and retention.	Freshman-year plan for family practice, being in the PSAP, having a National Health Service Corps scholarship, male sex, and taking an elective senior family practice rural preceptorship were independently predictive of physicians practicing rural primary care. Among PSAP graduates, taking a senior rural preceptorship was independently predictive of rural primary care. However, non-PSAP graduates with 2 key selection characteristics of PSAP students (having grown up in a rural area and freshman-year plans for family practice) were 78 percent as likely as PSAP graduates to be rural primary care physicians, and 75 percent as likely to remain, suggesting that the admissions component of the PSAP is the most important reason for its success.	Data includes a total of 3414 Jefferson Medical College graduates from the classes of 1978-1993, including 220 PSAP graduates.	Retrospective cohort study	Rabinowitz et al., 2001

Study Goal	Results	Data	Type of Study	Reference
Topic: Impact of the Increase in Medicaid Reimbursement Rate Relative to the Medicare Rate (Section V)				
Identify the causal effect of increases in Medicaid reimbursement rates relative to the Medicare rate on the propensity of primary care physicians accepting new Medicaid patients.	For primary care physicians, a 10 percentage point increase in the Medicaid/Medicare fee ratio for primary care is associated with only a 2.1 percentage-point increase in Medicaid patient acceptance. The average Medicaid reimbursement rate relative Medicare in 2008 was at 66.2 percent and the national average acceptance rate of new Medicaid patients by PCPs was 41.5 percent. Therefore, the implied elasticity of accepting primary care patients with respect to the payment rate is about 0.33. Excluding pediatricians it is 0.41.	Data acquired from HSC 2008 Health Tracking Physician Survey and American Medical Association (AMA) master file.	Econometric model (OLS)	Cunningham, 2011
Examine the effects of Medicaid payment generosity on access and care for adult and child Medicaid beneficiaries.	Higher payments increase the probability of having a usual source of care and the probability of having at least one visit to a doctor and other health professional for Medicaid adults, and produce more positive assessments of the health care received by adults and children. However, payment generosity has no effect on the other measures that we examined, such as the probability of receiving preventive care or the probability of having unmet needs.	Data from the National Surveys of America's Families (1997, 1999, 2002) and are linked to the Urban Institute Medicaid capitation rate surveys, the Area Resource File, and the American Hospital Association survey files.	Econometric model (difference-in-difference)	Shen & Zuckerman, 2005
Evaluation in California of whether the expansion of Medicaid managed care and a physician payment increase were associated with an increase over time in the percentage of physicians caring for Medicaid patients.	Despite large increases in the use of Medi-Cal, managed care and the implementation of Medi-Cal physician fee increases between 1996 and 2001, there was no significant in- crease in the percentage of primary care physicians accepting new Medi-Cal patients or having any Medi-Cal patients in practice over time.	Dataset comprised of surveys of probability samples of primary care and specialist physicians in California in 1996, 1998, and 2001 and AMA master file data.	Chi-square tests	Bindman et al., 2003
Examine the impact of California's Medicaid re- imbursement for nursing homes which includes incentives directed at staffing.	Consistent with the rate incentives and rational expectation behavior, expected nursing home reimbursement rates in 2008 were associated with increased RN staffing levels in 2006 but had no relationship with licensed practical nurse and certified nursing assistant staffing. The effect was estimated at 2 minutes per $10 increase in rate.	Data from Medicaid master file for a total of 927 California free-standing nursing homes in 2006.	Econometric model (two-stage MLE)	Mukamel et al., 2012
Assess the effects of Medicaid fee changes on physician participation, enrollee access, and shifts in the site of ambulatory care using several natural experiments in Maine and Michigan.	The reimbursement changes included substantial percentage changes in fees; however the value of the Medicaid fee improvements relative to the private market eroded very rapidly in the months following the interventions. Implied elasticities ranged between 0.39 and -0.021.	Dataset from Medicaid claims and enrollment data between 1988 and 1992	Program Overview & Outcomes of community-based training.	Coburn et al., 1999

Appendix B: Additional Exhibits

Exhibit B1: Distribution of Primary Care Providers with PCIP Eligible Specialty by Age, Sex and Year

Sex	Age	2005	2006	2007	2008	2009	2010	2011
Male	**<35**	11.4%	10.4%	10.2%	9.8%	9.4%	8.8%	7.9%
Male	**35-44**	29.9%	29.5%	28.8%	28.2%	27.6%	27.1%	26.5%
Male	**45-54**	34.7%	33.8%	32.3%	31.1%	29.9%	28.7%	28.1%
Male	**55-64**	18.6%	20.4%	22.0%	23.5%	25.0%	26.3%	27.5%
Male	**65+**	5.3%	5.9%	6.6%	7.4%	8.2%	9.0%	10.0%
Male	**Total**	95,911	101,781	111,971	116,133	118,868	121,264	122,048
Female	**<35**	21.5%	20.5%	20.6%	20.4%	20.1%	19.7%	18.9%
Female	**35-44**	36.8%	36.7%	35.9%	35.3%	34.7%	34.2%	34.0%
Female	**45-54**	31.5%	31.2%	30.4%	29.8%	29.1%	28.4%	27.8%
Female	**55-64**	9.1%	10.4%	11.7%	12.8%	14.2%	15.5%	16.8%
Female	**65+**	1.0%	1.2%	1.4%	1.7%	1.9%	2.2%	2.4%
Female	**Total**	59,446	66,054	78,531	86,972	93,905	100,930	106,003
Missing Sex/Age		29,633	33,759	42,945	49,954	54,580	60,665	73,232
Total		184,990	201,594	233,447	253,059	267,353	282,859	301,283

Exhibit B2: Average Number of PCIP Eligible E&M Claims per PCP under Medicare by Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Internal Medicine	869	823	759	746	712	697	653
Family Medicine	722	694	651	649	631	626	605
Pediatrics	51	50	42	39	41	40	36
Geriatrics	989	1,026	990	978	960	955	958
Clinical Nurse Specialist	86	85	77	87	97	107	118
Nurse Practitioner	258	257	230	219	219	228	228
Physician Assistant	125	128	120	121	124	134	140

Exhibit B3: Average Allowed Charges ($) for the PCIP Eligible E&M Claims per PCP under Medicare, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	$52,896	$51,477	$51,149	$51,737	$51,438	$55,188	$53,641
Family Medicine	$41,019	$40,557	$41,279	$42,369	$43,075	$46,833	$47,163
Pediatrics	$3,008	$3,028	$2,705	$2,533	$2,771	$3,055	$2,835
Geriatrics	$61,243	$70,593	$68,845	$73,829	$76,317	$82,230	$84,453
Non-Physicians							
Clinical Nurse Specialist	$4,219	$4,446	$3,974	$4,883	$5,824	$6,841	$7,890
Nurse Practitioner	$12,139	$13,055	$11,929	$12,019	$12,600	$14,274	$14,752
Physician Assistant	$5,724	$6,122	$6,064	$6,333	$6,765	$8,133	$8,831

Exhibit B4: Proportion of PCIP Eligible E&M Claims per 2011 PCIP Recipients by Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	45%	45%	44%	44%	41%	42%	41%
Family Medicine	45%	45%	44%	44%	41%	42%	40%
Pediatrics	45%	47%	47%	47%	45%	41%	39%
Geriatrics	67%	72%	70%	68%	64%	62%	64%
Non-Physicians							
Clinical Nurse Specialist	64%	66%	64%	60%	57%	57%	56%
Nurse Practitioner	66%	66%	69%	68%	65%	67%	68%
Physician Assistant	55%	56%	56%	55%	51%	52%	50%

Note: the proportions are calculated out of all Medicare claims (excluding hospital inpatient, ER, drug and lab)

Exhibit B5: Average Number of PCIP Eligible E&M Claims per 2011 PCIP Recipients under Medicare by Specialty, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	1,113	1,088	1,050	1,057	1,015	1,035	1,011
Family Medicine	808	785	752	756	729	752	743
Pediatrics	157	149	130	118	111	129	132
Geriatrics	1,168	1,237	1,191	1,187	1,145	1,181	1,193
Non-Physicians							
Clinical Nurse Specialist	375	384	361	346	335	382	389
Nurse Practitioner	384	403	369	392	405	457	492
Physician Assistant	251	266	260	268	266	301	301

Exhibit B6: Average Allowed Charges for the PCIP Eligible E&M Claims per 2011 PCIP Recipients under Medicare, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	$67,863	$68,281	$70,869	$73,505	$73,494	$81,629	$82,500
Family Medicine	$45,958	$45,878	$47,781	$49,440	$49,827	$56,350	$58,004
Pediatrics	$9,336	$9,051	$8,460	$7,864	$7,631	$9,836	$10,450
Geriatrics	$72,412	$85,046	$82,732	$89,548	$90,821	$101,283	$104,284
Non-Physicians							
Clinical Nurse Specialist	$17,795	$19,741	$18,922	$19,279	$19,557	$24,141	$25,405
Nurse Practitioner	$19,633	$21,605	$19,496	$22,516	$24,830	$29,740	$32,837
Physician Assistant	$11,628	$12,949	$13,457	$14,496	$15,128	$18,717	$19,363

Exhibit B7: Proportion of Allowed Charges for PCIP Eligible E&M Claims per 2011 PCIP Recipients, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
Physicians							
Internal Medicine	71%	72%	74%	76%	77%	79%	76%
Family Medicine	73%	75%	77%	77%	78%	80%	77%
Pediatrics	70%	73%	75%	75%	77%	77%	76%
Geriatrics	77%	87%	88%	89%	89%	90%	89%
Non-Physicians							
Clinical Nurse Specialist	76%	80%	81%	83%	85%	86%	85%
Nurse Practitioner	68%	71%	75%	79%	82%	87%	87%
Physician Assistant	72%	74%	76%	78%	81%	83%	82%

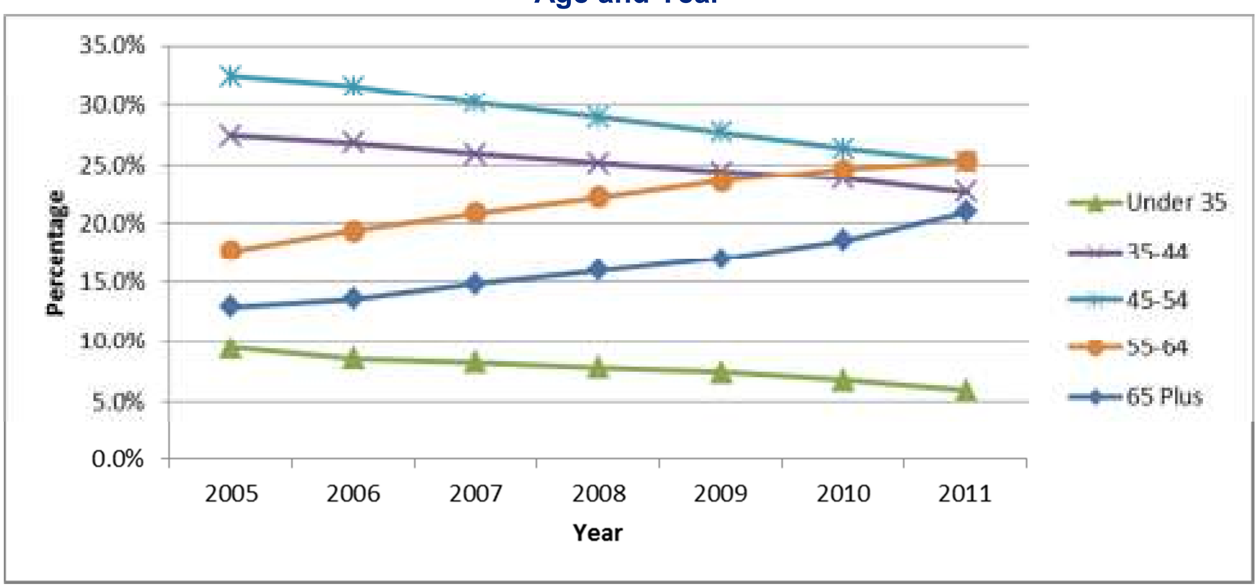
Note: the proportions are of allowed charges for all Medicare claims (excluding hospital inpatient, ER, drug and lab)

Exhibit B8: Distribution of the Number of NPs and PAs across HPSA and PSA regions

Profession Type	2005	2006	2007	2008	2009	2010	2011
Nurse Practitioners							
Total Providers	23,610	27,450	35,286	42,144	46,973	52,472	59,505
in HPSA*	x	X	14,171	16,978	18,858	20,929	23,045
in PSA**	2,946	3,331	4,139	4,694	N/A	N/A	N/A
in HPSA & PSA	x	X	1,638	1,855	N/A	N/A	N/A
PCIP 2011 Recipients	12,267	14,146	18,008	23,070	27,698	25,369	23,707
in HPSA*	x	X	7,335	9,344	11,148	10,178	9,312
in PSA**	1,558	1,754	2,168	2,571	N/A	N/A	N/A
in PSA & HPSA	x	X	861	1,027	N/A	N/A	N/A
Physician Assistants							
Total Providers	21,240	24,439	30,823	35,593	39,226	42,871	47,340
in HPSA*	x	X	13,246	15,236	16,889	18,489	19,828
in PSA**	2,166	2,436	3,098	3,467	N/A	N/A	N/A
in HPSA & PSA	x	X	1,230	1,363	N/A	N/A	N/A
PCIP 2011 Recipients	6,168	7,033	8,852	10,898	13,038	11,961	11,288
in HPSA*	x	X	3,830	4,732	5,760	5,226	4,755
in PSA**	760	839	1,034	1,217	N/A	N/A	N/A
in PSA & HPSA	x	X	408	494	N/A	N/A	N/A

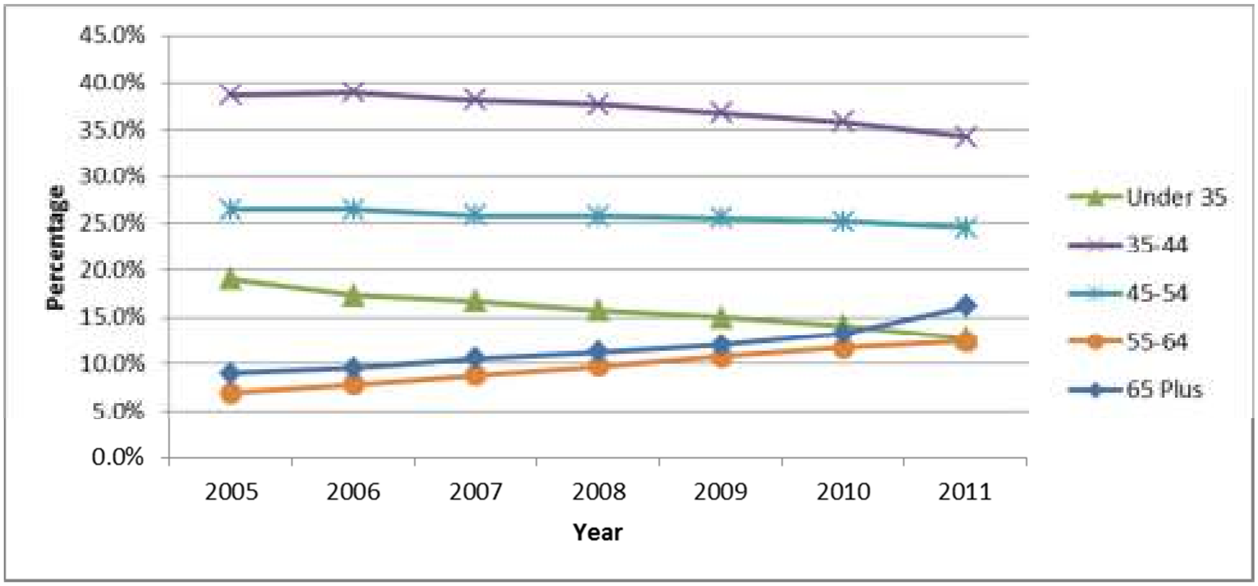
Note: *HPSA includes only full HPSA areas (data from Area Resource File and HPSA status data are not available prior to 2007). **PSA status after 2008 is not applicable as 2008 was the final year of the PSA bonus.

Exhibit B9.a: Distribution of Male Primary Care Physicians with PCIP Eligible Specialty by Age and Year



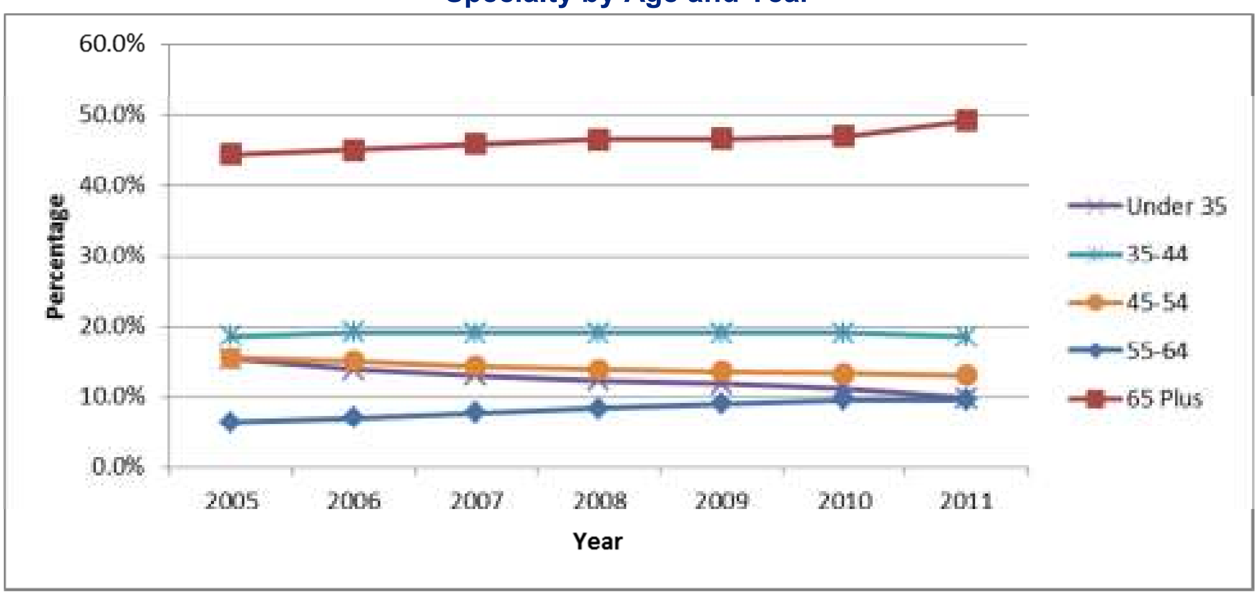
Note: Primary care physicians include following specialties: internal medicine, family practice, pediatrics, geriatrics.

Exhibit B9.b: Distribution of Female Primary Care Physicians with PCIP Eligible Specialty by Age and Year



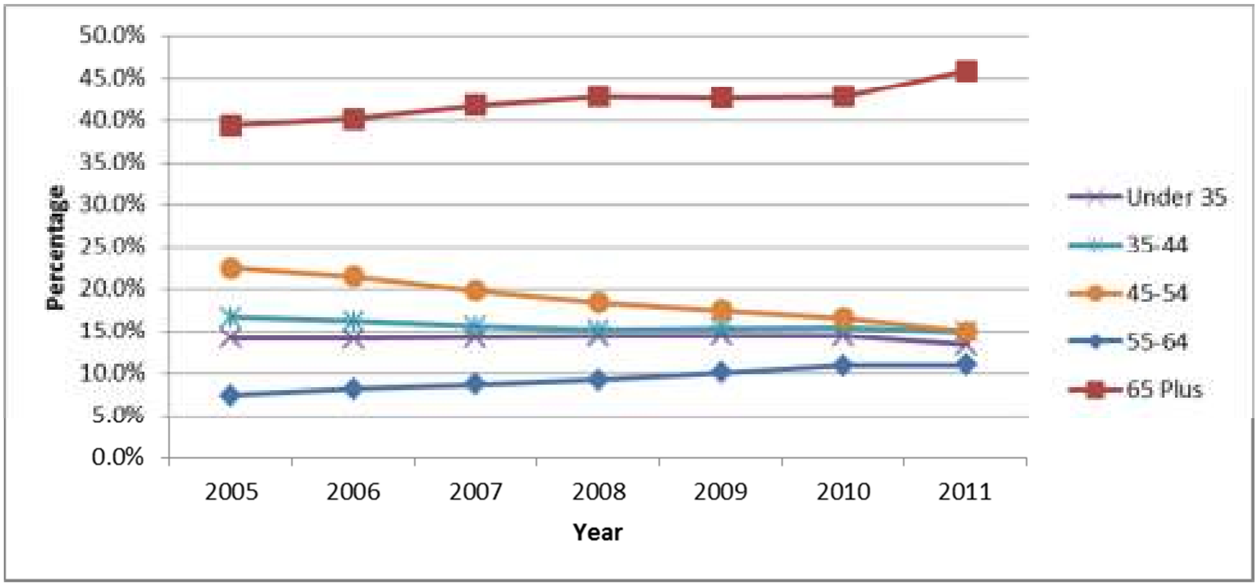
Note: Primary care physicians include following specialties: internal medicine, family practice, pediatrics, geriatrics.

Exhibit B10: Distribution of Male Primary Care Non-Physicians with PCIP Eligible Specialty by Age and Year



Note: Primary care non-physicians include following specialties: PA, NP and CNS.

Exhibit B11: Distribution of Female Primary Care Non-Physicians with PCIP Eligible Specialty by Age and Year



Note: Primary care non-physicians include following specialties: PA, NP and CNS.

Exhibit B12: Average Number of PCIP Eligible E&M Claims Submitted by 2011 PCIP Recipients, 2005 – 2011

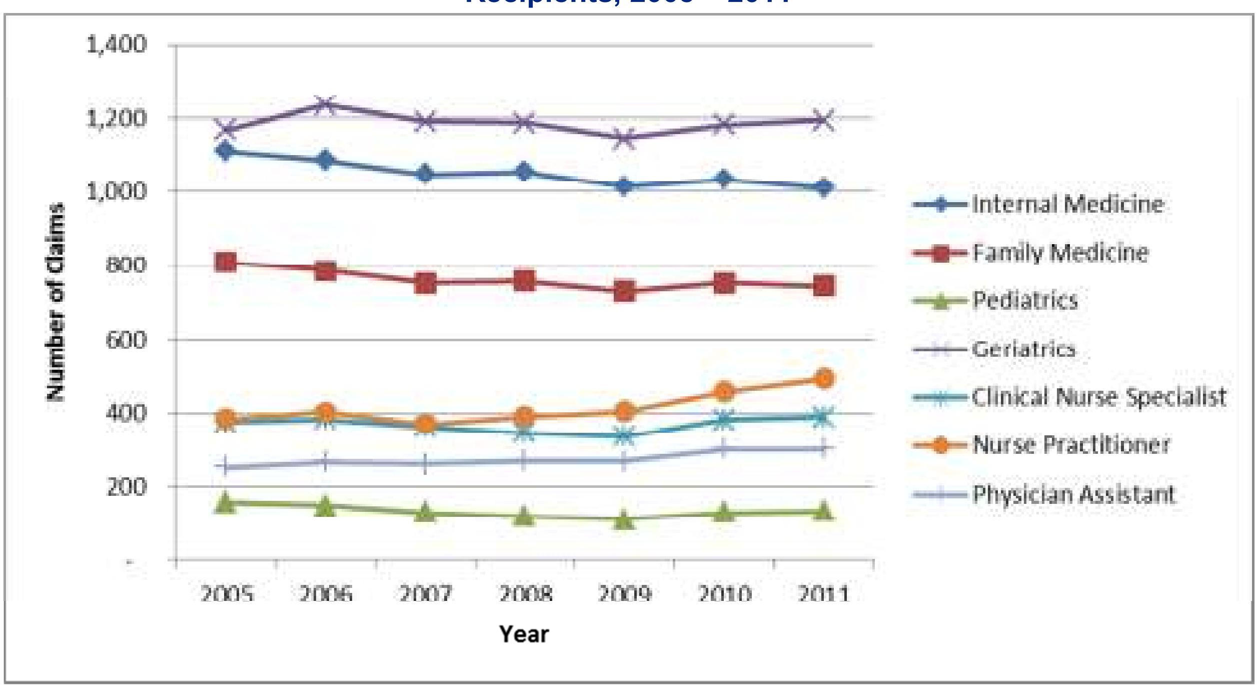


Exhibit B13: Allowed Charges for PCIP Eligible E&M Claims per 2011 PCIP Recipients, 2005-2011

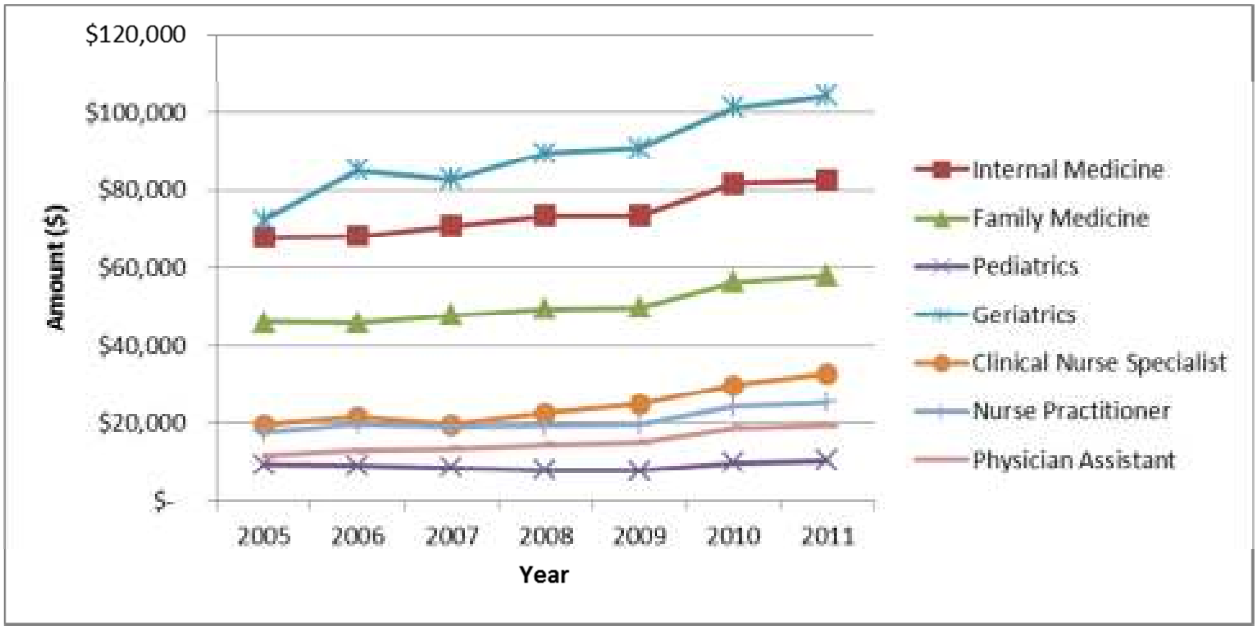


Exhibit B14: Total Number of PCIP Eligible E&M Claims submitted by All Providers in the Control Group, 2005-2011

Specialty	2005	2006	2007	2008	2009	2010	2011
OB/GYN	2,597,637	2,612,513	2,728,810	2,813,47	2,893,204	3,047,849	3,040,383
Ophthalmology	5,615,010	5,648,040	6,070,483	5,976,72	5,832,440	6,361,330	6,164,821
Pathology	46,894	51,364	54,748	57,005	57,147	64,078	63,652
Urology	6,964,185	7,202,012	7,571,544	7,775,85	7,777,728	8,616,096	8,641,898
Optometry	2,464,734	2,550,764	2,758,214	2,891,54	2,969,244	3,048,668	3,088,461
Podiatry	7,788,889	8,195,973	8,957,163	9,739,40	10,012,63	10,645,39	10,890,67
Psychology	42	11	27	64	1,552	2,440	2,097
Neurophysiology	12,609	13,838	13,858	15,451	18,142	17,962	17,714

Additional Regression Results

Exhibit B15: Impact of Medicare PCIP Policy on the Number of Primary Care Providers Who Have submitted any Medicare Claims (not necessarily under PCIP Eligible Services), (2005-2011)

Dependent Variable: Number of Providers per county	All Providers (1)	Physicians Only (2)	Non-Physicians Only (3)
PCIP Elig. Specialty Indicator	65.50*	40.54*	48.59*
	(3.929)	(4.449)	(2.759)
Elig. Specialty Ind x Post 2009	**4.408***	**3.255***	**5.710***
	(0.503)	(0.758)	(0.482)
Post 2009	4.588*	3.314*	4.187*
	(0.505)	(0.593)	(0.350)
Median Income ($10k)	2.306*	2.728*	1.643*
	(0.424)	(0.513)	(0.241)
Percent in poverty	0.466*	0.541*	0.360*
	(0.0535)	(0.0653)	(0.0332)
Population (10k)	0.727*	0.771*	0.487*
	(0.0298)	(0.0359)	(0.0144)
Percent Population over 65	-0.406*	-0.262*	-0.337*
	(0.0407)	(0.0502)	(0.0280)
Unemployment Rate	-0.660*	-0.652*	-0.493*
	(0.0522)	(0.0621)	(0.0392)
Intercept	-72.42*	-79.09*	-49.0*
	(4.371)	(4.812)	(3.069)
Specialty Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
N	140,192	107,526	95,647
Adj. R-sq.	0.391	0.396	0.480

Note: Robust standard errors are in parentheses; + significance at 10%; * significance at 5%. The number of observation is based on the number of counties, the number of years, and the number of provider specialties in each model (i.e., physicians include 4 primary care specialties and non-physicians include 3 sub- specialties).

Exhibit B16: Impact of Medicare PCIP Policy on the Number of Primary Care Providers Who Met 60% PCIP Eligibility Threshold Each Year, (2005-2011)

Dependent Variable: Number of Providers per county	All Providers (1)	Physicians Only (2)	Non-Physicians Only (3)
PCIP Elig. Specialty Indicator	20.62*	21.94*	6.540*
	(1.769)	(2.050)	(0.642)
Elig. Specialty Ind x Post 2009	2.322*	1.841*	2.776*
	(0.341)	(0.543)	(0.243)
Post 2009	1.252*	0.750+	0.994*
	(0.348)	(0.427)	(0.143)
Median Income ($10k)	0.549+	0.847*	0.0118
	(0.305)	(0.380)	(0.0942)
Percent in poverty	0.0663+	0.0965*	0.0165
	(0.0379)	(0.0473)	(0.0137)
Population (10k)	0.264*	0.298*	0.0610*
	(0.0229)	(0.0284)	(0.00579)
Percent Population over 65	-0.155*	-0.105*	-0.127*
	(0.0277)	(0.0355)	(0.0111)
Unemployment Rate	-0.252*	-0.259*	-0.0864*
	(0.0357)	(0.0444)	(0.0166)
Intercept	-22.81*	-27.17*	-3.777*
	(2.029)	(2.419)	(0.775)
Specialty Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
N	140,192	107,526	95,647
Adj. R-sq.	0.174	0.184	0.119

Note: Robust standard errors are in parentheses; + significance at 10%; * significance at 5%. The number of observation is based on the number of counties, the number of years, and the number of provider specialties in each model (i.e., physicians include 4 primary care specialties and non-physicians include 3 sub- specialties).

Appendix C: Difference-in-difference (DID) Methodology

C.1. DID model and derivation for estimating the impact of PCIP policy

The following equation (Equation (1)) shows the econometric model to identify the effect of Medicare PCIP program on the magnitude of primary care E&M services:

$$S_{it} = \alpha + \beta * T_i + \theta * Post_t + \delta * Post_t * T_i + X'_{it} * \gamma + \varepsilon_{it} \quad (1)$$

We let S_{it} be the volume of eligible E&M services provided by provider *i* in period *t*; T_i is an indicator for treatment group that takes the value 1 if the provider is a PCP, and zero otherwise; the variable $Post_{\,t}$ is an indicator variable taking the value of 1 in the years when the PCIP policy is likely to impact the behavior of the providers and 0 otherwise; the vector $X_{\,it}$ includes provider characteristics, such as age and gender etc. The term ε_{it} represents random unobserved factors affecting E&M services.

The DID methodology that we use here to identify the unbiased effect of PCIP policy on the volume of primary care E&M services is illustrated by considering two time periods: pre-PCIP (*pre*) and post-PCIP (*post*) periods with the latter being the years when the PCIP policy is likely to impact the behavior of the providers. Equation (2) below shows the change in the volume of E&M services provided by PCPs between pre-PCIP and post-PCIP periods, holding other things constant.

$$S_{pcp,post} - S_{pcp,pre} = \theta + \delta + \left(X'_{pcp,post} - X'_{pcp,pre}\right) * \gamma + \varepsilon_{pcp,post} - \varepsilon_{pcp,pre} \quad (2)$$

Similarly, equation (3) below shows the change in the volume of E&M services provided by non-PCPs between pre-PCIP and post-PCIP periods.

$$S_{nonpcp,post} - S_{nonpcp,pre} = \theta + \left(X'_{nonpcp,post} - X'_{nonpcp,pre}\right) * \gamma + \varepsilon_{nonpcp,post} - \varepsilon_{nonpcp,pre} \quad (3)$$

Holding other provider characteristics (embedded in *X*s) constant and assuming the changes in random shocks are zero in the limit for both the groups, equation (4) below shows that the change in the magnitude of the primary care E&M services provided by PCPs due to the introduction of the Medicare PCIP program is δ.

$$(S_{pcp,post} - S_{pcp,pre}) - (S_{nonpcp,post} - S_{nonpcp,pre}) = \delta \quad (4)$$

Thus the coefficient δ from equation (1) represents an unbiased estimate of the effect of the Medicare PCIP policy on the volume of primary care E&M services. Similar methodology can also be applied to estimate the effect of the PCIP policy on other outcomes of interest.

C.2. DID model and derivation for estimating the impact of HPSA bonus

Equation (5) below shows the empirical specification that we used to estimate the effect of HPSA status on the outcome variables discussed above:

$O_{ict} = \alpha + \beta * HPSA_{ict} + \delta_1 * ToHPSA_{ic} + \delta_2 * HPSA_{ict} * ToHPSA_{ic} + \lambda_1 * ToNonHPSA_{ic} + \lambda_2 * HPSA_{ict} * ToNonHPSA_{ic} + X'_{it} * \gamma + \tau_t * \theta + \varepsilon_{ict}$(5)

The model is specified based on the physician level data in each year. Here, the dependent variable, O_{ict} is one of the other potential outcomes of interest of a primary care physician *i,* in county *c,* at time *t*; $HPSA_{ict}$ is an indicator of whether physician *i*'s county is a HPSA at time *t*; $ToHPSA_{ic}$ is an indicator variable taking the value of 1 if the physician's county ever gained the HPSA status (from a non-HPSA) during the sample period and zero otherwise; $ToNonHPSA_{ic}$ is an indicator variable taking the value of 1 if the physician's county ever lost the HPSA designation during the sample period and zero otherwise; the vector X_{ict} includes variables reflecting the physician characteristics, their geographic locations etc., and τ_t is a vector of time-specific fixed effect terms.

The term ε_{ict} represents random unobserved factors affecting outcomes. If the change of HPSA status is associated with any changes in the volume of services provided by primary care physicians in those areas, then we should expect estimated values of δ_2 and λ_2 in equation (5) will reflect them. If the outcome of interest is the volume of services then a positive significant estimated value of δ_2 would imply higher volume of services due to gaining HPSA designation.

For simplicity, assume that we have physicians in the following four types of counties: counties that are always HPSA (type C1); counties that are always non-HPSA (type C2) ; counties that gained HPSA status and remained HPSA afterwards (C3); and counties that lost HPSA status and remained non-HPSA afterwards (C4). Also, consider the number of E&M claims submitted under Medicare as the outcome variable of interest. Now for given values of X, γ, τ, θ, and ε, let us focus on the first 7 terms of the above equation for a representative provider in each of these 4 types of counties:

Equation (6) shows the expression of the model, excluding the last three terms, for County Type C1 (always HPSA):

$$O_{ict} = \alpha + \beta \qquad (6)$$

Equation (7) shows the expression of the model, excluding the last three terms, for County Type C2 (always non-HPSA):

$$O_{ict} = \alpha \qquad (7)$$

Equation (8) shows the expression of the model, excluding the last three terms, for County Type C3 (gained HPSA status) when these counties have HPSA status:

$$O_{ict} = \alpha + \beta + \delta_1 + \delta_2 \qquad (8)$$

Equation (9) shows the expression of the model, excluding the last three terms, for County Type C3 (gained HPSA status) when these counties have Non-HPSA status:

$$O_{ict} = \alpha + \delta_1 \qquad (9)$$

Thus $(\alpha + \beta)$ in equation (6) shows the estimated average number of claims per physician in HPSA counties (after controlling for other factors); while in equation (7) α represents the estimated average number of claims per physician in non-HPSA counties. Thus, β captures the persistent difference in the average number of claims between the HPSA and non-HPSA counties.

On the other hand comparing equation (8) and (9), the model indicates that in counties that gained the HPSA status $(\beta + \delta_2)$ shows the difference between the estimated average number of claims per physician when the counties have the HPSA status and the average number of claims when they do not have the HPSA status. However, β already captures the persistent difference in the average number of claims between the HPSA and non-HPSA counties. Therefore, the parameter δ_2 shows the additional impact of HPSA status on the average number of claims per physician in the counties that gained HPSA status. If gaining HPSA status encourages physicians to increase the availability of primary care services, then we expect δ_2 to be positive.

Similarly equation (10) shows the expression of the model, excluding the last three terms, for County Type C4 (lost HPSA status) when these counties have HPSA status:

Type C4 and HPSA:

$$O_{ict} = \alpha + \beta + \lambda_1 + \lambda_2 \qquad (10)$$

Equation (11) shows the expression of the model, excluding the last three terms, for County Type C4 (lost HPSA status) when these counties have Non-HPSA status:

$$O_{ict} = \alpha + \lambda_1 \qquad (11)$$

Once again, comparing equation (10) and (11), the model indicates that in counties that lost the HPSA status $(\beta + \lambda_2)$ shows the difference between the estimated average number of claims per physician when they have the HPSA status and the average claims when they do not have the HPSA status. However, β already captures the persistent difference in the average number of claims between the HPSA and non-HPSA counties. Therefore, the parameter λ_2 shows the additional impact of HPSA status on the average number of claims per physician in the counties that lost HPSA status. If losing the HPSA status induces physicians to decrease the availability of primary care services, then we expect λ_2 to be positive implying higher average claims when the counties had the HPSA status.

Appendix D: Simulation Methodology

Method of Calculating the Predicted Proportion of Office-based Physicians Accepting New Medicaid Patience as a Function of the Medicaid-to-Medicare Fee Index

Consider that:

- I0 is the observed value of the Medicaid-to-Medicare fee index 2008.
- I1 is the new value of the Medicaid-to-Medicare fee index (e.g. I1 could be 1 percent or 10 percent or x percent higher than I0 where x is a chosen value).
- P0 is the observed proportion of office-based physicians accepting Medicaid patients in 2011.
- P1 is the predicted proportion of office-based physicians accepting Medicaid patients after the x percent increase in Medicaid-to-Medicare fee index.
- M1 is the estimated marginal effect of the Medicaid-to-Medicare fee ratio (2008) = 0.4 (reported in the study).
- B1 is the estimated logit coefficient of the Medicaid-to-Medicare fee ratio (2008).

Given the fact that marginal is equal to the estimated logit coefficient times P times (1-P) where P is the mean proportion of office-based physicians accepting Medicaid patients in the sample, equation (12) shows the estimated logit coefficient of the Medicaid-to-Medicare fee ratio (2008).

$$B1 = M1/(P * (1 - P)) = 0.4/(P * (1 - P)) \quad (12)$$

Since Decker (2012) reports that P is 0.694, this implies B1 is equal to 0.4/(0.694*(1-0.694)) which is approximately equal to 1.88.

Let's name the part of the estimated logit model which incorporates the effect of other independent variables (other than Medicaid-to-Medicare fee ratio) and the intercept term in the model as "Other Effects" or OE. Equation (13) below shows the expression of "Other Effects" (OE) based on a given value of P0 and a known value of B1 (where "ln" is the natural log).

$$OE = ln(P0/(1 - P0)) - B1 * I0 \quad (13)$$

Then based on the estimated logit model, we can predict the log-odds of the proportion of office-based physicians accepting new Medicaid patients for a new value of the Medicaid-to-Medicare index (say, I1). Equation (14) shows the log-odds of the proportion of office-based physicians accepting new Medicaid patients.

$$Predicted\ Log\ Odds = ln(P1/(1 - P1)) = OE + B1 * I1 \quad (14)$$

Therefore, equation (15) shows the implied predicted proportion of office-based physicians accepting new Medicaid patients (where "exp" is the exponential function operation).

$$Predicted\ proportion\ =\ P1\ = [\ 1 + {}^{1}/_{\{e^{(OE+B1*I1)}\}}]^{-1} \quad (15)$$

Example:

Based on Decker (2012):

(i) The national average of observed proportion of office-based physicians accepting Medicaid patients in 2011 (P0) is 0.694.

(ii) The Observed value of the Medicaid-to-Medicare fee index (I0) 2008 is 0.742.

We have already derived that the logit coefficient of the Medicaid-to-Medicare fee ratio (B1) is 1.88. This implies that OE is approximately 0.576 (based on equation (13)).

Now consider a 10 percent increase in the Medicaid-to-Medicare fee index from the national average in 2008. This implies that the new value of the Medicaid-to-Medicare fee index (I1) is 0.8162.

This further implies that the predicted log-odds of the proportion of office-based physicians accepting new Medicaid patients is equal to about 0.958 (using equation (14)).

Thus, using the expression in equation (15) the predicted proportion of office-based physicians accepting new Medicaid patients (P1) is equal to 0.723 or 72.3 percent.

The same methodology is applied while calculating the predicted proportions for each state and the US in Exhibit 25.