

The Value of Service Sector Relationships in Health Care*

Please click [here](#) for the most recent version

Adrienne Sabety

January 14, 2020

Abstract

The relationship between patients and their primary care provider (PCPs) is widely valued, but how much does it matter for health care consumption and health? I find that a PCP's retirement or relocation causes a large and long-lasting decline in patients' use of primary care. Patients have 17% fewer primary care visits for at least four years after a PCP's exit. Instead of forming new PCP relationships, patients receive less-extensive preventive care from their pre-existing network of specialists. Emergency department and inpatient admissions also increase for one year after a PCP's exit, which increases patients' spending by \$4,640 and Medicare spending by \$16,052 per exiting PCP. I develop a framework that formalizes two possible frictions faced by patients: (1) switching costs when finding a new PCP and (2) receiving less benefit from new PCPs because PCP-specific information grows over time. I find evidence for both. I also show that effects are smallest when patients belong to clinics that provide care as a team. Therefore, team care may be an effective way to help patients transition across PCPs.

*Ph.D. candidate in Health Policy, Harvard University. E-mail: asabety@g.harvard.edu. This work was supported in part by the National Science Foundation Graduate Research Fellowship Program (Grant No. DGE1144152), the Alfred P. Sloan Foundation Pre-Doctoral Fellowship on the Economics of an Aging Workforce award from the NBER, and a Thomas Parry Research Fellowship award from the Integrated Benefits Institute. This project was also supported by grant number U19HS024072 from the Agency for Healthcare Research and Quality. The content is solely the responsibility of the author and does not necessarily represent the official views of the Agency for Healthcare Research and Quality. I am grateful for the extensive support and guidance of my advisers: David Cutler, Claudia Goldin, and Timothy Layton. Michael Barnett, Alex Bartik, Savannah Bergquist, Samantha Burn, David Card, Michael Chernenov, Moya Chin, Edward Glaeser, Colin Gray, Jonathan Gruber, Nir Hak, Ryan Hill, Robert Huckman, Anupam Jena, Ariella Kahn-Lang Spitzer, Lawrence Katz, Victoria Marone, Thomas McGuire, Michael McWilliams, Hannah Neprash, Dev Patel, Jonathan Roth, Mark Shepard, Niharika Singh, Gabriel Unger, Melanie Wasserman, and Annetta Zhou as well as numerous seminar and conference participants provided unrivaled support, advice, and suggestions. It truly takes a village.

1 Introduction

Standard economic models often assume transactions occur between anonymous buyers and sellers. In practice, however, many exchanges take place in the context of longstanding relationships, such as the client-lawyer, borrower-lender, or patient-primary care provider (PCP) relationship. The patient-PCP relationship is widely suspected to be one of the most important, because of its direct impact on patients' health ([Starfield, 1994](#)).¹ But researchers still lack strong evidence for whether and to what extent this relationship matters for patients, despite the number of recent and proposed reforms affecting the PCP-patient relationship, and the strong preference many people have for keeping their current PCP.²

Continuing to develop our understanding of PCP-patient relationships helps firms and policymakers mitigate the harms of disrupting them. PCP departures are especially ubiquitous in the health care context where volatile provider networks and non-compete agreements may artificially sever a PCP-patient relationship, even if the PCP remains in practice.³ PCP retirements are also projected to increase over the next decade, with 32% of PCPs currently over age 60 ([Sabety, 2019](#)). As a result, if the loss of the relationship negatively affects patients, interventions such as team care may help patients transition between PCPs.

In this paper, I quantify how patients' health care consumption and outcomes are causally affected by a PCP's retirement or relocation. I identify the causal effect in a difference-in-differences research design, using a control group of PCPs who did not exit but are otherwise similar to the PCPs who exited. I then compare outcomes of patients with PCPs that retired or relocated to patients of matched, staying PCPs. My identification strategy assumes PCPs depart for idiosyncratic reasons unrelated to the health of their patients. In support of this assumption, outcomes among treated and control patients follow similar trends before a PCP's departure.

I show that relationships determine where patients demand care and that PCP-patient

¹The term primary care provider (PCP) refers to physicians, physician assistants, and nurse practitioners who deliver primary care services.

²See [Sessums, Basu and Landon \(2019\)](#) for a discussion of primary care first models, [McWilliams et al. \(2019\)](#) for a discussion of accountable care organizations, and [Sinaiko et al. \(2017\)](#) for a discussion of primary care medical homes.

³See [Lavetti, Simon and White \(2019\)](#) and [Hausman and Lavetti \(2016\)](#) for a discussion of non-competes and [Barnett et al. \(2017\)](#) for an example of how changing a patient's insurance network affects where a patient seeks primary care.

relationships are moderately important for patients' health. In response to a PCP's exit, patients decrease their use of primary care by 17% for at least four years after a PCP's exit. Patients are only 10 percentage points more likely to establish a new PCP relationship than patients who do not lose a PCP. Instead, patients substitute to specialists they know for less extensive preventive care long-term. This is true even among patients who have a replacement PCP at the main clinic.⁴ Emergency department (ED) and inpatient admissions also increase for one year after a PCP's exit, which increases patients' spending by \$4,640 and Medicare spending by \$16,052 per exiting PCP.

I interpret these results as clear evidence that patients face large and persistent frictions in replacing PCPs who retire or relocate. I develop a framework that formalizes two possible explanations. First, patients may face substantial switching costs when moving from one provider to another. Switching costs occur when a buyer purchases a good repeatedly and therefore finds it costly to switch to a new seller (Farrell and Klemperer, 2007). Second, patients may lose PCP-specific information that grows over time (Jovanovic, 1979a).

I find suggestive evidence that both switching costs as well as the loss of information explain why replacement PCPs are imperfect substitutes for exiting PCPs. In support of switching costs, when patients are better able to switch to a PCP they have a pre-existing relationship with, patients are less likely to substitute to specialists and the ED for primary care after a PCP's exit. Patients ability to rely on pre-existing PCPs is maximized in team clinics and minimized when the clinic closes when a PCP exits. This suggests that investing in a new PCP relationship is more costly for patients than using specialists and the ED setting for primary care.

In support of the loss of information, patients who had a longer relationship with the exiting PCP are more likely to rely on pre-existing specialists for primary care after a PCP's exit. Patients therefore receive less benefit from replacement PCPs than they did from exiting PCPs. However, adverse events do not increase with the length of the PCP-relationship, i.e. the rate of non-preventive ED visits, inpatient admissions, and death. This suggests that the lost information may be more psychological in nature, such as trust, opposed to being specific to patients' health.

I also reject four alternative explanations for frictions in replacing PCPs. First, patients may decrease their use of primary care because they are unable to find a replacement PCP

⁴The term "clinic" refers to where PCPs practice medicine, also known as the doctor's office.

that is a similarly good match ([Jovanovic, 1979b](#)). I show that primary care use decreases similarly among patients with more specific needs, i.e. high risk, disabled, minority as well as female patients with female PCPs. Therefore match quality along these dimensions does not appear to be a main mechanism. Second, replacement PCPs may be hard to find. I do not find support for this by showing that patients in thinner and thicker markets decrease their use of primary care similarly. Third, the loss of a PCP may overwhelm staying PCPs at the main clinic by increasing their workload. I find that staying PCPs *do* take on more patients after a PCP's exit, but that the outcomes of staying PCPs' patients are not affected. Further, patients in smaller clinics are only slightly more likely to substitute away from the main clinic, while the increased workload for PCPs who work in small clinics is relatively larger. This suggests that the increased workload does not affect staying PCPs' ability to care for patients. Fourth, I show that replacement PCPs do not refer to specialists at a higher rate than departing PCPs. Therefore, practice pattern differences between replacement and leaving PCPs do not explain why patients decrease their use of primary care and increase their use of specialty care after a PCP's exit.

This paper contributes to four health care literatures. First, [Johnson et al. \(2016\)](#) find that an obstetrician's familiarity with patients affects the *supply* of treatment. In contrast, I show that patients' familiarity with PCPs and specialists affects patients' *demand* for care. Second, I show that a PCP's departure significantly disrupts patient care. This complements research showing that better continuity of care improves patients' health (e.g. [Saultz and Albedaiwi, 2005](#); [David and Kim, 2018](#); [Agha, Frandsen and Rebitzer, 2017](#)). Third, findings relate to studies showing that insurance coverage has mixed effects on ED use (e.g. [Taubman et al., 2014](#) vs. [Miller, 2012](#) and [Akosa Antwi et al., 2015](#)). This paper's results suggest that ED visits may increase when individuals are newly insured because it is less costly to visit the ED than form a new PCP relationship. This aligns with work randomly assigning uninsured individuals to PCPs, which overcomes switching costs, creates "lock-in," and causes high risk patients to decrease their use of the ED for primary care treatable conditions ([Sabety et al., 2019](#)).

Fourth, my findings complement concurrent work that uses PCP exits to identify PCP practice patterns ([Fadlon and Parys, 2019](#) and [Kwok, 2019](#)) as well as the aggregate effect of a PCP's departure ([Sabety, 2019](#); [Bischof and Kaiser, 2018](#); [Staiger, 2018](#); [Simonsen et al., 2019](#); [Zhang, 2018](#); [Schwab, 2018](#)). Comparatively, this paper identifies the importance of relationships in explaining why patients' health care consumption and outcomes are affected

in response to a PCP’s exit. I also determine *why* the loss of the relationship is costly for patients, which guides firms and policymakers attempting to mitigate the harms of disrupting relationships service sector wide.

My results contribute to work showing that outside, replacement workers are imperfect substitutes for incumbent workers (e.g. [Jäger, 2017](#); [Stole and Zwiebel, 1996a](#); [Stole and Zwiebel, 1996b](#)). I extend this literature in two ways. First, I illustrate that, while the workload of incumbent workers increases in response to the loss of a co-worker, this does not observably affect incumbent workers’ productivity. Second, I show that, even if a firm can perfectly substitute between workers, clients themselves may not view workers as substitutes because of the existence of the relationship. This is of particular relevance to the service sector, where goods are delivered in the context of relationships.

The paper proceeds as follows. Section 2 outlines the institutional setting. Section 3 presents a simple conceptual framework that motivates the two main mechanisms. Section 4 describes how the data is constructed. In Section 5, I describe my empirical strategy and identification assumptions. Section 6 presents the main results. Section 7 explores the specific mechanisms behind the aggregate results. Section 8 concludes.

2 Institutional Setting: Primary Care

Primary care is widely considered to be a basic input into patients’ health. Individual PCPs specialize in administering primary care, such as immunizations, preventive screens, and medications. PCPs are also patients’ first point of contact to the health care system and are tasked with coordinating patient care across specialists ([Starfield, 1994](#)).

The role of a PCP is especially relevant for Medicare patients who are in worse health and are more likely to have multiple providers, as compared to younger patients. For instance, the average Medicare patient sees 1.5 PCPs (median 1) over 6 different visits and 3.8 specialists (median 3) over 9 different visits per year.^{5,6} PCP-patient relationships also tend to be long-lasting: the average Medicare patient over age 75, has known their PCP for 4.7 years (median

⁵In contrast, [Pham et al. \(2007\)](#) uses slightly different Medicare data and sample restrictions and finds that patients see two PCPs and five specialists on average.

⁶PCPs are within a 30 mile radius of each other for 96% of patients that have more than one PCP. The remaining 4% may have multiple residences and have a PCP in each location. For instance, if an individual spends 8 months of the year in Michigan and 4 months of the year in Florida, they may have a PCP in each location.

6).

As a result, the loss of a PCP may significantly change how Medicare patients' interact with primary care as well as the medical system more broadly. Medicare patients face similar out-of-pocket costs across settings and can see any provider at any time (no networks). Specialists may therefore be able to take on routine care at no additional cost to patients, like signing existing chronic medication prescriptions and administering preventive care.

The relevance of PCPs as an integral part of the health care delivery system relates to concerns about the growing number of specialists relative to PCPs in the physician workforce. As an increasing number of primary care physicians retire, new medical graduates overwhelmingly choose to specialize instead of going into primary care (Sabety, 2019; Whitcomb and Cohen, 2004).⁷ Adding to pressures facing the PCP workforce, new delivery models incentivize PCPs to take responsibility for the continuum of patient care, requiring PCPs to invest more in patients (e.g. Sessums, Basu and Landon, 2019; McWilliams et al., 2019; Sinaiko et al., 2017). As such, there has been near-consensus that more PCPs are needed (Chernew et al., 2009).

The delivery of primary care is changing in response to these increased demands. Tasks typically done by PCPs are shifting to other stakeholders. It is increasingly the case that primary care, urgent care, retail, and specialty *clinics* are patients' first point of contact (Friedberg, Hussey and Schneider, 2010). Further, many clinics have created roles for dedicated care coordinators, with at most a nursing background, who specialize in managing patient care across settings (Bayard, Caliano and Mee, 1997). Thus, with a robust network of care surrounding established patients, the role of the PCP-patient relationship, and under what conditions it should be prioritized, remains unclear.

3 Conceptual Framework

The following conceptual framework motivates why a patient's health care consumption and outcomes may be affected by the loss of a long-term PCP relationship. After the loss of a PCP, a patient re-optimizes among her remaining options when obtaining care. This decision depends on switching costs and the amount of PCP-specific information a patient

⁷I make the distinction between primary care physicians and PCPs, which are defined to include nurse practitioners, physician assistants, and primary care physicians who practice in the primary care setting.

loses when a PCP retires or relocates. The framework’s intuition is displayed graphically in Figure 1, which shows the utility a patient receives visiting a PCP, specialist, and the ED. The x-axis contains the length of the PCP-patient relationship (L). I assume there is no variation in quality among different PCPs, so all PCP options are captured by PCP .⁸

I begin by considering a patient’s utility consuming care across options. By revealed preference, a patient’s utility maximizing choice is to visit their initial PCP in $t = 0$ (P_0 on Figure 1). Point P^* is the utility a patient receives when visiting a new PCP at $L = 0$ after paying switching cost μ . $Spec$ is the utility a patient receives from visiting a specialist that they have known for $L = L_{Spec}$. The specialist curve $Spec$ is below the PCP curve PCP because providing primary care is outside of a specialist’s scope of practice. ED is the utility a patient receives visiting the ED, which is normalized to zero.

Where a patient chooses to receive care after a PCP’s exit depends on switching costs, μ , and if PCP-specific information grows over time, $\frac{\partial U(Length)}{\partial Length}$. Switching costs occur when a patient invests in a specific provider and the patient has to duplicate this investment for any new provider (Farrell and Klemperer, 2007).⁹ The size of the switching cost depends on the availability of options in a patient’s choice set.

It also depends on the slope of the PCP and SP curves. If the curves are upward sloping, information specific to the provider-patient relationship increases over time and, as such, patients who had a longer relationship with a PCP will lose more information than those who had a shorter relationship after a PCP’s exit, a la Jovanovic (1979a). If the curves are flat, information specific to the provider-patient relationship would not increase over time, and patients with longer and shorter relationships should be equally affected by the loss of a PCP. I assume that PCP and SP curves have the same slope because the quality of PCP-specific information likely applies to the quality of specialist-specific information as well.

A patient’s choice of replacement care could also depend on a patient’s time horizon as well as discount rate. For example, a younger patient may be more likely to incur switching cost μ because she gains higher long-run returns by investing in a new PCP relationship than visiting a specialist for primary care. Whereas an older patient may be less likely to invest

⁸This framework can easily be generalized to the case where providers have different levels of quality by allowing the curves to shift based on a providers average quality level.

⁹Figure 1 assumes that all PCPs and specialists are the same quality and only depend on L . However, in reality, there are many different PCP and SP curves with varying levels of quality, which likely determine the level of the PCP and SP curve.

in a new relationship because she has a shorter time horizon. Different discount rates will also affect a rational patient's choice of where to consume primary care. A patient with a higher discount rate will discount the future more and be less likely to invest in a new PCP relationship. In a world with hyperbolic discounting, a patient may discount the future at an even higher effective rate. A patient will therefore be even less likely to invest in a new PCP relationship, even if investing would be rational.

In the empirical results that follow, I consider three types of outcomes: utilization of clinic based services; medications and preventive care; as well as poor outcomes. Utilization of clinic based services includes primary care, specialty care, urgent care, and spending. Medications and preventive care include easily observable metrics that positively affect patients' health, such as the total number of medications, chronic medications, flu vaccines, annual exams, and preventive screens. Poor outcomes include ED visits, inpatient admissions, and death.

Outcomes	
Utilization of Clinic Based Services	Primary Care, Specialty Care, Urgent Care & Spending
Medications & Preventive Care	Total Medications / Chronic Medications, Flu Vaccines, Annual Exams, & Preventive Screens
Poor Outcomes	Emergency Department (ED) Visits Inpatient Admissions, & Death

If switching costs are a main mechanism very few patients should establish new relationships. Instead, patients should rely on their existing network of PCPs and specialists for primary care. Empirically, this should translate into patients receiving less primary care for at least two reasons. First, patients may avoid switching cost by not re-investing in a new PCP relationship, which leads to fewer PCP visits. Second, if patient substitute to specialists they have a pre-existing relationship with for primary care, patients may receive less primary care because providing primary care is outside of a specialist's scope of practice. In response to using less primary care, adverse events may increase, leading patients to increase their use of ED and inpatient settings. Patients may also increase their use of the ED for primary care if patients do not have existing providers to rely on and choose to not invest in a new PCP relationship. This could occur when patients have especially large switching costs, short time horizons, and small discount rates.

The loss of information will lead to similar empirical results, but for different reasons. Patients will choose existing PCPs and specialists over new PCPs if it maximizes their utility. For instance, patients with longer time horizons may be more likely to invest in a new PCP relationship opposed to using an existing specialist for primary care than patients with short time horizons. The aggregate level of primary care services may decrease if patients visit PCPs less frequently or if they switch to specialists for primary care. If the lost information is specific to patients' health, adverse events may increase in response to a PCP's exit, i.e. ED visits for urgent conditions, inpatient admissions, and death.

In the results that follow, I provide suggestive evidence for the importance of switching costs and the loss of PCP-specific information. For switching costs, I compare patients' rate of switching to specialists for primary care among patients who face large, medium, and small switching costs. Switching costs are largest when patients lose a PCP and clinic (clinic closures), medium when patients lose a PCP and do not have an existing relationship with the remaining PCPs at the clinic (individual clinics), and smallest when patients lose a PCP and do have a relationship with the remaining PCPs at the firm (team clinics). To quantify the importance of PCP-specific information, I compare patients with longer and shorter relationships with the same exiting PCP. If PCP-specific information grows over time, or if $\frac{\partial U(Length)}{\partial Length} > 0$, patients who had longer relationships with the exiting PCP should be more likely to substitute from the primary care to specialty setting in response to a PCP's exit. If information does not grow over time, or if $\frac{\partial U(Length)}{\partial Length} = 0$ and the curves are flat, patients with longer and shorter relationships should be equally likely to substitute to specialists after a PCP's exit.

4 Data Construction

4.1 Data Sources

My primary data source is a 20% sample of Medicare patients from 2008-2016. The data contains about 11 million patients and one million providers. The Medicare data captures all patient encounters with the health system paid by Medicare. Claims start when patients become eligible for Medicare (typically age 65) and end when patients die or enroll in Medicare Advantage (MA). All care delivered to patients is observed, such as outpatient care, inpatient care, and prescription fills. The data also includes a rich set of patient

demographics, such as sex, age, race, zip code of residence, and whether or not the patient is also in Medicaid.

A challenge is identifying the clinic where a PCP sees patients, also known as the doctors' office. Medicare data does not contain a clinic identifier, so I construct my own by combining the tax identification number (TIN) and nine-digit zip code (ZIP) associated with the claim. However, this definition may consider clinics located within the same facility as one clinic, when in fact they are separate. To overcome this, I exclude clinics with over 100 providers because larger "clinics" are more likely to be misspecified.¹⁰ This has the added benefit of increasing the probability that my treatment group has a common support. Larger clinics are mechanically more likely to have departures, so finding a large control clinic without a departure is challenging. For example, almost all clinics with over 100 PCPs experience a departure within a three year window. I also exclude non-US clinics because these are likely unique settings.

More generally, Medicare data is ideal for answering questions surrounding the health care workforce. It contains a nearly nationally representative sample of clinics and providers: 93% of American PCPs accept Medicare (Boccuti et al., 2015). Further, all providers are uniquely identified by their National Provider Identifier (NPI), a universal identifier used by providers when submitting billing claims.

The NPI identifier enables me to supplement the Medicare claims with information on providers from four other data sources: the National Plan and Provider Enumeration System, Doximity, Medicare's MD-PPAS, and Physician Compare. This enables me to identify providers' specialty, sub-specialty, sex, age, type of training, and whether NPIs belonged to individuals or organizations.¹¹

4.2 Primary Variable Construction

My identification strategy relies on being able to accurately define when a PCP leaves a clinic. I define a **departure** to occur when a PCP fully disappears from the data or relocates. Full disappearances occur at an average age of 59 (median 61), suggesting that these exits

¹⁰This excludes large organizations like the Cleveland Clinic, Kaiser, and Intermountain.

¹¹Analyses drop NPIs associated with an organization because it is unclear if a provider left during the period of interest. Table A1 illustrates the algorithm used for each year of data. Combining years, I resolve mismatches by taking the modal value across years.

are likely retirements. Relocations are defined as far moves where patients cannot follow the PCP, or when a PCP moves to a new clinic with a different three digit zip code.¹² I also identify cases when a PCP’s departure is followed by the main clinic closing, which occurs in 27% of cases. (See Appendix 1.1 for a more detailed definition of “clinic closure.”)

To compare treatment effects by the **length of the PCP-patient relationship**, I supplement years 2008-2016 in the main analyses with years 2002-2007 to identify relationship length.¹³ The length of the relationship is measured from the first time I observe the patient seeing the provider until 36 months before a PCP’s departure, where any visit within a year is a point of contact.¹⁴ I also drop patients who are less than age 75 as of $t = -36$ when I compare treatment effects by the length of the PCP-patient relationship. I do this to circumvent left censoring due to only observing patients when they become Medicare eligible at age 65. The restricted sample of patients is on average 81 years old, or 10 years older than patients in the main sample.

Team or an individual clinics are defined to be orthogonal to an individual patient’s outcomes. This is important because sicker and older patients are more likely to see multiple providers than healthier and younger patients. Therefore, defining team or individual at the patient level would consider sicker patients to be more likely to be in team clinics and healthier patients to be more likely to be in individual clinics. In order to extrapolate away from patient level observables, I define the model at the clinic level using all patients who visit a clinic within the first 12 months the clinic is observed in the data. I then restrict to patients who had three E&M visits over this 12 month period and categorize whether the three visits were with the same PCP. I then take the average rate over the clinic of how many patients exclusively saw one PCP, calling clinics above the average “individual clinics” and those below the average “team clinics.” I find that 59% of clinics were on individual models, where 58% of patients were seen by the same PCP for their first three E&M visits.

¹²This occurs when the first three digits of the new clinic’s ZIP is different from the original ZIP.

¹³I use 2008-2016 for main analyses because Medicare data uses UPINs, instead of NPIs, to represent PCPs from 2002-2007. I derive a UPIN to NPI crosswalk to connect NPIs used in my main analyses to their corresponding UPIN in pre-2008 years. However, this crosswalk is not perfect and I am unable to define the relationship length for 12% of patients and their PCPs. Analyses comparing patients by the length of their relationship thus excludes this group because their PCP’s NPI did not match to a UPIN.

¹⁴Defining the length of the relationship in this way may bias estimates toward zero because patients are categorized as having a long relationship regardless of the frequency of the interaction between the first and last point of contact. For instance, if a patient interacted with a PCP once 10 years before visiting them again from $-24 \leq t \leq -12$, I would categorize their relationship as lasting 10 years. This is a more tenuous link than a patient who has seen their PCP yearly for 10 years.

I also categorize the **local density of PCPs** to define the thickness of the local PCP market. The local density of PCPs is defined as the number of PCPs filing billing claims within a 30 mile radius of each focal clinic ZIP divided by the population.¹⁵

I use three different patient level definitions: **risk**, **disability**, and **racial** status. First, I define a patient's risk level using their calculated Elixhauser Index, which creates an index based on comorbidities and pre-existing conditions that are predictive of death by scanning over a patient's ICD-9 diagnosis codes. I use diagnosis codes three years before the departure to circumvent the potential endogeneity of patient outcomes to treatment.¹⁶ High risk patients are defined to be patients with the top quartile of Elixhauser scores within a PCP's pool of patients. Second, disabled individuals include patients with spinal cord injuries, blindness, mobility impairments, muscular dystrophy, chronic pain fatigue/fibromyalgia, spina bifida, multiple sclerosis, and cystic fibrosis. The three largest groups are chronic pain fatigue/-fibromyalgia, mobility impairments, and visual impairments. Third, I classify a patient's racial status based on the race variable in the Master Beneficiary Summary File.

Main outcomes include utilization of clinic based services and quality of care. Utilization includes primary care visits, specialist visits, and urgent care visits.¹⁷ Patients use of these settings has an ambiguous effect on patient health on aggregate. However, when dividing visits by the type of care received, services specific to the setting are best delivered in that setting because of the specialization of labor: PCPs specialize in primary care and specialists specialize in their specialty.

Each claim contains billing codes used for payment, which I leverage to classify if the visit is by a new or existing patient. For this classification I use evaluation and management (E&M) codes, which include annual exams, wellness visits, physician exams, and consultations.¹⁸

¹⁵A 30 mile radius was chosen because patients were found to travel 17 miles on average from their home to their assigned clinic, which was defined to be patients' modal clinic. The distance between five digit zip codes were great-circle distances calculated using the Haversine formula based on internal points in the geographic area. The data set was obtained from the NBER at <https://www.nber.org/data/zip-code-distance-database.html>.

¹⁶I then combine these individual scores to an aggregate score for each patient, which I use as my measure of riskiness.

¹⁷I use the outpatient files to identify urgent care visits.

¹⁸New patients are patients who did not receive any professional services from the physician (or non-physician) or another physician of the same specialty in the same group practice within the previous 3 years. Existing patients are individuals who received care from the physician (or non-physician) or another physician of the same specialty in the same group practice within the previous three years. CMS' coding rules can be found here: <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/eval-mgmt-serv-guide-ICN006764.pdf>

A major advantage to using E&M codes is that patients are only considered new if they have not seen that physician or another physician of the same specialty in the clinic within the previous 3 years. This allows me to more cleanly identify the demand side (patients seeking out new relationships) opposed to supply side changes (patients being transferred to replacement PCPs within the clinic).

Of all primary care visits, about 75% are for E&M visits and, of these, 96% are for existing patients and 4% are for new patients. Comparatively, E&M visits are much less common in the specialty setting. Specialists bill for E&M visits 24% of the time and, of these, 12% are for new patients and 84% are for existing patients. As a result, E&M codes should be considered as a proxy for whether or not the patient was new or existing because some visits may not be categorized.

Quality of care metrics include adverse events, preventive care, and medications. Adverse events include death as well as ED visits for non-preventable conditions and inpatient admissions.¹⁹ Preventive care includes influenza (flu) vaccines, annual exams, and preventive screens.²⁰ Preventive screens include: mammography screens, colorectal cancer screens, cholesterol screens, and diabetes screens.^{21,22} The medication category separately quantifies the total number of medications as well as only chronic medications.²³ About 37% of all medication prescriptions are for chronic medications.

4.3 Sample Restrictions

Figure 2 illustrates the creation of the PCP sample. The sample was constructed to avoid three main issues. First, a main limitation to the Medicare data is that it is a 20% sample

¹⁹The ED visit classification relies on an algorithm by Billings, Parikh and Mijanovich (2000) with updates by Johnston et al. (2017).

²⁰Obtaining a yearly flu vaccine is widely considered a key input into patient health, especially among the elderly. In spite of the presumable salience of this fact, many patients do not receive a yearly flu vaccine. For instance, the Centers for Disease Control and Prevention reported that 59.6% of adults over age 65 received a flu vaccine during the 2017-2018 flu season (CDC, 2018).

²¹The rate of mammograms was categorized as the total number of mammograms within a PCP's pool of patients divided by the number of *women* in that PCP's patient pool.

²²Preventative care was identified from the carrier file's Health care Common Procedure Coding System codes based on a crosswalk used by Centers for Medicare and Medicaid Services to categorize quality scores for Accountable Care Organizations (ACO) in the domain of preventative health. <https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/medicare-preventive-services/MPS-QuickReferenceChart-1.html>

²³More detailed information on the medication definition is in Appendix 1.1.

of patients. As a result, it is possible to miscategorize a PCP as departing if the PCP’s patients are not part of the 20% patient sample. To get around this, I restrict to PCPs who saw more than 30 total patients in months $-36 \leq t < -24$.²⁴ Once I condition on seeing 30 patients, treatment PCPs see on average 130 patients (median 88) and control PCPs see on average 156 patients (median 115) from $-36 \leq t < -24$. This sample yields a departure rate of 12% from 2011 to 2014 (Table A2). See Appendix 1.2 for more details on departures.

Second, compositional changes in the number and types of patients seen around a PCP’s departure is an issue for identification. For instance, PCPs may transfer their sicker patients to replacement PCPs before their healthier patients (or vice versa). To address this, I use a sample of PCPs that I observe practicing three years before the departure. I then assign patients to PCPs 2-3 years before the departure to circumvent the endogeneity of visits around the departure. To create a parallel control sample, I restrict to control PCPs who are in the data for 48 months, 3 years before and one year after the departure. Third, relative time for the control group needs to be constructed because control PCPs do not depart over the relevant window. To address this I match control and treatment PCPs in month $t = -36$, or 36 months before a PCP’s exit, to define relative time.²⁵

5 Empirical Strategy

I implement a difference-in-differences (DD) design where I match 10,437 PCPs who left a physician group in a given month-year to a comparison group of 10,437 PCPs with similar lagged characteristics, that did not relocate or retire. I then analyze the effect of the departure using 627,647 patients associated with either control or treatment PCPs.

5.1 PCP Matching Procedure to Select Comparison Group

Departing and staying PCPs may be different along at least three dimensions. First, Figure A1a shows that departing PCPs are slightly older than staying PCPs on average.

²⁴30 was chosen because treatment PCPs see 67 total patients on average (median 26) and control PCPs see 32 total patients on average (median 0) over my *unrestricted* primary care sample. Note, the reason treatment and control PCPs have such different patient loads over the *unrestricted* primary care sample is because there are a lot of PCPs in my sample that see very few patients.

²⁵If a control PCP works in a physician group that experienced a departure, they do not enter the control sample.

Older PCPs may be different from younger PCPs. They may have older patients or have specific practice styles. Second, the rate of departure as well as practice styles may differ by whether the PCP is a nurse practitioner (NP), physician assistant (PA), or medical doctor/doctor of osteopathy (MD) as well as the gender of the PCP. Third, the physician workforce is in the midst of a burn out crisis and a growing number of PCPs are leaving clinical practice (Sabety, 2019).

To adjust for these differences, I match observably similar treatment and control PCPs one-to-one, three years before the departure. I match exactly on month-year of calendar time, which enables me to derive a relative time measure for control PCPs and their associated patients. I also match exactly on PCP sex and the type of PCP (i.e. NP, PA, or MD) as well as four coarsened bins of PCP age in $t = -36$ and 10 coarsened bins of the number of patients seen. This matching procedure follows the standard in the literature.²⁶

I intentionally match on time invariant covariates to address the potential for mean reversion. The one exception to this is the number of patients seen in $t = -36$, which is a lagged covariate. Matching on the volume of patients is important because PCPs who see large volumes of patients may be more likely to leave practice than PCPs who see fewer patients, which in turn could affect patient outcomes.

I then assign patients to PCPs based on their modal number of E&M visits 3-2 years before the departure. I use E&M visits for the assignment in order to isolate visits made to a patient’s PCP as opposed to secondary staff.^{27,28} A similar procedure was used to define the clinic level sample, which is detailed in Appendix 2.

²⁶I use coarsened exact matching (CEM) following recent literature (e.g. Jäger, 2017; Jaravel, Petkova and Bell, 2018; Sarsons, 2017; Azoulay, Zivin and Wang, 2010) as well as work arguing that CEM is more transparent and interpretable than other approaches, such as propensity score matching (e.g. King and Nielsen, 2016; Iacus, King and Porro, 2012). In determining the number and coarseness of matching covariates I minimize the number of covariates while maintaining balance to maximize the number of successful matches.

²⁷Section 4.2 provides additional details on E&M visits.

²⁸This allocation method follows the standard in the literature (Pollack et al., 2016). If a patient is assigned to a PCP that is not in the matched sample, that patient is not included in analyses. If I assign away all of a PCP’s patients, I not only drop that PCP from my sample, but I also drop the matched pair.

5.2 Summary Statistics

Table 1 describes summary statistics for PCPs and patients by treatment status. The goal of the matching process is to create a balanced comparison group. The difference-in-differences design then absorbs average levels of outcome variables between control and treatment groups, relying on a common-trends assumption (see Section 5.3). The illustration of summary statistics confirms that the matching procedure created a balanced comparison group for the difference-in-differences design. Further, it provides context when interpreting treatment effects.

Match Rate. The first section of the table illustrates the match rate and resultant sample size. Of treated PCPs that meet the sample restrictions, 90% are matched, or 10,437 control and treatment PCPs. This translates to 298,943 treated patients and 328,704 control patients, or 57,914,522 PCP-patient-time observations. Table A3 illustrates that the strongest restriction is exactly matching on whether or not the PCP was a NP, PA, or MD.

PCP Matching Covariates. The second panel shows that the matching covariates defining the coarsened bins are fairly balanced. Treated patients are 0.4 years older than control PCPs, which does not appear to be an economically meaningful difference. Both treated and control PCPs see 12.2 patients in $t = -36$. In addition to PCP age and caseload, which are displayed in Table 1, the type of the PCP (NP, PA, or MD), PCP gender, and month-year of calendar time are exactly matched on.

Characteristics of Patients by Treatment Status. The third section of the table shows that treated and control patient characteristics are broadly similar, although there are some differences. Treated patients are more likely to be white and live in rural areas. They are also slightly healthier, being less likely to have end stage renal disease and be enrolled in Medicaid. Treated patients also see slightly more PCPs (1.6 v. 1.1) and specialists (3.4 v. 2.7). This suggests that the loss of a PCP may impact treated patients slightly less than control patients, had they also lost a PCP.

5.3 Estimating Equations and Identification

I estimate the causal impact of a PCP’s departure on patient outcomes using an event study, difference-in-differences design. In particular, equations are of the form:

$$y_{jt} = \rho_{m(j)} + \sum_{\tau=-24}^{12} \beta_{\tau} \times \mathbf{1}(t = \tau) + \sum_{\tau=-24}^{12} \beta_{\tau}^{Treated} \times \mathbf{1}(t = \tau) \times Treated_j + \epsilon_{jt} \quad (1)$$

where y_{jt} denotes the average outcomes over PCP j 's pool of patients in relative time t . $\mathbf{1}(period_t)$ includes relative time t fixed effects. $\rho_{m(j)}$ are PCP fixed effects, which absorb average differences across PCPs.²⁹ I cluster the standard errors at the pre-departure PCP-match level to account for idiosyncratic factors that are specific to a matched pair. This assumes that each matched pair's errors are uncorrelated with other matched pairs. As outlined in Section 4.3, I restrict the data to support the plausibility of this assumption. Identification is based on comparing outcomes within a PCP's group of patients to the matched control PCP's pool of patients, relative to the omitted group.

For *event study graphs* that follow patients one year post-departure, t is the month-year relative to the departure at $t = 0$. The coefficient of interest, $\beta_t^{Treated}$, captures the effect of a departure in month-year t and is normalized to zero in $t = -24$.

Regressions are at the relative year level. All estimates are relative to $24 \leq t < -12$.^{30,31} This allows for anticipation up to 12 months before a PCP's exit. Visually inspecting event study graphs supports this assumption. The main results use a sample that follows patients for one year post-departure unless otherwise specified.

6 Aggregate Impact of the Loss of a PCP on Patients

This section shows that a PCP's exit has a significant impact on patient care. I start by describing how visits to patients' main PCP and clinic change after a PCP's departure. I then show how patients are impacted by the loss of a PCP on aggregate. I explore the specific mechanisms behind these results in Section 7.

²⁹As a robustness check, I also estimate main results with PCP-match fixed effects, which leads to virtually identical standard errors. I additionally estimate the main specification clustering at the firm level, yielding similar results.

³⁰I start at the patient level and sum over patient i 's y_{ijt} s within a PCP's pool of patients. I then normalize this outcome by the number of patients in each PCP's pool. I then sum over the monthly PCP level averages of each outcome to get the yearly rate. As a result, frequency weights are used in all regressions to obtain estimates that are representative of the original population. Regressions are run at the PCP-year level.

³¹For specifications that use more than one post year, a dummy is included for each year relative to treatment, which is then interacted with treatment status.

Figure 3a and 3b illustrate the identifying variation. Graphs plot the average number of visits to assigned PCPs and clinics over relative time t for one year post-departure. For instance, if the average number of primary care visits per month is 0.3, patients visit their main PCP slightly more than three times a year. Blue triangles represent control patients and red crosses represent treated patients. Patients are assigned to PCPs from $-36 \leq t < -24$, $t = -24$ marks the start of the treatment period, and $t = 0$ marks the last month exiting PCPs see patients.³² Treatment and control patients do not visit their main PCP at the same rate because treated patients see slightly more PCPs than control patients (1.6 vs. 1.1 PCPs) and therefore see the main PCP slightly less (Table 1).

Figure 3a shows that after a PCP exits in $t = 0$, patients no longer see that PCP for primary care. Treated and control patients see their assigned PCPs at the same rate as illustrated by curves moving in parallel. Both curves slope downward due to mean reversion and patients dying over time. Curves begin to separate around 8 months before the departure implying that exiting PCPs see fewer patients leading up to the departure. As a result, I estimate event studies relative to $t = -24$ and regressions relative to $-24 \leq t < -12$ to allow for anticipation up to -12 months before the departure. Figure 3a shows that visits decrease from 0.24 visits at $t = -1$, to 0.17 visits at $t = 0$, to 0 at $t = 1$ in response to a PCP's exit. Visits are not zero in $t = 0$ because PCPs stop seeing patients at various times during the month.

Figure 3b graphs the number of visits a patient makes to the main clinic over time. The graph is similar to Figure 3a except slightly closer in terms of levels. In response to a PCP's departure, patients' decrease their rate of visiting the main clinic 47%, or from 0.32 visits in $t = -1$ to 0.15 visits in $t = 1$. For more context, Figure 3c graphs the number of PCPs *per clinic* two years before and after a PCP's departure. It shows that clinics slowly replace PCPs and that the replacement rate is not one-to-one.³³

³²Treatment and control PCPs are matched in $t = -36$ and patients are assigned to the PCP (and clinic) that provided the majority of their primary care from $-36 \leq t < -24$. The first month in the post-departure period is $t = 0$

³³This graph is based on a sample that matches clinics (instead of PCPs), which is used for clinic level analyses in Section 7.5. See Appendix 2 for more details on the clinic level sample.

6.1 How the Loss of a PCP Affects Patient Outcomes

Figure 4 shows the effect of a PCP’s departure in the raw data. The x-axis contains time relative to the departure in $t = 0$, where relative time is measured in months. Treated patients are represented by red crosses, whereas control patients are represented by blue triangles. Figure 4a shows the raw number of primary care visits per month in a sub-sample that follows patients one year post-departure. Figure 4b shows the probability a patient forms a new relationship as a cumulative hazard rate. Figure 4c graphs the probability a patient forms a new relationship by relative time t . Figure 4b and Figure 4c use a sub-sample that follows patients four years post-departure.

Figure 5 plots coefficients $\beta_t^{Treated}$ at the quarter level, based on equation 1. Coefficients are only identified up to a constant term, so $t = quarter = -8$ is normalized to zero. Primary care visits (black line, with triangle points) and specialty visits (blue line, with circular points) are dependent variables in Figure 5a. The number of chronic medications prescribed by PCPs (black line, with triangle points) and specialists (blue line, with circular points) are dependent variables in Figure 5b. Figure 5c plots the number of ED visits and Figure 5d plots the number of ED visits for primary care treatable conditions. Lending credibility to the research design, there is no significant pre-trending from $-8 \leq t < -4$ for any of the outcome variables.

Figure 4a and Figure 5a show a sharp, discontinuous, and long-term decrease of -0.92 primary care visits per year when a PCP exits (16.9% decrease). Figure 4a shows that PCP visits dip about 0.02 visits below the long-term rate the month after a PCP’s departure ($t = 1$). This suggests that patients do not immediately rematch to replacement PCPs.

The long-term decline in primary care visits is due to decreases in the number of patients visiting PCPs at least once (extensive margin) as well as the number of visits per patient (intensive margin). Further, patients predominantly shift to PCPs they know over starting new PCP relationships. Table 2 shows that 87% of patients visited a PCP at least once per year from $-8 \leq t < -4$, a rate that declines by 0.11 percentage points (pp) the first year after exit. The number of visits among patients who visit a PCP at least once also declines by 18.6%, or 1.2 visits per year. Of the PCP visits made by patients, 90% are to PCPs that patients had a pre-existing relationship with the first year post-departure.³⁴ Patients who

³⁴Table A16 shows estimates for E&M visits. $90\% = (3.1 \text{ existing E\&M} - 0.73 \text{ point estimate}) / (3.2 \text{ all E\&M} - 0.57 \text{ point estimate})$.

lose a PCP are only 10 pp more likely to form a new relationship than patients who do not lose a PCP over the four years post-departure (Figure 4b and Figure 4c).^{35,36}

Partially offsetting the decrease in PCP visits, the blue line in Figure 5a shows a 0.48 increase in specialty visits which is immediate and sustained (5.1% increase). This is driven by patients shifting to specialists they are familiar with: 80% of specialist visits are to specialists that patients have an existing relationship with (Table A16).³⁷ Further, increases are primarily driven by the intensive margin. The number of patients with at least one specialist visit increases by 1.3%, whereas the number of visits among patients with at least one visit increases by 9.4% (Table 2).

When patients decrease their use of PCPs and increase their use of specialists, this affects where patients receive preventive care. Specialists administer significantly *more* flu vaccines, annual exams, preventive screens, total prescriptions, and chronic medication prescriptions after a patient's PCP exits, whereas PCPs administer significantly *fewer* (Table 3). The number of preventive screens and flu vaccines administered in retail settings also significantly increase post-departure (Table A19). On aggregate, this translates into patients receiving 6.4% fewer flu vaccines, 25.0% fewer annual exams, and 2.2% fewer preventive screens the first year post-departure (Table 2). Although Table 2 shows that all prescriptions as well as chronic prescriptions do not change on aggregate, patients' prescription regimens change in potentially beneficial ways. Prescription process measures show that there is an increase in new medication prescriptions as well as an increase in patients switching prescriptions within the same medication class post-departure (Table A19). Further, the number of opioid prescription fills significantly decrease.

Results show that patients increase their use of specialists for primary care. This suggests that patients are substituting to existing specialists for primary care instead of establishing new PCP relationships. To provide further support for this, I show that patients substitute to specialists who act closest to PCPs—e.g. nephrologists, cardiologists, and gastroenterologists—opposed to specialties that deliver short-term, condition specific care, such as surgeons (Table A19).

In addition to patients substituting to specialists for primary care long-term, there are

³⁵See Table A17 for results that follow patients four years post-departure.

³⁶Main effects are maintained when practice size is added as an additional matching covariate (Table A18).

³⁷Table A16 shows estimates for E&M visits. $80\% = (2.5 \text{ existing E\&M} + 0.16 \text{ point estimate}) / (3.1 \text{ all E\&M} + 0.23 \text{ point estimate})$.

also short-term disruption costs. Urgent care visits increase by 0.0025 visits per year, ED visits increase by 0.033 visits per year, and inpatient admissions increase by 0.011 visits per year (Table 2 and Figure 5). These increases are isolated to the first year post-departure (Table A17). Figure 5 shows that patients increase their use of the ED for primary care treatable conditions by 0.016, or about 50% of the increase in total ED visits. ED visits for not preventable conditions also significantly increase, but at a smaller rate of 0.0084 visits per year. As a falsification test, I show that injuries are not significantly affected (Table A16).

The increase in ED and inpatient use suggests patients' health is adversely affected by a PCP's exit. However, I am unable to reject the null of no change in the probability of death, although the confidence intervals suggest it is between -1% and +7%. As a result of these shifts, patients spend \$32 more out-of-pocket and \$142.7 more in total charges the first year after a PCP's exit (Table 2). Most of this increase is due to increased ED and inpatient use. Table A16 shows that ED and inpatient charges increase by \$105.50, or 74% of the total increase, although it is not significantly different from zero. In a 100% sample of Medicare patients, where the average PCP sees 29 unique patients, this translates to \$4,640.00 in increased out-of-pocket costs and \$20,691.50 in increased total costs per exiting PCP. Medicare's cost is \$16,051.50 (\$20,691.50 - \$4,640.00). This should be considered a lower bound for the costs associated with a PCP's exit because it only includes Medicare patients.

Results show that a PCP's departure affects patients' health care consumption and outcomes. Patients clearly substitute away from PCPs to specialists for primary care long-term. Much of the increase in specialty and ED visits is driven by patients using non-primary settings for primary care. The loss of a PCP also adversely affects patient health. The aggregate level of preventive care declines long-term, where preventive care is considered to be a positive input into patients' health. Further, although death does not significantly change, patients increase their use of the ED and inpatient settings short-term, signaling that adverse events increase in response to a PCP's exit.

6.2 Additional Results and Robustness Checks

In addition to analyzing pre-trends, I test for differential attrition into Medicare Advantage (MA). I do not observe patients when they switch to MA, so this could create an issue if

patients who switch to MA are different than patients who stay in TM. This test addresses at least two concerns. First, if a PCP stops taking Traditional Medicare (TM) patients, this would be categorized as an exit. In response, patients may switch to MA in order to continue seeing their PCP. Second, patients may switch to MA to access additional services or providers in response to the loss of a PCP. Alleviating these concerns, Table A16 shows that patients do not systematically switch into MA in response to a PCP’s exit. This then motivates dropping patients that switch to MA from the main sample to reduce noise.

I also test if clinic level changes cause PCPs to exit. This would imply that effects attributed to the PCP’s departure may instead be due to changes occurring at the clinic level. To test for this, Figure A2 plots the number of PCPs exiting over time. It shows that PCP exits occurring after the main PCP departs do not systematically happen at the treatment threshold, but rather the line trends smoothly downward two years post-departure. This implies that there are not systematic changes occurring at the clinic that are driving effects.³⁸

7 Why is the Relationship Valuable?

7.1 The Cost of Forming New Relationships

PCP visits may decrease and specialist visits may increase when a PCP leaves because patients face switching costs when establishing new PCP relationships. These costs occur whenever a patient invests in a specific provider and this effort has to be duplicated for any new provider the patient visits (Farrell and Klemperer, 2007). If costs are large, patients will substitute to existing PCPs and specialists instead of starting new PCP relationships.

I compare patients likelihood of substituting away from primary care to specialty care by the size of the switching cost, which depends on the clinic environment. Switching costs are largest when patients have to find a new PCP and clinic, medium when a patient can remain in the same clinic but has to find a new PCP, and small when a patient can remain in the same clinic and can switch to a PCP they are familiar with. This occurs when clinics close when a PCP exits, when clinics remain open and PCPs have a one-on-one relationship with

³⁸Three other tests are still in progress. First, I focus on a group of PCPs who were not pre-replaced. Second, I focus on PCPs who do not wind down their patient load pre-departure. Third, I isolate PCPs whose patients didn’t leave their PCP and go elsewhere pre-departure. I will ensure that effects are maintained across subgroups.

patients, and when clinics remain open and are managed to practice as a team. Within open clinics, patients in individual clinics are less familiar with remaining PCPs at the clinic than patients in team clinics. Patients are therefore monotonically less likely to have to form a new PCP relationship across options.

PCPs and patients of clinics that closed versus stayed open are observably quite similar, with the exception of clinic size. Table A7 shows that clinics that close when a PCP departs have on average 1.5 PCPs at baseline, whereas those that stay open have on average 12.7 PCPs. Given size differences, it could be the case that smaller clinics that remain open post-departure are a better counterfactual than the aggregate open clinic category. Regardless, results are robust to size (Table 7, Table A32, and Table A30).

Table A8 shows balance across individual and team control clinics. PCPs working in team clinics are more likely to be female. Team clinics are also twice as likely to have a NP or PA on staff and have 3 times more PCPs on average than individual clinics (12.6 v. 4.4). Patients in individual clinics are less likely to be white, more likely to be enrolled in Medicaid, have more primary care visits, and have a similar number of specialty visits 3-2 years before a PCP’s exit compared to patients in team clinics. Patients in individual clinics also have smaller primary care and specialty networks than patients in team clinics. Patients in individual clinics visit 1.1 PCPs and 2.6 specialists on average, whereas patients in team clinics visit 1.8 PCPs and 3.8 specialists on average 3-2 years before exit.^{39,40}

Patients’ use of primary and specialty care across clinic environments is shown in Figure 6, which plots estimated coefficients $\beta_t^{Treated}$. Following equation 1, t is estimated at the month level. Coefficients are only identified up to a constant term, so the value for $t = month = -24$ is normalized to zero. Figure 6a overlays primary care and specialty visits. It includes clinics that close (green line), stay open and practice individually (blue line), and stay open and practice as a team (red line). The next two panels take the decrease in primary care visits from the main figure and focus on the differences between individual and team clinics. Figure 6b shows how primary care visits change on aggregate, which mirrors what is plotted in Figure 6a with the addition of confidence bands. Figure 6c breaks aggregate primary care

³⁹Given differences, one may be concerned that control PCPs are not an appropriate control group. Table A22 shows results when matching on whether the clinic was on an individual and team model, showing extremely similar results.

⁴⁰Main results use an individual and team clinic definition that uses an above and below average threshold. (See Section 4.2 for more details on how the groups were defined.) As a robustness check, Table A23 uses the 25th, 50th, and 75th percentile as cut-offs and shows that results are qualitatively the same.

visits into primary care visits at the main clinic and visits at other PCP clinics.

Figure 6a shows that as switching costs decrease, patients are less likely to substitute away from the primary to specialty care setting. Patients decrease their use of primary care by -1.3 visits per year when clinics close, -0.76 visits per year in open individual clinics, and -0.69 visits per year in open team clinics. Patients increase their use of specialists by 0.82 visits when the clinic closes, 0.42 visits in open individual clinics, and 0.23 visits in open team clinics. ED visits follow the same pattern. ED visits increase by 0.047 visits per year when the clinic also closes, 0.039 visits per year in open individual clinics, and 0.018 visits per year in open team clinics (Table 4).⁴¹

Figure 6c focuses on the aggregate -0.76 and -0.69 primary care visit decline in open individual and team clinics. Patients in individual clinics are more likely to leave main clinics and visit an alternative primary care clinic than patients in team clinics. Visits to the main clinic decrease by 2.1 visits for individual clinic patients and 1.7 visits for team clinic patients. Visits to other primary care clinics increase by 1.4 visits among individual clinic patients and 0.98 visits for team clinic patients.

Taken together, results suggest that patients face switching costs when establishing new PCP relationships. These costs appear higher than visiting the ED in the short-run and specialists in both the short- and long-run for primary care. These costs may be physical, such as finding a new clinic, as well as psychological, such as switching to a new PCP within a main clinic.

7.2 Do Patients Lose PCP-Specific Information?

PCP-patient relationships may contain valuable information that cannot be transferred to replacement PCPs. If information accrues within a specific PCP-patient relationship, effects should be larger among patients with longer PCP-patient relationships (Jovanovic, 1979a). To test for this, I compare patients by the length of their relationship with the exiting PCP, or quartiles of relationship length: 3 year, 4-9 year, 10-11 year, and 12-13 year long relationships.⁴²

⁴¹Table A21 shows results after also matching on practice size. Table A22 shows results after matching on whether the clinic practiced on a panel or individual model.

⁴²See Section 4.2 for more details on how this sample was defined. Table A10 compares *control* patients by the length of the relationship and shows that patient groups are extremely similar.

To give a sense of whether this strategy creates balanced groups, Table A10 compares patients with 3 year long relationships, the bottom quartile of relationship length, to patients with longer relationships, or 4-13 year long relationships. Patients with shorter and longer relationships are similar, except for the size of their existing PCP networks. Patients with 3 year relationships see 6.4 PCPs and 17.7 specialists 3-2 years before the departure, whereas patients with 4-13 year relationships see 2.9 PCPs and 8.4 specialists. This suggests that patients with shorter relationships have more external relationships.

Figure 7 plots estimated coefficients $\beta_t^{Treated}$ the first year post-departure by the length of the PCP-patient relationship. Estimates are based on an equation similar to equation 1, but t is estimated at the year level. Coefficients are only identified up to a constant term, so the value for $t = year = -2$ is normalized to zero. All analyses compare patients with the same exiting PCP to control for PCP as well as clinic level factors that may be different between groups. The first panel contains outpatient visits, or the sum of primary and specialty visits. The second panel estimates primary and specialty care visits separately. The third panel plots adverse events, which are defined to include not preventable ED visits, inpatient admissions, and death.

Figure 7a shows that patients decrease their use of outpatient care similarly by the length of the relationship. Although on aggregate there is no change, estimating primary and specialty visits separately shows that patients likelihood of substituting away from primary care to specialty care increases across the length of the relationship (Figure 7b). This suggests that PCP-specific information grows over time and that patients with longer relationships with the exiting PCP receive differentially less benefit from replacement PCPs.

To understand the quality of the lost information, Figure 7c shows the rate of adverse events by relationship length. If the lost information directly impacts patients' health, adverse events should increase with the length of the relationship. Whereas if the information is more psychological (e.g. trust and likability), adverse events should not be correlated with the length of the relationship. Figure 7c shows that adverse events, although noisy, do not monotonically increase with the length of the relationship. This suggests that the lost information may be more psychological in nature.

However, it could instead be the case that patients with longer PCP relationships are more likely to switch to specialists because good matches last, not because PCP-specific information grows over time. I consider two models of match quality that could explain these results. First, if we assume that patients draw a random PCP each time they search,

patients with better versus worse initial PCP matches should be equally likely to find a good match. Patients with longer and shorter relationships should therefore decrease their use of primary care similarly, an empirical fact that is not borne out in the data.

Second, patients with good initial matches may have a harder time finding a PCP that is a similarly good match. Patients with shorter relationships should therefore be more likely to recover to their pre-departure level of primary care use than patients with longer relationships. I quantify this in Figure A5, which plots the number of primary care visits per quarter for four years post-departure ($\beta_t^{Treated}$ in equation 1), where $t = quarter = -8$ is normalized to zero. I compare patients with the shortest quartile of relationship length to patients with quartiles 2-4 (3 year to 4-14 year long PCP-patient relationships).⁴³ Figure A5 shows that both groups of patients immediately decrease their use of primary care, a decrease that is maintained for at least four years post-departure. This goes against what we would expect if match quality explained results. Rather, pairing this result with Figure 7 suggests that experience increases linearly with increases diminishing over time.

7.3 Are Patients Unable to Find a PCP that is a Good Match?

PCP-specific information may be match specific, where good matches are hard to find (Jovanovic, 1979b). If patients decrease their use of primary care because they cannot find a good match, effects should be magnified among patients with more specific needs. To test for this, I compare patients that are high risk, disabled, and of a minority race. Female patients may also prefer having a female PCP, so I compare female patients to male patients with the same female exiting PCP.

Tables A12-A15 give a sense of how these groups observably differ. Table A12 shows that high risk patients are about 3 years older on average, are more likely to be in end stage renal disease as well as enrolled in Medicaid than lower risk patients.⁴⁴ They also use the medical system at a higher rate and have larger PCP networks. The average high risk individual visits a PCP 8.1 times and sees 4.1 different PCPs per year, whereas the average not high risk individual visits a PCP 5.5 times and sees 1.4 PCPs per year.

Similarly, Table A13 shows that disabled patients look fairly similar to high risk patients. They are higher risk and use the medical system at a higher rate than not disabled patients

⁴³See Table A24 for the pooled estimates. See Table A25 for results based on matching also on practice size.

⁴⁴See Section 4.2 for more details on how this group was defined.

(7.4 vs. 5.6 primary care visits per year). Table A14 compares minority and white patients. Minority patients are twice as likely to be also enrolled in Medicaid as well as in end stage renal disease. While minority patients use more ED care than their white counterparts, they also use less primary care, specialty care, and urgent care. They see 6.0 PCPs and 13.7 specialists in a given year, whereas white patients see 1.6 PCPs and 3.9 specialists. This suggests that minority patients may interact with the health system differently than white patients.

Female and male patients who have the same female PCP are also compared. If patients decrease their use of primary care because it is hard to find a good match, female patients who lose a female PCP should take longer to re-match if patients prefer female PCPs. Table A15 compares balance between groups. Male patients are two years older and less likely to be in end stage renal disease than their female counterparts, but otherwise look fairly similar. Female patients also have larger primary care and specialty networks.

Figure 8 plots estimated coefficients $\beta_t^{Treated}$. Following equation 1, t is estimated at the quarter level. Coefficients are only identified up to a constant term, so the value for $t = quarter = -8$ is normalized to zero. Figure 8a compares high risk to low risk patients, Figure 8b compares disabled to not disabled patients, Figure 8c compares minority to white patients, and Figure 8d compares male to female patients with exiting female PCPs. Table 5 contains relevant point estimates, that are pooled over the entire year. All analyses control for PCP as well as clinic level factors that may be different between groups by comparing patients with the same exiting PCP.

Patients with more specific needs should be (a) less likely to re-match to a PCP and (b) more likely to substitute from primary to specialty care if it is harder for them to find a good match. Figure 8 shows that all patients decrease their use of primary care for at least four years after a PCP's exit, with no sign of recovering. This suggests that patients with more specific needs are not less able to re-match to a PCP. In terms of the rate of substitution from primary to specialty care, high risk patients decrease their use of primary care and increase their use of specialty care more in terms of the number of visits, but less in terms of percent changes. Disabled patients are less likely to substitute away from the primary care to specialty setting, which is counter to what we would expect if disabled patients had a harder time matching to a replacement PCP. Minority and white patients decrease their use of primary care similarly, but minority patients are more likely to switch to a specialist,

which may suggest that minorities like their replacement PCP less than white patients.⁴⁵ When comparing male to female patients with female PCPs, both groups decrease their use of primary care similarly and males are more likely to increase their use of specialists. In sum, there is limited evidence to support match quality along these dimensions as a relevant mechanism.

7.4 Are Patients Unable to Find a Replacement PCP?

Patients may substitute away from the primary care setting towards specialty care because they are unable to find a replacement PCP. If the availability of PCPs drives the decrease in primary care visits, patients in thinner markets should be less able to find a new PCP than patients in thicker markets. Patients in thinner markets should therefore decrease their use of primary care more than patients in thicker markets.

To understand the relevance of this mechanism, I compare the probability a patient forms a new PCP relationship as well as the number of PCP visits by the local density of PCPs. This is defined as the number of PCPs filing billing claims within a 30 mile radius of each focal clinic ZIP divided by the local population. I focus on clinics that remained open after a PCP's departure because clinics may be more likely to close in rural areas. Thick markets are defined to be above average density areas and thin markets are below average density areas.

Table A9 compares observables between high and low density areas 3-2 years before a PCP's departure. Groups are fairly similar except patients in thin markets are more likely to live in rural areas. Figure 9 plots estimated coefficients $\beta_t^{Treated}$ from equation 1, where t is estimated at the month level. Coefficients are only identified up to a constant term, so the value for $t = month = -24$ is normalized to zero. The first panel shows total primary care visits and the second panel the number of new patient visits.

Figure 9 shows that patients in thicker markets are *less* likely to establish a new PCP relationship than patients in thinner markets (2.4% vs. 3.3% of visits, $p = 0.001$). Further, primary care visits decrease by similar amounts in thin and thick markets. This provides evidence against the local availability of PCPs affecting patients' rate of using primary

⁴⁵Ideally, I would be able to compare minority to white patients with minority PCPs, but, unfortunately, the data limits my ability to determine the race of a PCP.

care.^{46,47}

7.5 Are Patients Unable to Access Care at Focal Clinics?

Patients may substitute to non-primary care settings because they are unable to access care at main clinics. I test this in two ways. First, I quantify the number of patients seen by staying PCPs after a PCP exits. I then show how these changes affect outcomes among staying PCPs' patients. If one assumes that staying PCPs treat their existing set of patients the same as the patients they inherit from exiting PCPs, this should indicate if directly affected patients are impacted vis-à-vis staying PCPs. Second, I compare treatment effects by the size of patients' home clinic. If clinics are constrained in their ability to care for patients, patients in smaller clinics should be more affected than patients in larger clinics.

Firm Disruption and Network Effects. A long literature has studied how firms compensate for the loss of a worker, starting with [Slichter \(1919\)](#). However, much less work has examined how the loss of a worker affects the quality of a firm's outputs, especially in the health care context. I estimate spillovers by moving to the clinic level and matching clinics instead of PCPs (see [Appendix 2](#) for details on the sample). I then quantify how the loss of the main PCP affects staying PCPs and staying PCPs' patients at the main clinic. For instance, it may be the case that overburdened clinics are no longer able to maintain the same quality of care, causing patients to substitute away from their main primary care clinic.

Figure [10a](#) shows the number of patients seen per month per PCP, grouped by the type of PCP. The red crosses represent exiting PCPs, the blue triangles represent staying PCPs, and the black circles represent new PCPs. Exiting PCPs are defined to exit in $t = 0$. Staying PCPs are defined to be PCPs who were practicing at the clinic in $t \leq -36$, or 3 years before the main PCP's exit. New PCPs are any PCP that began practicing at the clinic

⁴⁶Table [A26](#) shows additional estimates. It shows that urgent care and specialty visits do not increase significantly more in low density areas, compared to high density areas. This is likely due to the local density of PCPs being highly correlated with the availability of specialist as well as urgent care clinics.

⁴⁷I varied this analysis in two ways. First, I compare patients who were and were not affiliated with a clinic that has multiple sites in Table [A27](#). When comparing patients who lost a clinic using this heterogeneity, it was not an important indicator of patients ability to re-match. However, when comparing patients in open clinics by this metric, effects were more mixed. Second, I used the Center for Medicare and Medicaid Services rural/urban fee schedule to compare rural and urban areas. This is a coarser metric than the market thickness definition constructed in the data, which is based on local availability within 30 miles. However, Table [A28](#) shows that the results are qualitatively similar.

from $-36 < t \leq 24$. Zeros are not included in the average, so to aid in the interpretation of Figure 10a, the total number of PCPs in each group is shown in Figure 10b (the denominator of the average). The average clinic size is larger than that in the matched PCP sample. Solo clinics are not included in the clinic level sample because spillovers onto indirectly affected patients cannot be estimated in this case.

Figure 10a shows that staying PCPs are affected by a co-working PCPs departure. The first year post-departure, the average staying PCPs sees 44.1 more patients per year, which is sustained in year 2 (Table 6). The sustained increase in the number of patients seen by staying PCPs may be because clinics do not immediately replace leaving PCPs. Figure 10b shows that the rate of new PCPs being added to the clinic trends smoothly over time, opposed to suddenly increasing when a PCP exits.

I next quantify how increases in the number of patients seen by staying PCPs affects staying PCPs' patients. By assuming that staying PCPs treat their existing set of patients (indirectly affected patients) similarly to the patients they take-on post-departure (directly affected patients), this can tell us something about how directly affected patients are treated by staying PCPs.⁴⁸ Table 6 shows that outcomes among indirectly affected patients remain unchanged post-departure. This suggests that staying PCPs are able to compensate for the loss of a co-worker and maintain the same standard of care.

Effects by Size of Focal Clinic. The results above imply that a clinic is impacted by the loss of a PCP, but it does not affect staying PCPs' ability to care for patients. However, the above analysis quantifies aggregate effects, which may obscure significant heterogeneity by the size of a clinic. If a clinic's ability to provide care is impacted by the loss of a PCP, there are fewer PCPs to take on the increased workload in smaller clinics, so effects should be larger among small clinic PCPs. I test this hypothesis in the matched PCP sample used in the main analyses and focus on clinics that remain open after a PCP's exit. I compare clinics with 1-3 PCPs versus 4-100 PCPs (3 PCPs is the median clinic size). Regression results follow the main specification outlined in equation 1.

I start by showing how small and large control clinics observably differ in Table A11. The largest difference is that 66% of small clinics and 19% of large clinics practice on individual models. This suggests that results may be confounded by a clinic's management structure. Patients in larger clinics also see 1.8 PCPs and 3.6 specialists, whereas patients in smaller

⁴⁸ "Indirectly affected" patients are patients of staying PCPs and do not ever have a claim billed by exiting PCPs.

clinics see 1.1 PCPs and 2.8 specialists 3-2 years before a PCP's departure.

Table 7 shows that changes in aggregate primary care visits are not significantly different by clinic size.⁴⁹ However, patients are slightly more likely to shift away from the main clinic and increase their use of other primary care clinics and specialists. This could mean that smaller clinics may be more constrained post-departure, which affects patients' ability to access care at focal clinics.

Size is highly correlated with whether the clinic practices on an individual or team model. As a result, Table A31 shows a 2x2 matrix with treatment effects by size and management structure. It shows that treatment effects are driven by differences in the clinic model, rather than size. For instance, the number of visits to patients' main clinics decreases by 1.7 visits in shared models with 1-3 PCPs and 1.7 visits in shared models with 4-100 PCPs. For individual clinics, the number of visits to the main clinic decreases by 2.4 visits in clinics with 1-3 PCPs and 2.1 visits in clinics with 4-100 PCPs, but the estimates are not significantly different from each other. In sum, differences by the size of the clinic are minimal. Further, given that the aggregate level of primary care visits is unchanged, this does not appear to be a main explanation for effects.

7.6 Ruling Out Differences in Leaving and Replacement PCP Practice Patterns

There is a growing literature finding that PCP practice styles explain 2-3% of the variation in long-run total utilization (Kwok, 2019; Fadlon and Parys, 2019). As a result, it is possible that the sustained decrease in primary care visits and increase in specialty care visits are driven by differences between exiting and replacement PCPs propensity to refer to specialists.

I test for the importance of this hypothesis by controlling for specialist and primary care utilization of replacement PCPs' indirectly affected patients from $1 \leq t \leq 12$ (i.e. the leave-out-mean).⁵⁰ In order to attribute utilization to a specific PCP, I assign all patients to the modal PCP seen from $1 \leq t \leq 12$.⁵¹ Treated patients who do not see a new PCP from

⁴⁹Table A32 breaks clinic size into three categories: 1 PCP, 2-3 PCPs, 4+ PCPs. It shows that effects are largest among patients who belong to clinics with one PCP. However, this case is by definition an individual clinic and patients by definition do not have a replacement PCP at the clinic. Therefore, the result more closely aligns with the switching cost hypothesis outlined in Section 7.1.

⁵⁰I control for 100 quantiles of SP and PCP utilization.

⁵¹Utilization from $1 \leq t \leq 12$ was used to follow other work, namely Kwok (2019). Using this assignment

$1 \leq t \leq 12$ (31% of patients) and treated patients with replacement PCPs who only see treated patients over the relevant period (2% of patients) are not included in analyses. This is a limitation of this method and of the literature more generally.

The magnitude of the coefficients does not significantly change when controlling for the leave-out-mean of specialist and primary care utilization (Table 8). The number of primary care visits decline by 0.90 visits (SE 0.032), which is not significantly different from the decline of 0.91 visits (SE 0.032) in the uncontrolled results. The number of specialist visits is also not significantly different when controlling for indirectly affected patients use of specialists (0.49 vs 0.49 visits). These results show that practice styles explain virtually none of the observed long run decrease in average primary care and specialty use. This rules out changing practice styles as an explanation for the long-term decline in primary care visits and increase in specialty visits.

7.7 Alternative Mechanisms

There are at least two other hypotheses that could explain why patients substitute from the primary care to specialty setting in response to a PCP's exit. First, replacement PCPs may not compensate for the loss of the main PCP because they do not realize they are now responsible for the entirety of a patient's primary care. If this was the case, one would expect patients who stay at the main clinic to be unaffected because PCPs who care for patients that remain should be aware that their co-working PCP left. Table 4 shows that patients who belong to clinics that stay open after a PCP's exit still substitute away from the primary care towards the specialty care setting, which goes against what we would expect if this was a primary mechanism.

Second, replacement PCPs may treat new patients differently from their other patients. PCP visits would therefore decline if replacement PCPs are not prioritizing new patients. If this was a main explanation, the rate of PCP visits should slowly recover over the four years post-departure as the replacement PCP-patient relationship grows. Further, PCP visits should mostly decrease on the intensive margin. Instead, I show that patients decrease their use of primary care long-term and primarily on the extensive margin.

More generally, if PCP behavior was driving patients' shift to specialists, one would expect

mechanism, I find the median PCP sees 76 non-focal patients over this period.

preventive care—such as preventive screens and flu vaccines—to still be administered by replacement PCPs. This is because preventive screens and flu vaccines are clearly targeted metrics that are straightforward for new PCPs to administer. They are also not in a specialist’s scope-of-practice, so for specialists to absorb these procedures, they are presumably doing so at the patient’s request. Therefore, mechanisms that surround PCP, opposed to patient, behavior are hard to reconcile with PCPs administering less and specialists administering more preventive care.

8 Conclusion

The relationship between patients and their PCP is widely valued, but does it matter for patients’ health care consumption and outcomes? Despite the centrality of the PCP-patient relationship, and the strong preferences many people have to keep their current PCP, the role of the PCP-patient relationship, and under what conditions it should be prioritized, remains unclear.

I show that the relationship determines where patients demand care and is moderately important for patients’ health. In the first year post-departure, primary care visits decrease by 17%. This decrease is immediate and long-term, lasting at least four years post-departure. Compensating for the loss of a PCP, patients substitute to their existing network of specialists for primary care. Of the care that was previously done by the exiting PCP, specialists perfectly absorb the prescription of medications, whereas the aggregate level of preventive care declines. In addition to the long-term decrease in preventive care, patients’ health is negatively affected by a PCP’s exit the first year post-departure. Poor outcomes—ED visits and inpatient admissions—increase, which increases patients’ spending by \$4,640 and Medicare spending by \$16,052 per exiting PCP

I present suggestive evidence that switching costs affect patients’ ability to establish new relationships and that PCP-specific information grows over time. In support of switching costs, when patients are better able to switch to a PCP they have a pre-existing relationship with, patients are less likely to substitute to specialists and the ED for primary care. These costs are largest when a patient is more likely to have to find a new PCP and clinic because their main clinic closed. Costs are smallest in team clinics because patients are better able to switch to a PCP they know.

Patients with longer PCP-patient relationships are more likely to substitute away from the primary care setting towards specialists after a PCP's exit. These results are consistent with patients receiving less benefit from replacement PCPs because PCP-specific information builds over time ([Jovanovic 1979a](#)). Adverse events are similar across the length of the relationship suggesting the lost information is more psychological in nature, such as trust, opposed to being directly relevant to patients' health.

This is a context where patients may place a premium on their relationship with a PCP because they are older and in worse health. Medicare patients face low and relatively constant out-of-pocket costs across providers and also have large teams of PCPs and specialists. While this more precisely identifies patient preferences, it is unclear how results would generalize to younger patients who may face network constraints, need a PCP for referrals, and have less attachment to individual PCPs. For instance, requiring that a patient see a PCP to be referred to a specialist may effectively push patients back to primary care if switching costs are lower than the cost of not adhering to these guidelines. Further, younger patients may be more likely to choose convenience over building a relationship, using retail and urgent care clinics as a regular source of care.

Patients who are more able to substitute to pre-existing PCPs face smaller switching costs after the loss of a PCP. In addition to teams, which this work speaks to, organizations such as independent practice associations may be a helpful bridge for patients as they attempt to re-establish care. This is especially relevant for patients who belong to clinics that close when a PCP exits, who cannot switch to PCPs within the main clinic.

Findings clearly affirm the theoretical role of the PCP as a point of contact to the rest of the health system as well as an administrator of preventive care ([Starfield, 1994](#)). This role is receiving more focus as recent and proposed policy reforms directly target the PCP-patient relationship. For instance, Medicare's Shared Savings Program shares savings with PCPs who keep total costs below a financial benchmark, encouraging PCPs to take greater control over the continuum of patient care ([McWilliams et al., 2016](#)).

Continuing to develop our understanding of how and why these relationships matter will help firms and policymakers better mitigate the harms of disrupting them. Exits are especially ubiquitous in the health care context where volatile provider networks and non-compete agreements may artificially sever a relationship, even if the PCP remains in practice. PCP retirements will also increase over the next decade, with 32% of PCPs currently over 60 years of age ([Sabety, 2019](#)). As a result, interventions such as team care or better transitioning

patients' care to replacement providers may reduce frictions in replacing PCPs as well as maintain patients' health as a growing number of PCPs leave clinical practice.

References

- Agha, Leila, Brigham Frandsen, and James B Rebitzer. 2017. “Causes and Consequences of Fragmented Care Delivery: Theory, Evidence, and Public Policy.” *NBER Working Paper* 23078.
- Akosa Antwi, Yaa, Asako S. Moriya, Kosali Simon, and Benjamin D. Sommers. 2015. “Changes in emergency department use among young adults after the patient protection and affordable care act’s dependent coverage provision.” *Annals of Emergency Medicine*, 65(6): 664–672.e2.
- Amy N. Finkelstein, Ph.D., Sarah L. Taubman, Ph.D., Heidi L. Allen, Ph.D., Bill J. Wright, Ph.D., and Katherine Baicker, Ph.D. 2016. “Effect of Medicaid Coverage on ED Use — Further Evidence from Oregon’s Experiment.” *New England Journal of Medicine*, 375(16): 1505–1507.
- Azoulay, Pierre, Joshua S Graff Zivin, and Jialan Wang. 2010. “Superstar Extinction.” *Quarterly Journal of Economics*, 125.2: 549–589.
- Barnett, Michael L., Zirui Song, Sherri Rose, Asaf Bitton, Michael E. Chernew, and Bruce E. Landon. 2017. “Insurance Transitions and Changes in Physician and Emergency Department Utilization: An Observational Study.” *Journal of General Internal Medicine*, 32(10): 1146–1155.
- Bayard, Joanne M., Carol Calianno, and Cheryl L. Mee. 1997. “Care Coordinator-Blending Roles to Improve Patient Outcomes.” *Nursing Management*, 28(8): 49–52.
- Billings, J, N Parikh, and T Mijanovich. 2000. “Emergency Room Use: The New York Story.” *The Commonwealth Fund. Issue Brief*, , (November): 1–11.
- Bischof, Tamara, and Boris Kaiser. 2018. “Physician Retirement , Practice Closures and Discontinuity of Primary Care Motivation and Research Questions.” *In mimeo*, 1–24.
- Boccuti, Cristina, Christa Fields, Giselle Casillas, and Liz Hamel. 2015. “Primary Care Physicians Accepting Medicare: A Snapshot.” *The Kaiser Family Foundation*, , (Issue Briefs).
- CDC. 2018. “Estimates of Influenza Vaccination Coverage among Adults—United States, 2017–2018 Flu Season.”
- Chernew, Michael E., Lindsay Sabik, Amitabh Chandra, and Joseph P. Newhouse. 2009. “Would having more primary care doctors cut health spending growth?” *Health Affairs*, 28(5): 1327–1335.
- David, Guy, and Kunhee Kim. 2018. “The Effect of Workforce Assignment on Performance: Evidence from Home Health Care.” *Journal of Health Economics*, 59: 26–45.

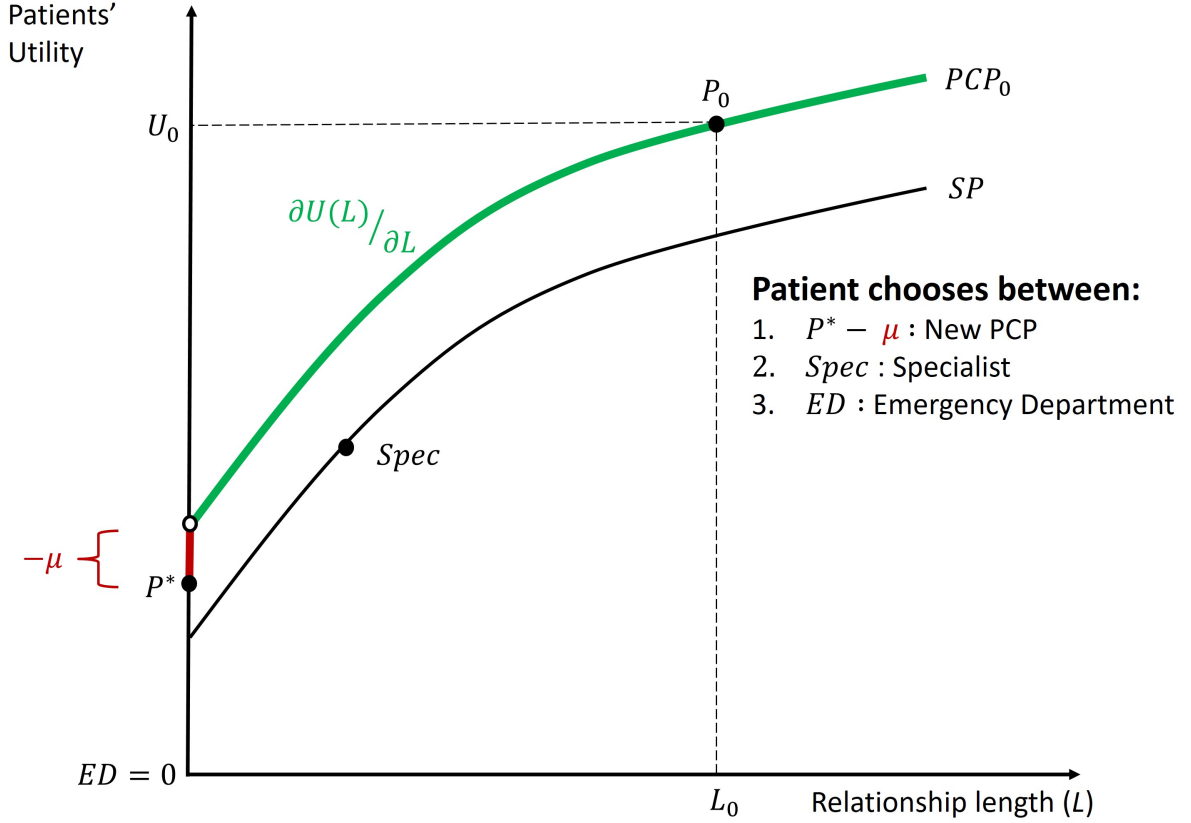
- Fadlon, Itzik, and Jessica Van Parys. 2019. "Primary Care Physician Practice Styles and Patient Care: Evidence from Physician Exits in Medicare." *NBER Working Paper 26269*.
- Farrell, Joseph, and Paul Klemperer. 2007. "Chapter 31 Coordination and Lock-In: Competition with Switching Costs and Network Effects." *Handbook of Industrial Organization*, 3(06): 1967–2072.
- Friedberg, Mark W., Peter S. Hussey, and Eric C. Schneider. 2010. "Primary care: a critical review of the evidence on quality and costs of health care." *Health Affairs*, 29(5): 766–772.
- Hausman, Naomi, and Kurt Lavetti. 2016. "Physician Concentration and Negotiated Prices: Evidence from State Law Changes." *Working Paper*.
- Iacus, Stefano M., Gary King, and Giuseppe Porro. 2012. "Causal inference without balance checking: Coarsened exact matching." *Political Analysis*, 20(1): 1–24.
- Jäger, Simon. 2017. "How Substitutable Are Workers? Evidence from Worker Deaths." *Ssrn*.
- Jaravel, Xavier, Neviana Petkova, and Alex Bell. 2018. "Team-Specific Capital and Innovation." *American Economic Review*, , (108(4-5)): 1034–1073.
- Johnson, Erin, M. Marit Rehavi, David C. Chan, and Daniela Carusi. 2016. "A Doctor Will See You Now: Physician-Patient Relationships and Clinical Decisions." *NBER Working Paper 22666*.
- Johnston, Kenton J., Lindsay Allen, Taylor A. Melanson, and Stephen R. Pitts. 2017. "A "Patch" to the NYU Emergency Department Visit Algorithm." *Health Services Research*, 52(4): 1264–1276.
- Jovanovic, Boyan. 1979a. "Firm-specific Capital and Turnover." *Journal of Political Economy*, 87(6): 1246–1260.
- Jovanovic, Boyan. 1979b. "Job Matching and the Theory of Turnover." *Journal of Political Economy*, 87(5): 972–990.
- King, Gary, and Richard Nielsen. 2016. "Why Propensity Scores Should Not Be Used for Matching." *Political Analysis*, 1–20.
- Kwok, Jennifer H. 2019. "How Do Primary Care Physicians Influence Healthcare? Evidence on Practice Styles and Switching Costs from Medicare." *In mimeo*.
- Lavetti, Kurt, Carol Simon, and William D. White. 2019. "The Impacts of Restricting Mobility of Skilled Service Workers: Evidence from Physicians." *Journal of Human Resources*, 0617–8840R5.
- McWilliams, J. Michael, Bruce E. Landon, Vinay K. Rathi, and Michael E. Chernew. 2019. "Getting More Savings from ACOs - Can the pace be pushed?" *New England Journal of Medicine*, 380(23): 2190–2192.

- McWilliams, J. Michael, Laura A. Hatfield, Michael E. Chernew, Bruce E. Landon, and Aaron L. Schwartz. 2016. “Early Performance of Accountable Care Organizations in Medicare.” *New England Journal of Medicine*, 374(24): 2357–2366.
- Miller, Sarah. 2012. “The Impact of the Massachusetts Health Care Reform on Health Care Use Among Children.” *American Economic Review (Papers and Proceedings)*, 102(3): 502–507.
- Pham, Hoangmai H., Deborah Schrag, Ann S. O’Malley, Beny Wu, and Peter B. Bach. 2007. “Care Patterns in Medicare and Their Implications for Pay for Performance.” *New England Journal of Medicine*, 356(11): 1130–1139.
- Pollack, Craig E., Peter S. Hussey, Robert S. Rudin, D. Steven Fox, Julie Lai, and Eric C. Schneider. 2016. “Measuring care continuity : A comparison of claims-based methods.” *Medical Care*, 54(5): e30–e34.
- Sabety, Adrienne. 2019. “Association of General Practitioner Turnover with Utilization and Outcomes Among Medicare Beneficiaries: Observational Study.” *Working Paper, Harvard University*.
- Sabety, Adrienne, Jonathan Gruber, Rishi Sood, and Jin Yung Bae. 2019. “The Action-HealthNYC Experiment: Effects of Insuring Unauthorized Immigrants.” *Working Paper, Harvard University*.
- Sarsons, Heather. 2017. “Interpreting Signals in the Labor Market: Evidence from Medical Referrals.” *Working Paper*, 1–71.
- Saultz, John W., and Waleed Albedaiwi. 2005. “Interpersonal continuity of care and patient satisfaction: A critical review.” *Annals of Family Medicine*, 2(5): 445–451.
- Schwab, Steve. 2018. “You Had Me at Hellow: The Effects of Disruptions to the Patient-Physician Relationship.” *In mimeo*.
- Sessums, Laura L., Sanjay Basu, and Bruce E. Landon. 2019. “Primary Care First — Is It a Step Back?” *The New England Journal of Medicine*, 1–3.
- Simonsen, Marianne, Lars Skipper, Niels Skipper, and Peter Rønø Thingholm. 2019. “Discontinuity in Care: Practice Closures among Primary Care Providers and Patient Health.” *In mimeo*.
- Sinaiko, Anna D., Mary Beth Landrum, David J. Meyers, Shehnaz Alidina, Daniel D. Maeng, Mark W. Friedberg, Lisa M. Kern, Alison M. Edwards, Signe Peterson Flieger, Patricia R. Houck, Pamela Peele, Robert J. Reid, Katharine McGraves-Lloyd, Karl Finison, and Meredith B. Rosenthal. 2017. “Synthesis Of Research On Patient-Centered Medical Homes Brings Systematic Differences Into Relief.” *Health Affairs*, 36(3): 500–508.
- Slichter, S.H. 1919. D. Appleton.

- Staiger, Rebecca. 2018. "The Role of the Physician-Patient Relationship in Patient Outcomes." *In mimeo*.
- Starfield, Barbara. 1994. "Is primary care essential?" *The Lancet*, 344(8930): 1129–1133.
- Stole, Lars A, and Jeffrey Zwiebel. 1996*a*. "Intra-firm Bargaining under Non-binding Contracts." *The Review of Economic Studies*, 63(3): 375–410.
- Stole, Lars A, and Jeffrey Zwiebel. 1996*b*. "Organizational Design and Technology Choice under Intrafirm Bargaining." *The American Economic Review*, 86(1): 195–222.
- Taubman, Sarah L, Heidi L Allen, Bill J Wright, Katherine Baicker, and Amy N. Finkelstein. 2014. "Medicaid Increases Emergency-Department Use: Evidence from Oregon's Health Insurance Experiment." *Science*, 343(6168): 263–268.
- Whitcomb, Michael E., and Jordan J. Cohen. 2004. "The Future of Primary Care Medicine." *New England Journal of Medicine*, 351(7): 710–712.
- Zhang, Xuan. 2018. "Disruption in Primary Care and Patient Outcomes: Evidence from Physician Retirement." *In mimeo*.

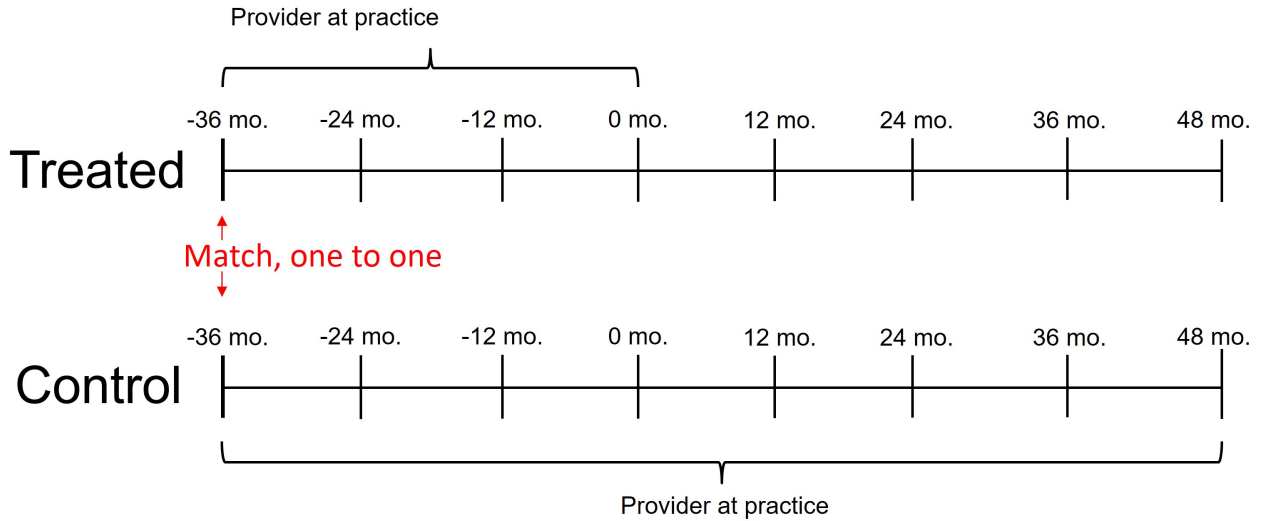
9 Figures

Figure 1: Patients' Choice of Replacement Provider



Notes: Figure 1 contains the length of the relationship (L) on the x-axis and the utility a patient receives consuming care with a PCP and specialist on the y-axis. The graph illustrates a patient's choice of replacement care after a PCP's exit. This depends on switching costs, μ , and how PCP-specific information grows over time, $\frac{\partial U(L)}{\partial L}$. Patients start at P_0 with their original PCP where the length of PCP-patient relationship is L_0 . After a PCP's departure, patients can choose between P^* , $Spec$, and ED . P^* is the utility a patient receives when visiting a new PCP ($L = 0$) after paying switching cost μ . $Spec$ is the utility received visiting a specialist who the patient has known for L_{spec} . ED is the utility a patient receives visiting the ED, which is normalized to zero.

Figure 2: Data Restriction and Matching Strategy



Match in $t=-36$ on:

- Month-year of calendar time
- Provider sex
- NP, PA, or MD
- # patients seen $t=-36$ **
- Provider age***

➔ Assign patient to modal PCP
Based on evaluation & management codes

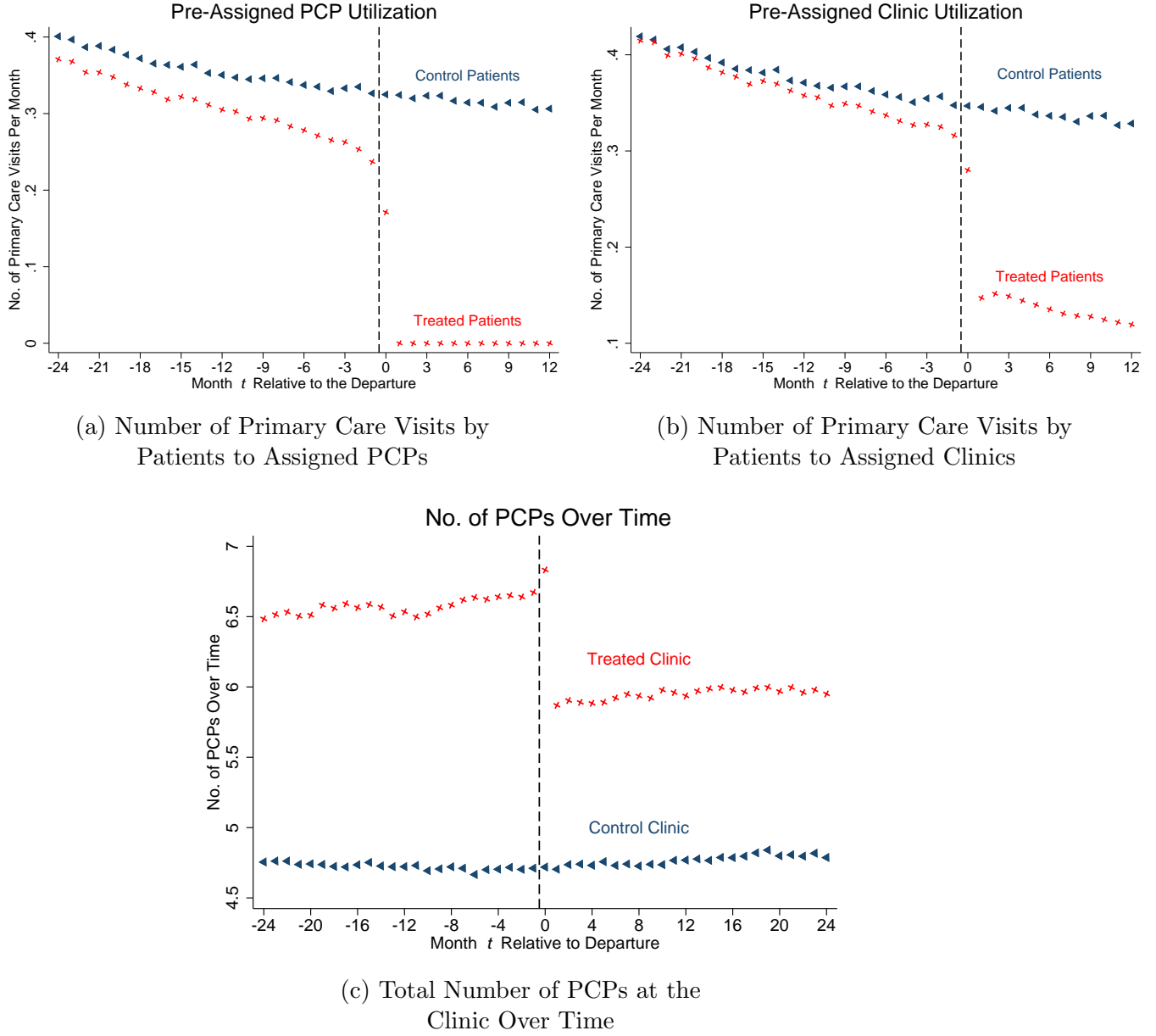
Throw out PCPs in clinics >99 PCPs

**Variables coarsened using 10 quantiles

***Variables coarsened using 15 quantiles

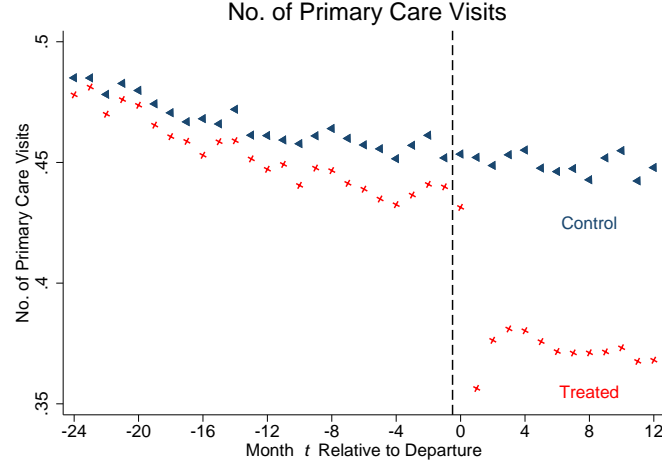
Notes: “Tx” are departing PCPs and “Ct” are staying PCPs. **Indicates that the variable was coarsened using 10 quantiles. ***Indicates that the variable was coarsened using four quantiles. I restrict to departing PCPs who were at the clinic at least three years prior to exit and control PCPs who exist in the data for at least four years, 3 years before exit and 1 year. Different subsamples place different restrictions on the length of time staying PCPs have to be observed at the clinic. A sample is also used that matches clinics, which is described in Appendix 2.

Figure 3: Number of Visits Patients Make to the Assigned PCP and Clinic

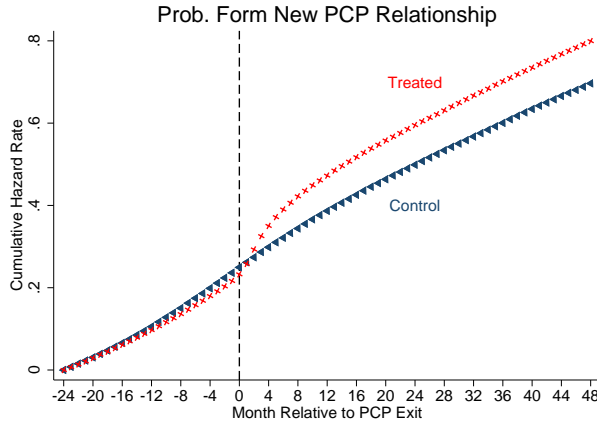


Notes: Figure 3a and Figure 3b plot the number of primary care visits by patients to assigned (a) PCPs and (b) clinics over relative time t . Graphs show that the loss of a PCP is a shock to patients. The y-axis starts in relative time -24 and ends in relative time 12 , or 1 year post-departure. The underlying sample matches leaving to staying PCPs in $t = -36$. Patients are assigned to PCPs and clinics from $-36 \leq t < -24$ based on where the majority of their primary care was provided. Primary care visits among patients of staying PCPs are reflected in blue triangles and patients of exiting PCPs are reflected in red crosses. Figure 3c uses a sample that matches *clinics*, instead of PCPs, which is described in Appendix 2. The graph shows the total number of PCPs observed filing Medicare claims in relative time t among clinics that stayed open post-departure. The y-axis starts in relative time -24 and ends in relative time 24 , or 2 years post-departure. It shows that exiting PCPs are not replaced one-for-one.

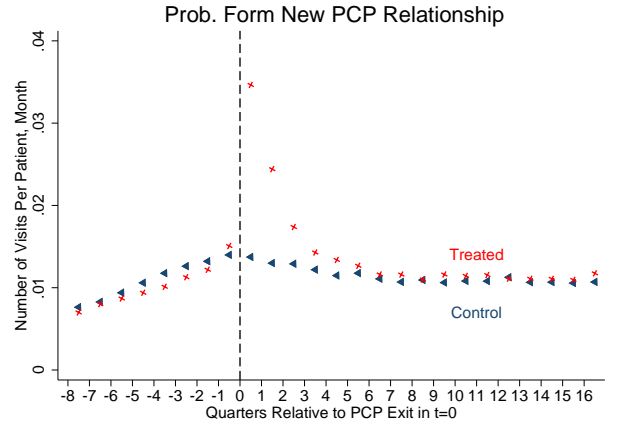
Figure 4: Effects of a PCP Leaving a Clinic on Patients' Utilization of Care



(a) Raw Avg. No. PCP Visits



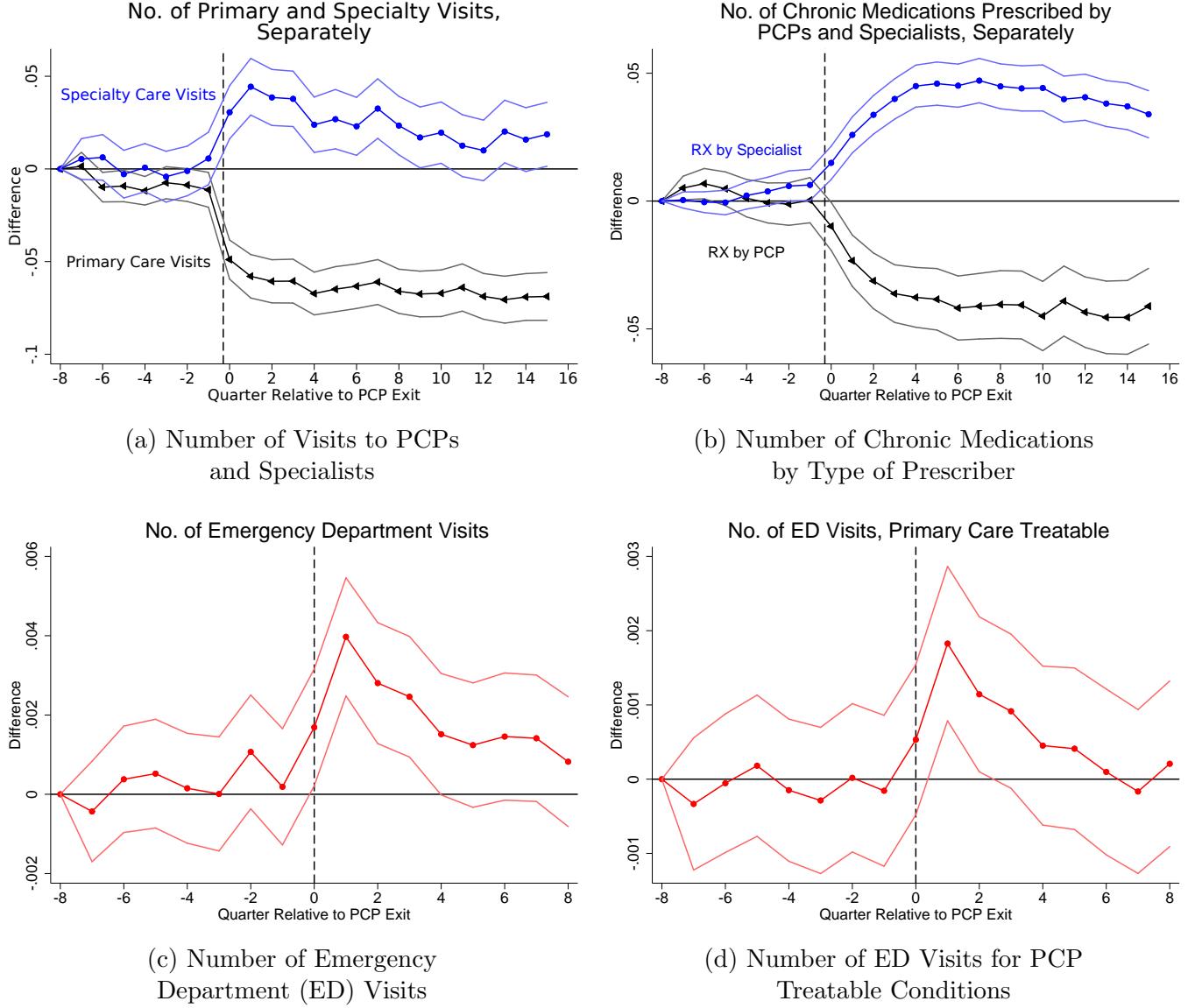
(b) Cumulative Hazard Rate of Patients Forming New Relationships



(c) Raw Avg. No. New Relationships Formed

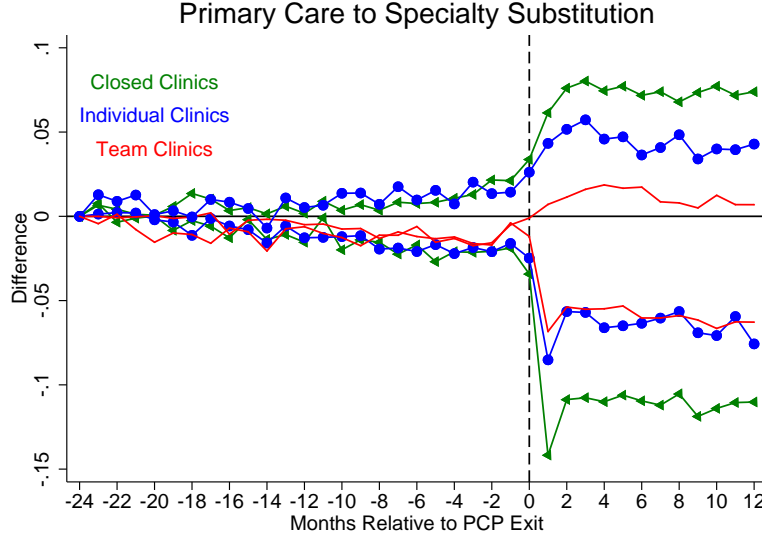
Notes: Figure 4 shows the effect of a PCP's departure in the raw data. The x-axis contains time relative to the departure in $t = 0$, where relative time is measured in months. Figure 4a shows the raw number of primary care visits by month in a sub-sample that follows patients one year post-departure. Figure 4b and Figure 4c use a sub-sample that follows patients four years post-departure. Figure 4b shows the probability a patient forms a new relationship as a cumulative hazard rate. Figure 4c graphs the probability a patient forms a new relationship by relative time t . Treated patients are represented by red crosses, whereas control patients are represented by blue triangles.

Figure 5: Effects of a PCP Leaving a Clinic on Patients' Utilization of Care

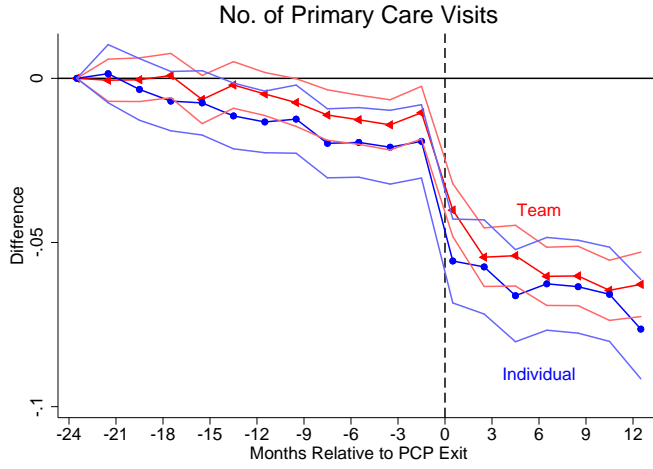


Notes: Event study graphs plot each coefficient from the difference-in-differences specification outlined in Section 5.3. Regressions are at the PCP-quarter level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. “No.” indicates that the outcome is the quarterly number. Plots use different data samples illustrated by the length of the x-axis. The first and second figure use a sample that follows patients 4 years post-departure, whereas the third and fourth follow patients 2 years post-departure. “ED” represents emergency department visits. Pooled, yearly estimates are in Table 2 and Table 3.

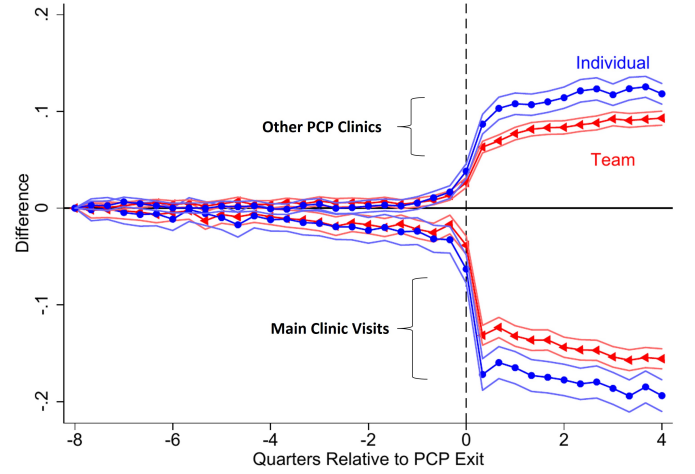
Figure 6: Effects of a PCP Leaving a Clinic on Patients' Utilization of Care



(a) Use of primary and specialty care across clinic environments



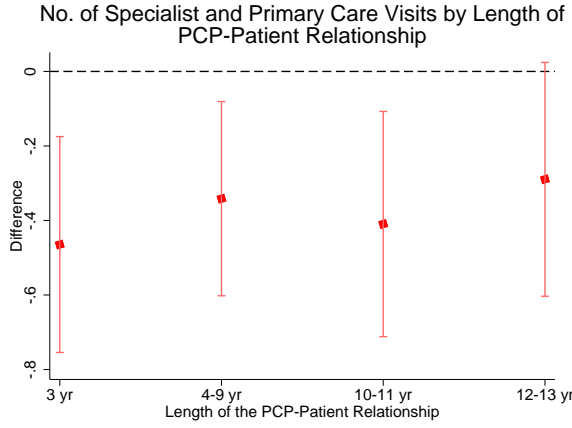
(b) Primary care by team and individual clinics



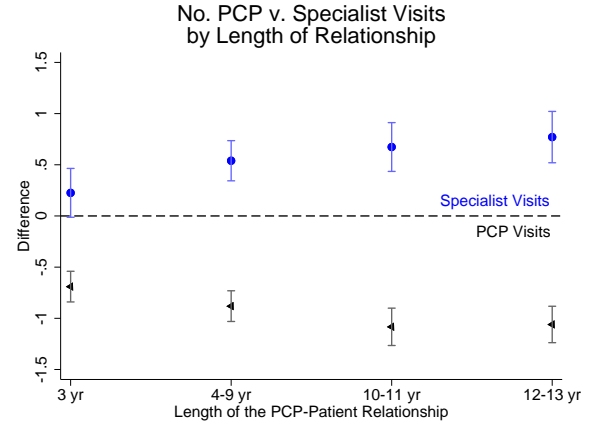
(c) Location of PCP visit by team and individual clinics

Notes: Event study graphs plot estimated coefficients $\beta_t^{Treated}$ from equation 1, where t is estimated at the month level and patients are followed one year post-departure. Regressions are at the PCP-month level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Coefficients are only identified up to a constant term, so the value for $t = month = -24$ is normalized to zero. Figure 6a overlays primary care against specialty visits. It includes clinics that close (green line), stay open and practice individually (blue line), and stay open and practice as a team (red line). Standard errors are not included for clarity. The next two panels take the decrease in primary care visits from the main figure and focus on the differences between individual and team clinics. Figure 6b shows how primary care visits change on aggregate, which mirrors Figure 6a with the addition of confidence bands. Figure 6c breaks aggregate primary care visits into primary care visits at the main clinic and visits at other PCP clinics. Table 4 shows point estimates.

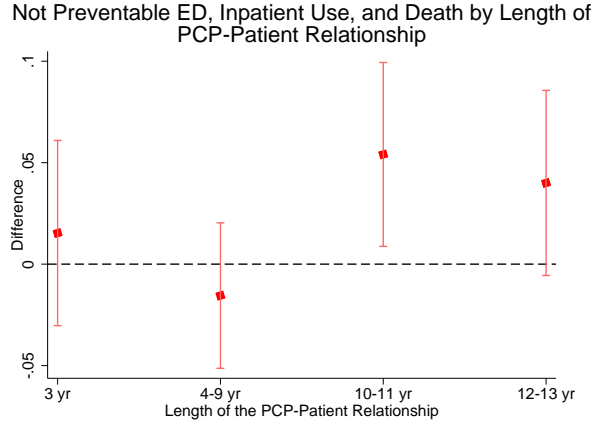
Figure 7: Effects by Length of PCP-Patient Relationship



(a) No. Outpatient Visits by Relationship Length



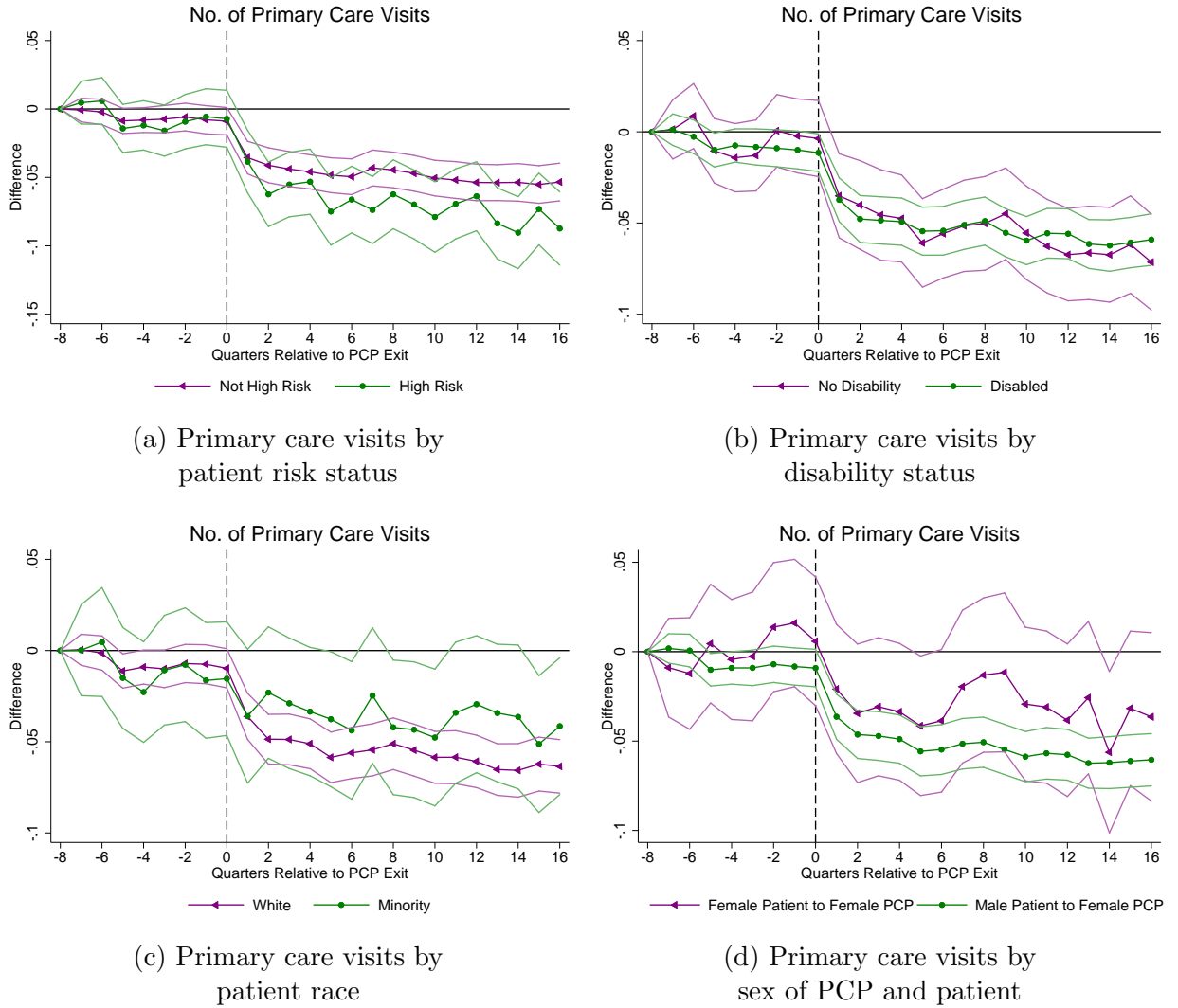
(b) No. Primary Care v. Specialty Visits by Relationship Length



(c) Rate of Adverse Events by Relationship Length

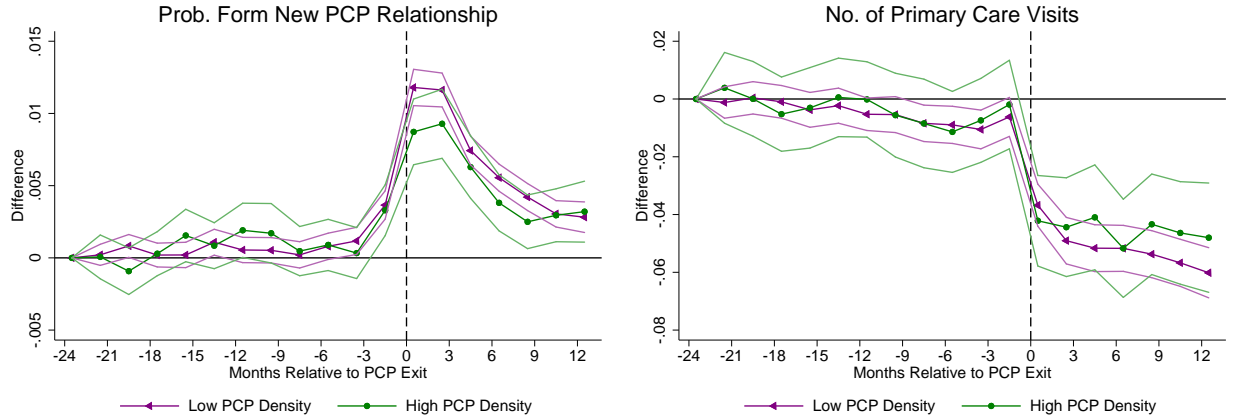
Notes: Event study graphs plot each pooled coefficient from the difference-in-differences specification outlined in Section 5.3 one year post-departure. “No.” indicates that the outcome is the yearly number. Regressions are estimated at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. The underlying sample drops 12% of patients contained in the main sample because the PCP’s NPI did not match to a UPIN, the PCP identification scheme used from 2002-2016. Further, patients aged < 75 as of $t = -36$ were dropped from analyses to avoid censoring due to only observing patients once they become Medicare eligible (typically at age 65). See Section 4.2 for more details on how heterogeneity and variables were defined.

Figure 8: Effects of a PCP Leaving on PCP Visits
by Amount of Information Lost



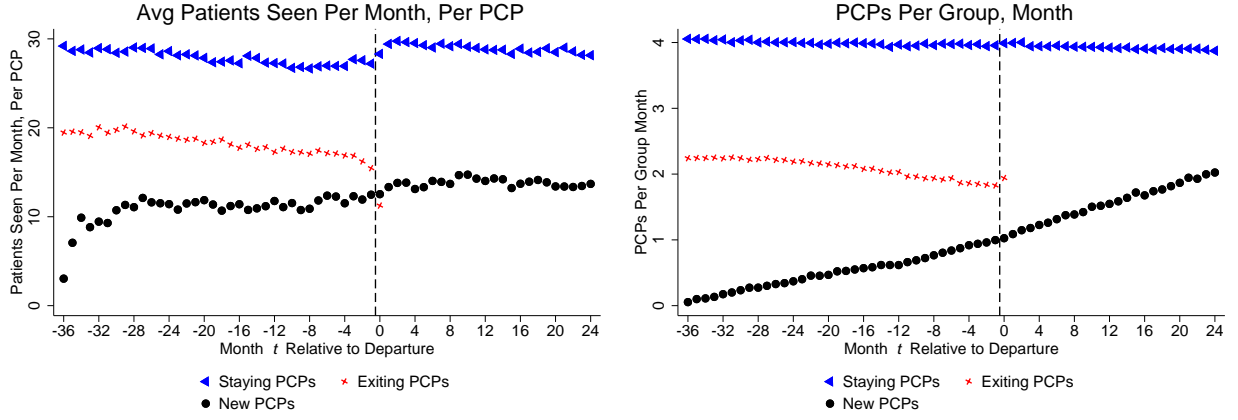
Notes: Event study graphs plot each coefficient from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the monthly number. Regressions are at the PCP-month level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Event studies rely on the a sample that follows patients 4 years post-departure. High risk patients are patients with the top quartile of Elixhauser risk scores. See Table 5 for pooled estimates across outcomes.

Figure 9: Effects of a PCP Leaving on Patients' Utilization of Care by Local Density of PCPs



Notes: Event study graphs plot each coefficient from the difference-in-differences specification outlined in Section 5.3. Estimates are relative to *month* = -24. “Prob.” indicates that the outcome is the monthly probability and “No.” indicates that the outcome is the monthly number. Regressions are at the PCP-month level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Event studies rely on the main sample shown in Table 1, which only follows patients for one year post-departure. Density is defined by the number of PCPs within a 30 mile radius divided by the population in that zip code. High PCP density areas are above average density and low PCP density areas are below average density. Table A26 contains pooled point estimates.

Figure 10: Clinic Level Effects
Patients Seen Per Month and Replacement Rate Over Time



(a) Average Number of Patients Seen Per Month, Per PCP by Group

(b) Number of PCPs by Type of PCP Over Time

Notes: Graphs rely on a sample that matches *clinics*, instead of PCPs. This sample does not include practices with one PCP. Additional details are described in Appendix 2. Figure 10a shows the number of patients seen per month, per PCP by type of PCP. Blue triangles represent staying PCPs, a group that includes PCPs that existed at the clinic in $t = -36$. Red crosses represent exiting PCP, who exit from $0 \leq t \leq 24$. Black circles represent PCPs that are new to the clinic between $-35 \leq t \leq 24$. Because points in Figure 10a do not account for the size of the group, Figure 10b shows the number of PCPs per group over time (the denominator of the rate showed in Figure 10a).

10 Tables

Table 1: Balance Table for Exiting PCPs and Their Patients

	Treatment	Control	P-Value
% Match	90%	29%	
No. of PCPs	10,437	10,437	
No. of Patients	298,943	328,704	
No. of Observations	28,957,261	28,957,261	
PCP Matching Covariates, 3 Years Before PCP Exit			
PCP Age (yr)	53.8	53.4	0.005
Caseload per PCP/Month	12.2	12.2	1.00
Patient Covariates That Were Not Matched On, 3-2 Years Before PCP Exit			
<i>Patient Demographics</i>			
Patient Age (yr)	71.1	71.5	p< 0.001
White (%)	85.6	81.7	p< 0.001
Female (%)	37.0	36.9	0.94
Urban (%)	79.2	83.8	p< 0.001
<i>Patient Clinical Characteristics</i>			
Elixhauser Risk Score	2.5	2.6	p< 0.001
End Stage Renal Disease (%)	0.91	1.1	p< 0.001
Also Enrolled in Medicaid (%)	19.4	20.7	p< 0.001
<i>Average Annual Rate per Patient</i>			
No. of Primary Care Visits	6.1	6.2	p< 0.001
No. of PCPs Seen	1.6	1.1	p< 0.001
No. of Specialty Care Visits	9.7	9.9	p< 0.001
No. of Specialists Seen	3.4	2.7	p< 0.001
No. of Emergency Department Visits	0.70	0.65	p< 0.001
No. of Urgent Care Visits	0.018	0.014	p< 0.001
No. of Inpatient Department Visits	0.39	0.39	0.33
Annual Spending (\$)	8433.98	8827.97	p< 0.001
Prob. of Death (%)	0.0032	0.0036	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' clinic locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending includes provider charges from the carrier file, inpatient charges, and outpatient charges.

Table 2: Treatment Effect of a PCP Leaving a Clinic

Type	Mean	Impact	Type	Mean	Impact
Utilization of Clinic Based Services			Medications		
No. of Specialist and Primary Care Visits	14.9	-0.43*** (0.048) -2.9%	No. of Filled Prescriptions	26.1	-0.046 (0.081) -0.17%
No. of Primary Care Visits	5.4	-0.92*** (0.032) -16.9%	No. of Chronic Med RX Fills	9.7	0.036 (0.033) 0.37%
No. of Patients Visting PCP at Least Once	0.87	-0.11*** (0.0027) -12.9%	Preventive Care		
No. of PCP Visits, Intensive Margin	6.4	-1.2*** (0.11) -18.6%	Tot. Amount of Preventive Care	2.2	-0.090*** (0.015) -4.1%
No. of Specialist Visits	9.5	0.48*** (0.035) 5.1%	Prob. of a Flu Vaccine	0.49	-0.031*** (0.0024) -6.4%
No. of Patients Visting SP at Least Once	0.86	0.011*** (0.0012) 1.3%	No. of Annual Exams	0.11	-0.026*** (0.0040) -25.0%
No. of SP Visits, Intensive Margin	11.3	1.063*** (0.17) 9.4%	No. of Preventive Screens	1.6	-0.035** (0.014) -2.2%
No. of Urgent Care Visits	0.018	0.0025*** (0.00071) 14.2%	Aggregate Markers for Poor Care		
Tot. Spending	9415.1	144.3* (79.7) 1.5%	No. of Emergency Department Visits	0.74	0.033*** (0.0053) 4.5%
Tot. Out of Pocket	1177.1	32.0** (11.7) 2.7%	No. of ED Visits, Primary Care Treatable	0.37	0.016*** (0.0033) 4.2%
			No. of ED Visits, Not Preventable	0.12	0.0084*** (0.0019) 7.3%
			No. of Inpatient Visits	0.44	0.011** (0.0043) 2.5%
			Prob. of Death	0.045	0.0013 (0.00089) 2.9%
Treated PCP Sample Size	10437				
Control PCP Sample Size	10437				

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability. “No.” and “Tot.” indicate that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. Preventive screens include mammography screens, colorectal cancer screens, cholesterol screens, and diabetes screens. See Section 1.1 for how medications were defined. See Section 4.2 for other variable definitions.

Table 3: Shift of Care from Primary Care to Specialty Setting

	PCP Administered			Specialist Administered		
Medications						
No. of Filled Prescriptions from PCP	17.5	-1.3*** (0.078) -7.3%	No. of Filled Prescriptions from Specialists	8.7	1.2*** (0.057) 14.1%	
No. of Chronic Med RX Fills from PCP	7.2	-0.46*** (0.033) -6.5%	No. of Chronic Med RX Fills from Specialists	2.5	0.50*** (0.023) 19.7%	
Preventive Care						
Tot. Amount of Preventive Care by PCP	1.6	-0.24*** (0.015) -14.3%	Tot. Amount of Preventive Care by SP	0.36	0.13*** (0.0060) 35.8%	
Prob. of a Flu Vaccine by PCP	0.27	-0.061*** (0.0026) -22.4%	Prob. of a Flu Vaccine by Specialist	0.042	0.018*** (0.0012) 43.1%	
No. of Preventive Screens by PCP	1.3	-0.14*** (0.013) -10.9%	No. of Preventive Screens by Specialist	0.33	0.10*** (0.0054) 31.7%	
No. of Annual Exams by PCP	0.10	-0.034*** (0.0040) -33.8%	No. of Annual Exams by Specialist	0.0043	0.0077*** (0.00064) 179.4%	

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability. “No.” and “Tot.” indicate that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. The chronic medication category includes Selective Serotonin Reuptake Inhibitors (SSRIs), antihypertensives, antidiabetics, and statins.

Table 4: Treatment Effect of a PCP Leaving a Clinic by Clinic Heterogeneity
Test for Importance of Costs of Starting a New Relationship

	Clinic Also Closed		Clinic Stayed Open				
			Individual		Team		
Type	Mean	Impact	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.7	-1.3*** (0.062) -23.1%	5.8	-0.76*** (0.064) -12.9%	5.1	-0.69*** (0.036) -13.4%	0.23
No. of PCP Visits at Clinic	4.5	-3.9*** (0.051) -86.7%	4.7	-2.1*** (0.072) -45.2%	4.1	-1.7*** (0.042) -40.9%	p< 0.001
No. of PCP Visits at Other Clinics	1.1	2.6*** (0.050) 227.2%	1.1	1.4*** (0.057) 121.7%	1.070	0.98*** (0.033) 91.3%	p< 0.001
Prob. Form New PCP Relationship	0.043	0.12*** (0.0020) 276.0%	0.042	0.042*** (0.0022) 98.1%	0.046	0.031*** (0.0014) 67.5%	p< 0.001
No. of Specialist Visits	9.7	0.82*** (0.058) 8.4%	9.6	0.42*** (0.064) 4.4%	9.3	0.23*** (0.046) 2.4%	0.004
Prob. Visit Pre-Existing SP	2.6	0.25*** (0.015) 9.6%	2.6	0.15*** (0.017) 6.0%	2.5	0.088*** (0.011) 3.5%	0.003
Tot. Amount of Preventive Care	2.1	-0.11*** (0.024) -5.1%	2.3	-0.095*** (0.028) -4.1%	2.2	-0.079*** (0.021) -3.7%	0.63
No. of Emergency Department Visits	0.72	0.047*** (0.0079) 6.6%	0.79	0.039*** (0.0090) 5.0%	0.74	0.018*** (0.0072) 2.5%	0.03
Tot. Spending	9824.90	305.20*** (121.90) 3.1%	9880.4	144.0 (132.1) 1.5%	9067.8	19.0 (107.8) 0.21%	0.90
Tot. Out of Pocket	1205.1	60.1*** (17.6) 5.0%	1251.9	38.8** (19.3) 3.1%	1140.0	4.7 (15.8) 0.41%	0.35
Treated PCP Sample Size	2851		1804		5782		
Control PCP Sample Size	10437		5932		4505		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. Bolded estimates indicate that the groups are significantly different at the 5% level. “Prob.” indicates that the outcome is the yearly probability. “No.” and “Tot.” indicate that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. See Table A20 for additional outcomes. See Section 4.2 for more details on how heterogeneity and variables were defined.

Table 5: Treatment Effect of a PCP Leaving a Clinic by Patient Status

	High Risk	Not High Risk	Func.	No Func.	Minority	White	Male-Female Match	Female-Female Match
No. of Primary Care Visits	7.0 -1.048*** (0.047) -14.9%	4.9 -0.79*** (0.030) -16.2%	5.0 -0.77*** (0.029) -15.5%	6.5 -1.064*** (0.050) -16.4%	5.3 -0.87*** (0.072) -16.5%	5.4 -0.86*** (0.032) -15.8%	5.4 -0.65*** (0.034) -12.1%	5.1 -0.51*** (0.069) -10.1%
<i>p-value</i>		p < 0.001		p < 0.001		0.86		0.05
No. of Specialist Visits	13.5 0.59*** (0.068) 4.4%	8.0 0.41*** (0.036) 5.1%	8.3 0.40*** (0.036) 4.8%	12.5 0.62*** (0.065) 5.0%	8.1 0.59*** (0.083) 7.2%	9.7 0.42*** (0.037) 4.3%	9.4 0.33*** (0.039) 3.5%	9.7 -0.044 (0.12) -0.46%
<i>p-value</i>		0.003		p < 0.001		0.05		0.002
Treated PCPs (N)	10204	10173	10278	9301	5154	9986	7531	2303
Control PCPs (N)	10204	10173	10278	9301	5154	9986	10376	2808

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. Bolded estimates indicate that the groups are significantly different at the 5% level. “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Comparisons between groups are within PCP. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data only follows patients for one year post-departure. See Section 4.2 for more details on how heterogeneity and variables were defined. “Male-Female Match” represents male patients who had a female PCP and “Female-Female Match” represents female patients who had a female PCP.

Table 6: Treatment Effect of PCP Unexpectedly Leaving Practice
on Clinic Level Outcomes

Type	Mean	Impact Year 1 Post Exit	Impact Year 2 Post Exit	P-Value
Firm Level Outcomes				
Avg Number of Pat Seen Per Month-PCP, Staying PCPs	214.9	44.1*** (6.0) 20.5%	38.1*** (6.5) 17.7%	0.02
Avg Number of Pat Seen Per Month-PCP, New PCPs	23.9	35.7*** (6.1) 149.5%	38.7*** (6.5) 162.1%	0.04
Count of New PCPs	0.056	0.028*** (0.0064) 51.2%	0.018*** (0.0061) 33.2%	0.10
Treated Clinic Sample Size	1573			
Control Clinic Sample Size	1573			
Indirectly Affected Patients' Outcomes				
Utilization of Clinic Based Services				
No. of Primary Care Visits	5.0	-0.050 (0.046) -1.0080%	-0.0012 (0.055) -0.025%	0.11
No. of Specialist Visits	9.8	-0.030 (0.060) -0.31%	0.091 (0.071) 0.92%	0.02
No. of Urgent Care Visits	0.015	-0.00061 (0.0012) -4.2%	0.00072 (0.0011) 5.0%	0.21
Aggregate Markers for Poor Care				
No. of ED and Inpatient Visits	0.89	0.0033 (0.0091) 0.37%	0.012 (0.0095) 1.3%	0.33
Treated Clinics	1558			
Control Clinics	1558			

Notes: This table displays results from a specification similar to the difference-in-differences specification outlined in Section 5.3, with one large difference: analyses rely on a data set that matches clinics, not PCPs, and follows patients two years post-departure. As a result of the clinic level match, clinics with only one PCP are not included. Regressions are at the clinic-year level, contain clinic fixed effects, and cluster at the clinic level. Indirect patients are patients who were never observed to visit a departing PCP. Regressions are at the clinic-year level, contain clinic fixed effects, and cluster at the clinic level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. See Section 4.2 for variable definitions and Appendix 2 for more details on how the clinic level sample was created.

Table 7: Treatment Effect of a PCP Leaving a Clinic
Utilization of Clinic Based Services by Focal Clinic Practice Size

Within Open Clinics	1-3 PCPs		4-100 PCPs		
Type	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.4	-0.75*** (0.063) -13.9%	5.3	-0.76*** (0.043) -14.3%	0.88
No. of PCP Visits at Clinic	4.1	-2.0*** (0.068) -48.8%	4.3	-1.8*** (0.048) -42.8%	0.04
No. of PCP Visits at Other Clinics	1.3	1.2*** (0.051) 98.1%	1.019	1.072*** (0.037) 105.2%	0.004
No. of Specialist Visits	9.7	0.45*** (0.064) 4.7%	9.3	0.23*** (0.059) 2.5%	0.007
No. of Emergency Department Visits	0.80	0.036*** (0.0099) 4.5%	0.73	0.028*** (0.0088) 3.8%	0.49
Treated PCP Sample Size	1931		5655		
Control PCP Sample Size	8398		2039		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the yearly number. “No.” indicates that the outcome is the yearly number and “Avg.” indicates that the outcome is the average over the year. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Clinics with 1-3 PCPs were compared to those with 4-100 PCPs because 3 PCPs was the median practice size (7 is the mean). Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. See Section 7.5 for more details on how small and large groups were created.

Table 8: Treatment Effect of a PCP Leaving a Clinic
Controlling for Replacement PCP Practice Patterns

Type	Without Controls		With Controls
	Mean	Impact	Impact
No. of Primary Care Visits	5.4	-0.91*** (0.032) -16.8%	-0.90*** (0.032) -16.5%
No. of Specialist Visits	9.5	0.49*** (0.035) 5.1%	0.49*** (0.035) 5.2%
Treated PCP Sample Size	10334		10334
Control PCP Sample Size	10421		10421

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. The leave-one-out average of utilization of replacement PCP’s patients was controlled for non-parametrically using 100 quantiles of the replacement PCP’s non-focal patient’s PCP and specialist utilization. See Section 7.6 for additional definitions.

Appendix

Appendix 1 Additional Data Details

Table A1: Prioritization of Data Sources

Outcome	1 st	2 nd	3 rd	4 th	5 th
NP, PA, or MD/DO	NPPES	MD-PPAS	PC	Doximity	Claims
Physician Specialty	Doximity	MD-PPAS	Claims		
Age	MD-PPAS	Doximity			
Gender	Modal Response				

Notes: The National Plan and Provider Enumeration System (NPPES), Doximity, Medicare’s MD-PPAS, Physician Compare (PC), and Medicare’s Part B Carrier file (Claims) were combined and prioritized based on reliability to determine the type of provider, specialty, sub-specialty age and gender based on health providers’ national provider identifiers (NPI). MD/DO, PA, and NP stands for medical doctors/doctors of osteopathy, physician assistants, and nurse practitioners, respectively. “Modal Response” means that the modal gender across all five data sources was considered the correct sex.

1.1 Additional Definitions

Each PCP is assigned a unique identifier combining their NPI and associated clinic identifier (NPI-TIN-ZIP). NPIs belonging to organizations, and not individuals, are dropped from the sample because it is not possible to observe individual provider exits.

Clinic Closures. I define clinic closures to occur when a PCP departs and (i) the TIN is the last TIN observed at the ZIP,⁵² (ii) all PCPs at the clinic completely disappear from the data, or (iii) the TIN disappears from the data in month $t + 1$ and the number of NPIs at that nine digit zip decreases by the exact number of NPIs affiliated with that clinic as of month t .

Utilization. “Office settings” are tagged using place of service codes equal to 11 in the carrier file. Medicare Provider Analysis and Review files identify hospitalizations. I do not use years 2002-2007 to define departures because in 2008 provider identifiers switch from UPINs to NPIs. The crosswalk between UPINs and NPIs is imperfect, so to avoid misclassifying

⁵²This would not include clinics that switched TINs due to an ownership change because I would observe a new clinic at that ZIP in that case.

departures I focus on later years. See Section 4.1 for how I identified whether a provider's NPI belonged to a PCP or specialist.

Total spending follows recent literature and aggregates patients' carrier, inpatient, outpatient, urgent care, and ED charges (Amy N. Finkelstein, Ph.D., Sarah L. Taubman, Ph.D., Heidi L. Allen, Ph.D., Bill J. Wright, Ph.D., and Katherine Baicker, 2016). Out-of-pocket costs aggregate the coinsurance and deductibles paid by patients for these services. Prescription drug claims are obtained from the Part D Event and Plan Characteristic files. Medicare Beneficiary Summary files provide patients' date of death, demographic characteristics, and enrollment information. All files are linked using beneficiary identification numbers and claim dates.

Medicare Advantage Patients. Patients were coded as being in Medicare Advantage (MA) according to the Master Beneficiary Summary file.

Medications. The number of medications as well as chronic medications are classified. Medications are counted based on filled prescriptions, so prescriptions that are written but not filled are missed. The chronic medication category includes Selective Serotonin Reuptake Inhibitors (SSRIs), antihypertensives, antidiabetics, and statins. In order to derive the classification, prescriptions are aggregated into categories and classes using a crosswalk between RedBook data and the generic names from Medicare's Part D plan characteristics file.

Statins were classified as antihyperlipidemic drugs. Opioids were classified as opiate agonists, opiate part agonists, and opiate antagonists. Antihypertensives include NEC cardiac drugs (e.g. losartan and olmesartan), ACE inhibitors, alpha-beta blockers, beta blockers, and calcium channel blockers. Antidiabetics include insulins, sulfonylureas, and other antidiabetic agents. Supplies used by diabetics, such as lancets and blood sugar diagnostic materials, were also included. Antidepressants included prescriptions like fluoxetine, escitalopram, and sertraline. Benzodiazepines included prescriptions like lorazepam, alprazolam, and diazepam. NPIs on prescription scripts were used to identify prescribers. Whether a prescriber was a PCP or specialist was determined from merging in the NPI data set described in 4.1.

Patient Risk Score and High Risk Patients. Elixhauser scores were used to create a risk index based on patients' entire set of International Classification of Disease 9th and 10th edition (ICD-9/10) diagnosis codes from the carrier file. The Elixhauser Index scores patients based on comorbidities and pre-existing conditions that are predictive of death.

Patients' Elixhauser scores were derived using the Stata function "Elixhauser."⁵³ To define high risk patients, yearly risk scores were derived based on all diagnosis codes recorded over the year. Patients who had no claims in a specific year were given a risk score of zero. The score was used to stratify the population into low and high risk patients, within a PCP's pool of patients.⁵⁴ The top quartile of scores were defined to be high risk, the bottom $\frac{3}{4}$ were defined to be not high risk.

Clinic Rural or Urban. A clinic's zip code was determined to be urban or rural using the Center for Medicare and Medicaid Services 2019 fee schedule.

Additional Patient Sample Restrictions. Patients who switched in and out of being enrolled in Medicare Advantage (MA) were dropped from the sample to avoid missing data on the patient while they were in MA. All remaining patients who enrolled in MA from $-36 \leq t < -24$, or over the assignment period, were dropped from the main sample. They were only dropped once it was determined that patients do not differentially switch to MA at the threshold. This is checked and quantified in Table A16. Patients that died over the assignment period were also dropped from the sample. This was done to precisely define a PCP's pool of patients from $-36 \leq t < -24$.

1.2 Additional Description of Departures

Table A2: Breakdown of Departures

2011	2,673	2.32%
2012	3,075	2.63%
2013	3,374	2.87%
2014	3,653	3.1%
<i>Total Departures:</i>	12,761	9%

⁵³Vicki Stagg, 2015. "Elixhauser: Stata module to calculate Elixhauser index of comorbidity," Statistical Software Components S458077, Boston College Department of Economics.

⁵⁴Elixhauser, Anne, Claudia Steiner, D. Robert Harris, and Rosanna M. Coffey. "Comorbidity measures for use with administrative data." Medical care (1998): 8-27.

Figure A1: Histograms of PCP Age

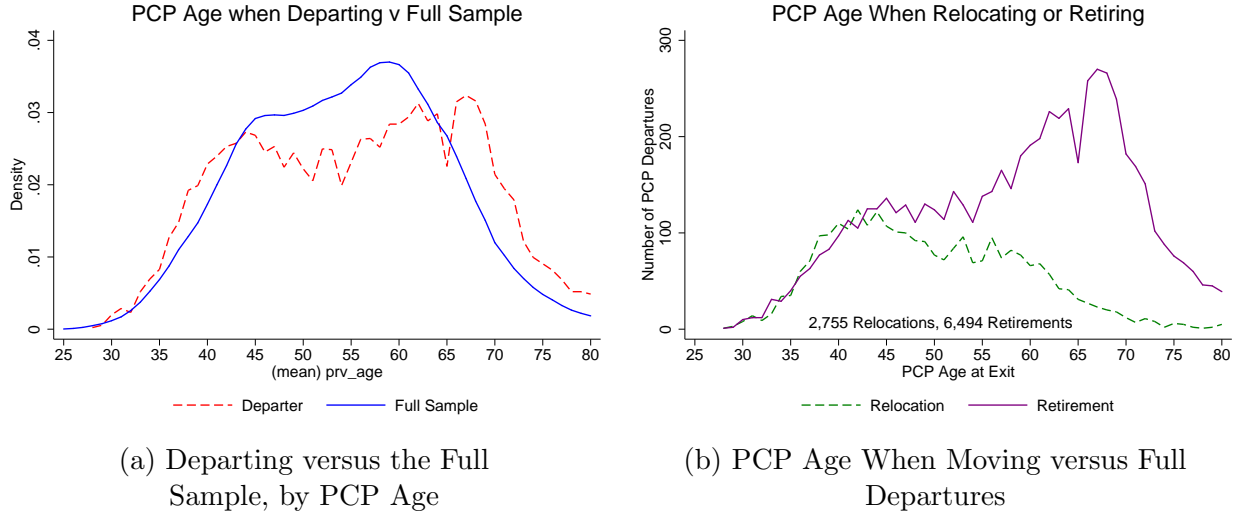


Table A3: Match Attrition for Each Matching Variable

Dropping	Treatment Match Rate
—	87%
PCP Age	89%
Female	88%
Patients Seen at $t=-24$	92%
NP, PA, or MD	94%

Appendix 2 Clinic Level Sample

Treated Clinics: The same departure definition was used as in Section 4.2. Treatment clinics are defined to be clinics that (i) existed for 49 months, (ii) see an average of ≥ 2 patients per month over the period, and (iii) see ≥ 30 patients from $-36 \leq t \leq -24$. This algorithm drops clinic closures and solo clinics. Further, clinics with >100 PCPs were excluded.

Control Clinics: If a PCP departed a clinic but the conditions laid out in Section 4.2 were not met, the PCP would be considered a control and, as such, the PCP’s clinic would be called a “control clinic.” Further, control clinics had to (i) exist for 49 months, (ii) see an average of ≥ 2 patients per month over the period, and (iii) see ≥ 30 patients from $-36 \leq t \leq -24$.

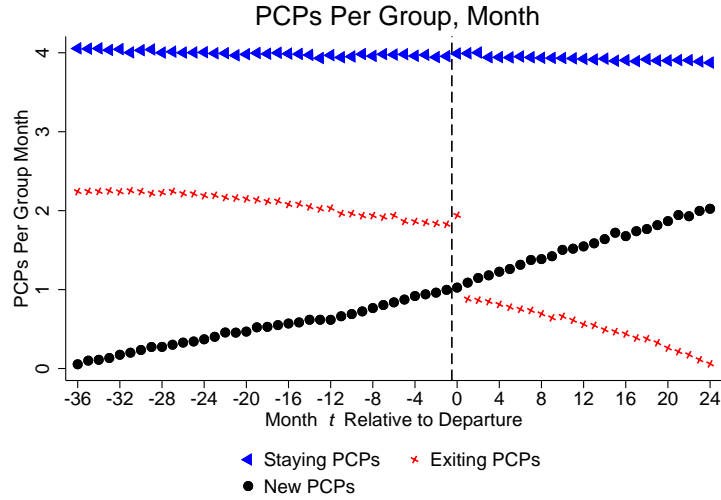
Matching: Three coarsened bins of average PCP age at the clinic, seven coarsened bins

of the number of PCPs per practice, nine coarsened bins of the number of patients seen in $t = -36$, whether or not the clinic was on an individual or shared model, and month and year of calendar time were matched on. Balance for clinics is illustrated in Table A4 and balance for indirectly affected patients is shown in Table A5

Indirectly Affected Patients: I call a patient indirectly affected if they *never* saw a strongly departing PCP. I assign patients to clinics in $-36 \leq t \leq -24$ and then I assign patients to PCPs within the clinic based on their modal PCP.

Additional Sample Restrictions: Clinics where the total number of PCPs changed by more than 2 standard deviations in a given year were dropped. This additional restriction was imposed on the clinic sample because being able to accurately draw clinic barriers is more important for clinic level analyses, opposed to PCP level analyses. This drops 30% of treated clinics. Analyses without this restriction were run for robustness and showed that the number of visits at non-focal clinics decreased in response to a focal-PCP departure, which is unintuitive and suggests that clinic boundaries were likely incorrect in this case.

Figure A2: PCPs per Group Over Time



Notes: Graphs rely on a sample that matches *clinics*, instead of PCPs, which is described in Appendix 2. Figure 10b shows the number of PCPs per group over time. The average number of exiting PCPs does not go to zero at $t = 1$, instead showing that there are subsequent departures at the group. PCPs that exit after the focal PCP departure in $t = 0$ gradually exit over the two year post period.

Table A4: Balance Table for Clinics and Patients
Following Groups 2 Years post-departure

	Treatment	Control	P-Value
% Match	82%	24%	
Number of Clinics	1,579	1,579	
Number of Patients	225,625	213,951	
Clinic Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	50.3	49.9	0.16
Caseload per Clinic/Month	54.0	49.9	0.04
PCPs Per Practice	5.2	4.6	p< 0.001
Patient Covariates That Were Not Matched On, 3 Years Prior to Exit			
<i>Patient Demographics, 3 Years Prior to Exit</i>			
Patient Age (yr)	71.1	71.5	0.02
White (%)	85.6	87.2	0.02
Urban (%)	76.6	81.2	0.001
<i>Patient Clinical Characteristics, 3 Years Prior to Exit</i>			
Elixhauser Risk Score	2.5	2.5	0.51
Also Enrolled in Medicaid (%)	19.6	16.8	p< 0.001
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	6.1	6.1	0.84
No. of Specialist Visits	10.3	10.4	0.07
No. of Emergency Department Visits	0.87	0.84	p< 0.001
No. of Inpatient Visits	0.42	0.43	0.005
Annual Spending (\$)	8728.85	8905.83	p< 0.001
Prob. of Death (%)	2.8	2.9	p< 0.001
No. of Visits with Departing PCP	8.3	—	p< 0.001
No. of Visits at Clinic	23.3	22.9	0.02

Notes: See Table 1 for description of overlapping outcomes. PCPs per practice categorizes the total number of PCPs at the clinic. Share of NPs/PAs (females) are the number of NPs/PAs (females) per clinic over the total number of PCPs at the clinic.

Table A5: Balance Table for Clinics and Patients Indirectly Affected by Departure

	Treatment	Control	P-Value
% Match	82%	24%	
Number of Clinics	1,558	1,558	
Number of Patients	137,047	212,605	
Clinic Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	50.2	49.9	0.20
Caseload per Clinic/Month	54.4	50.3	0.04
PCPs Per Practice	5.2	4.6	p< 0.001
Clinic Covariates That Were Not Matched On, 3 Years Prior to Exit			
Share of NPs/PAs	0.17	0.13	p< 0.001
Share Female	0.38	0.36	0.02
Avg Pop. in Zip	25623	26645	0.07
Patient Covariates That Were Not Matched On			
<i>Patient Demographics, 3 Years Prior to Exit</i>			
Patient Age (yr)	71.0	71.5	0.003
White (%)	85.9	87.2	0.05
Urban (%)	76.5	81.1	0.002
<i>Patient Clinical Characteristics, 3 Years Prior to Exit</i>			
Elixhauser Risk Score	2.4	2.5	0.001
Also Enrolled in Medicaid (%)	19.1	16.8	p< 0.001
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	5.4	6.1	p< 0.001
No. of Specialist Visits	9.9	10.4	p< 0.001
No. of Emergency Department Visits	0.82	0.84	p< 0.001
No. of Inpatient Visits	0.40	0.43	p< 0.001
Annual Spending (\$)	8410.41	8893.87	p< 0.001
Prob. of Death (%)	3.0	2.9	0.005
No. of Visits with Departing PCP	—	—	—
No. of Visits at Clinic	18.3	22.9	p< 0.001

Notes: See Table 1 for description of overlapping outcomes. PCPs per practice categorizes the total number of PCPs at the clinic. Share of NPs/PAs (females) are the number of NPs/PAs (females) per clinic over the total number of PCPs at the clinic.

Appendix 3 Balance Tables

Table A6: Balance Table for Patients and PCPs, with Practice Size Match

	Treatment	Control	P-Value
% Match	71%	23%	
No. of PCPs	8,307	8,307	
No. of Patients	237,273	261,242	
No. of Observations	23,003,605	23,003,605	
PCP Matching Covariates 3 Years Prior to PCP Exit			
PCP Age (yr)	53.8	53.0	p< 0.001
Caseload per PCP/Month	11.9	11.9	1.00
Patient Covariates That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.1	71.8	p< 0.001
White (%)	84.9	84.5	0.32
Female (%)	37.1	36.2	0.002
Urban (%)	79.5	84.9	p< 0.001
<i>Patient Clinical Characteristics</i>			
Elixhauser Risk Score	2.5	2.5	0.30
End Stage Renal Disease (%)	0.93	1.0	0.06
Also Enrolled in Medicaid (%)	20.0	17.4	p< 0.001
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	17.1	17.5	p< 0.001
No. of PCPs Seen	5.5	4.4	p< 0.001
No. of Specialty Care Visits	29.4	29.8	p< 0.001
No. of Specialists Seen	11.9	10.3	p< 0.001
No. of Emergency Department Visits	2.3	2.0	p< 0.001
No. of Urgent Care Visits	0.056	0.046	p< 0.001
No. of Inpatient Department Visits	1.3	1.3	p< 0.001
Annual Spending (\$)	28396.43	28421.79	0.53
Prob. of Death (%)	9.9	9.8	p< 0.001

Notes: See Table 1 for description of outcomes. Values are as of 3 years before a PCP's exit.

Table A7: Balance Table for Treated PCPs and Patients by Whether Clinic Closed or Remained Open

	Only Treated PCPs and Patients		
	Closed	Open	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	60.3	51.4	p< 0.001
Caseload per PCP/Month	13.1	11.8	p< 0.001
PCP Covariates That Were Not Matched On			
PCPs Per Practice	1.5	12.7	p< 0.001
Avg Pop. in Zip	27782	25804	p< 0.001
Median Income in Zip (\$)	54270.84	52774.15	0.002
Panel Model	0.69	0.24	p< 0.001
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.8	70.8	p< 0.001
PCP-Patient Bond (yr)	6.5	5.2	p< 0.001
White (%)	82.1	86.9	p< 0.001
Female (%)	38.2	36.5	p< 0.001
Urban (%)	80.1	78.8	0.15
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.6	2.5	p< 0.001
End Stage Renal Disease (%)	0.93	0.91	0.74
Also Enrolled in Medicaid (%)	20.6	19.0	p< 0.001
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	6.3	6.0	p< 0.001
No. of PCPs Seen	1.0	1.8	p< 0.001
No. of Specialty Care Visits	9.9	9.6	p< 0.001
No. of Specialists Seen	2.6	3.6	p< 0.001
No. of Emergency Department Visits	0.67	0.71	p< 0.001
No. of Urgent Care Visits	0.016	0.019	p< 0.001
No. of Inpatient Department Visits	0.37	0.39	p< 0.001
Annual Spending (\$)	8687.84	8338.57	p< 0.001
Prob. of Death (%)	0.0036	0.0031	p< 0.001

Notes: See Table 1 for description of outcomes. Values are as of 3 years before a PCP's exit.

Table A8: Balance Table for Control Clinics by Individual or Shared

	Only Treated PCPs and Patients		
	Panel	Shared	P-Value
Clinic Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	56.4	52.4	p< 0.001
Caseload per PCP/Month	13.9	11.2	p< 0.001
Clinic Covariates That Were Not Matched On			
Share of Practice that is Female	0.28	0.42	p< 0.001
Share of Practice that are APs	0.073	0.18	p< 0.001
PCPs Per Practice	4.4	12.6	p< 0.001
Avg Pop. in Zip	26791	26091	0.04
Median Income in Zip (\$)	52753.43	53425.48	0.14
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.5	70.8	p< 0.001
PCP-Patient Bond (yr)	6.0	5.3	p< 0.001
White (%)	83.3	86.9	p< 0.001
Female (%)	39.1	35.7	p< 0.001
Urban (%)	77.8	80.0	0.007
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.7	2.4	p< 0.001
End Stage Renal Disease (%)	0.90	0.92	0.78
Also Enrolled in Medicaid (%)	21.3	18.4	p< 0.001
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	6.8	5.6	p< 0.001
No. of PCPs Seen	1.1	1.8	p< 0.001
No. of Specialty Care Visits	9.7	9.6	p< 0.001
No. of Specialists Seen	2.6	3.8	p< 0.001
No. of Emergency Department Visits	0.71	0.69	p< 0.001
No. of Urgent Care Visits	0.015	0.020	p< 0.001
No. of Inpatient Department Visits	0.40	0.38	p< 0.001
Annual Spending (\$)	8914.25	8162.86	p< 0.001
Prob. of Death (%)	0.0037	0.0030	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A9: Balance Table for Control PCPs and Patients by
Local Density of PCPs

	Only Treated PCPs and Patients		
	High PCP Density	Low PCP Density	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	53.9	53.6	0.47
Caseload per PCP/Month	12.3	11.4	p< 0.001
PCP Covariates That Were Not Matched On			
PCPs Per Practice	9.7	9.0	0.02
Avg Pop. in Zip	30166	9379	p< 0.001
Median Income in Zip (\$)	53247.01	52898.79	0.54
Panel Model	0.36	0.37	0.44
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.1	71.0	0.36
PCP-Patient Bond (yr)	5.6	5.6	0.58
White (%)	85.5	86.0	0.37
Female (%)	36.8	37.5	0.14
Urban (%)	80.0	75.4	p< 0.001
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.5	2.4	p< 0.001
End Stage Renal Disease (%)	0.90	1.0	0.41
Also Enrolled in Medicaid (%)	19.7	18.4	0.02
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	6.0	6.1	0.01
No. of PCPs Seen	1.5	1.7	p< 0.001
No. of Specialty Care Visits	9.8	9.2	p< 0.001
No. of Specialists Seen	3.4	3.4	0.75
No. of Emergency Department Visits	0.70	0.69	0.17
No. of Urgent Care Visits	0.017	0.024	p< 0.001
No. of Inpatient Department Visits	0.39	0.38	0.05
Annual Spending (\$)	8485.75	8204.19	p< 0.001
Prob. of Death (%)	0.0033	0.0031	0.04

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A10: Balance Table for Control PCPs and Patients by Length of Relationship

	Only Treated PCPs and Patients		
	4-13 Yrs	3 Yrs	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	57.0	54.8	p< 0.001
Caseload per PCP/Month	15.3	16.2	p< 0.001
PCP Covariates That Were Not Matched On			
PCPs Per Practice	2.3	2.4	0.03
Avg Pop. in Zip	28918	28615	0.38
Median Income in Zip (\$)	56704.04	57155.58	0.34
Panel Model	0.62	0.60	0.02
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	81.8	81.7	0.48
PCP-Patient Bond (yr)	9.5	3.0	p< 0.001
Max SP Relationship Length (yr)	4.9	3.8	p< 0.001
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.9	2.9	0.07
End Stage Renal Disease (%)	0.50	0.60	0.19
Also Enrolled in Medicaid (%)	15.5	16.4	0.10
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	6.6	6.1	p< 0.001
No. of PCPs Seen	2.8	6.1	p< 0.001
No. of Specialty Care Visits	10.3	10.6	p< 0.001
No. of Specialists Seen	8.0	17.0	p< 0.001
No. of Emergency Department Visits	0.60	0.74	p< 0.001
No. of Inpatient Department Visits	0.43	0.55	p< 0.001
Annual Spending (\$)	9380.53	11019.21	p< 0.001
Prob. of Death (%)	0.0057	0.0058	0.41

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A11: Balance Table for Control PCPs and Patients by Clinic Size

	Only Treated PCPs and Patients		
	1-3 PCPs	4-100 PCPs	P-Value
PCP Matching Covariates 2 Years Prior to PCP Exit			
Avg PCP Age (yr)	58.0	51.4	p< 0.001
Caseload per PCP/Month	12.5	12.0	0.010
PCP Covariates That Were Not Matched On			
PCPs Per Practice	1.3	14.4	p< 0.001
Avg Pop. in Zip	27352	25763	p< 0.001
Median Income in Zip (\$)	53646.50	52915.73	0.11
Panel Model	0.66	0.19	p< 0.001
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.3	71.0	0.005
PCP-Patient Bond (yr)	6.1	5.3	p< 0.001
White (%)	82.2	87.6	p< 0.001
Female (%)	38.0	36.4	p< 0.001
Urban (%)	79.3	79.1	0.83
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.6	2.4	p< 0.001
End Stage Renal Disease (%)	1.0	0.88	0.12
Also Enrolled in Medicaid (%)	21.7	18.1	p< 0.001
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	6.3	5.9	p< 0.001
No. of PCPs Seen	1.1	1.8	p< 0.001
No. of Specialty Care Visits	10.0	9.5	p< 0.001
No. of Specialists Seen	2.8	3.6	p< 0.001
No. of Emergency Department Visits	0.70	0.69	0.12
No. of Urgent Care Visits	0.016	0.020	p< 0.001
No. of Inpatient Department Visits	0.38	0.39	p< 0.001
Annual Spending (\$)	8719.56	8269.32	p< 0.001
Prob. of Death (%)	0.0035	0.0031	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A12: Balance Table for Control PCPs and Patients by Patient Risk Status

	Only Treated PCPs and Patients		
	High Risk	Not High Risk	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	53.4	53.4	0.95
Caseload per PCP/Month	12.3	12.3	0.94
PCP Covariates That Were Not Matched On			
PCPs Per Practice	2.6	2.5	0.78
Avg Pop. in Zip	28672	28711	0.87
Median Income in Zip (\$)	56291.65	56412.63	0.72
Panel Model	0.57	0.57	0.93
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	73.3	70.9	p< 0.001
PCP-Patient Bond (yr)	6.2	5.8	p< 0.001
White (%)	81.3	81.9	0.11
Female (%)	37.8	36.7	p< 0.001
Urban (%)	83.8	84.0	0.82
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	4.9	1.8	p< 0.001
End Stage Renal Disease (%)	2.5	0.61	p< 0.001
Also Enrolled in Medicaid (%)	22.6	19.9	p< 0.001
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	8.1	5.5	p< 0.001
No. of PCPs Seen	4.1	1.4	p< 0.001
No. of Specialty Care Visits	15.1	8.1	p< 0.001
No. of Specialists Seen	12.9	3.0	p< 0.001
No. of Emergency Department Visits	1.1	0.52	p< 0.001
No. of Urgent Care Visits	0.015	0.013	p< 0.001
No. of Inpatient Department Visits	0.71	0.28	p< 0.001
Annual Spending (\$)	14918.82	6643.82	p< 0.001
Prob. of Death (%)	0.0063	0.0026	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A13: Balance Table for Control PCPs and Patients by Disability Status

	Only Treated PCPs and Patients		
	Disabled	Not Disabled	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	53.6	53.4	0.32
Caseload per PCP/Month	13.0	12.3	p< 0.001
PCP Covariates That Were Not Matched On			
PCPs Per Practice	2.5	2.6	0.34
Avg Pop. in Zip	28511	28671	0.53
Median Income in Zip (\$)	56351.25	56320.34	0.93
Panel Model	0.58	0.57	0.09
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.6	71.6	0.89
PCP-Patient Bond (yr)	6.3	5.7	p< 0.001
White (%)	82.3	81.5	0.05
Female (%)	31.6	39.3	p< 0.001
Urban (%)	83.8	83.8	0.96
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	3.1	2.4	p< 0.001
End Stage Renal Disease (%)	1.4	1.0	p< 0.001
Also Enrolled in Medicaid (%)	25.1	18.6	p< 0.001
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	7.4	5.6	p< 0.001
No. of PCPs Seen	3.9	1.5	p< 0.001
No. of Specialty Care Visits	13.4	8.6	p< 0.001
No. of Specialists Seen	11.7	3.5	p< 0.001
No. of Emergency Department Visits	1.1	0.47	p< 0.001
No. of Urgent Care Visits	0.020	0.011	p< 0.001
No. of Inpatient Department Visits	0.66	0.29	p< 0.001
Annual Spending (\$)	13528.81	7001.06	p< 0.001
Prob. of Death (%)	0.0050	0.0030	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A14: Balance Table for Control PCPs and Patients by Patient Race

	Only Treated PCPs and Patients		
	Minority	White	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	54.4	53.3	p< 0.001
Caseload per PCP/Month	14.9	12.3	p< 0.001
PCP Covariates That Were Not Matched On			
PCPs Per Practice	2.4	2.6	p< 0.001
Avg Pop. in Zip	30275	28402	p< 0.001
Median Income in Zip (\$)	56615.08	56519.93	0.82
Panel Model	0.63	0.57	p< 0.001
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	69.0	71.8	p< 0.001
PCP-Patient Bond (yr)	5.8	5.9	0.22
White (%)	–	100.0	p< 0.001
Female (%)	37.9	37.5	0.33
Urban (%)	87.1	83.6	p< 0.001
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.8	2.6	p< 0.001
End Stage Renal Disease (%)	2.9	0.67	p< 0.001
Also Enrolled in Medicaid (%)	35.9	17.1	p< 0.001
<i>Average Annual Rate per Patient, 2-3 Years Before Exit</i>			
No. of Primary Care Visits	6.0	6.2	p< 0.001
No. of PCPs Seen	5.7	1.6	p< 0.001
No. of Specialty Care Visits	8.6	10.2	p< 0.001
No. of Specialists Seen	13.7	3.9	p< 0.001
No. of Emergency Department Visits	0.78	0.64	p< 0.001
No. of Urgent Care Visits	0.010	0.014	p< 0.001
No. of Inpatient Department Visits	0.41	0.40	p< 0.001
Annual Spending (\$)	9122.15	8871.90	p< 0.001
Prob. of Death (%)	0.0026	0.0036	p< 0.001

Notes: P-values were estimated with the use of two-sample Student's t-tests. NPIs identified PCPs and patients were assigned to PCPs based on their modal number of pre-period evaluation and management visits. The PCP sample included high volume PCPs, control PCPs who did not practice with exiting PCPs, and PCPs practicing in clinics with fewer than 100 PCPs. PCP age was determined from a secondary data set encompassing the NPPES, Doximity, Medicare's MD-PPAS, and Physician Compare. In addition to the PCP level matching covariates reported, gender, type of PCP (i.e. MD/DO, PA, NP), and month year of calendar time were exactly matched on. The caseload per PCP/month captured the number of patients seen by each PCP for any type of visit, regardless of whether the PCP was assigned as the patient's PCP. Patient age, gender, and race were determined according to the Medicare Beneficiary Summary File. "Urban" refers to patients' practice locations, which were determined using the Center for Medicare and Medicaid Services rural/urban fee schedule. The Elixhauser Risk Index scores patients based on comorbidities and pre-existing conditions that are predictive of death; scores range from 0 to 12, with higher scores indicating more coexisting conditions and that patients are of "higher risk." Whether a patient was also enrolled in the end stage renal disease program and/or Medicaid was determined according to the Medicare Beneficiary Summary File. Spending included provider charges from the carrier file, inpatient charges, and outpatient charges.

Table A15: Balance Table for Treated PCPs and Patients by Female Patients versus Male Patients Matched with Female PCPs

	Only Treated PCPs and Patients		
	Male	Female	P-Value
PCP Matching Covariates 3 Years Prior to PCP Exit			
Avg PCP Age (yr)	48.1	48.1	1.00
Caseload per PCP/Month	9.9	9.9	1.00
PCP Covariates That Were Not Matched On			
PCPs Per Practice	2.9	2.9	1.00
Avg Pop. in Zip	27236	27236	1.00
Median Income in Zip (\$)	55754.04	55754.04	1.00
Panel Model	0.53	0.53	1.00
Outcomes That Were Not Matched On			
<i>Patient Demographics</i>			
Patient Age (yr)	71.7	69.5	p< 0.001
PCP-Patient Bond (yr)	5.2	5.0	p< 0.001
White (%)	82.8	83.1	0.69
Female (%)	–	100.0	–
Urban (%)	79.6	79.6	1.00
<i>Patient Clinical Characteristics</i>			
Elixhauser Score	2.6	2.7	p< 0.001
End Stage Renal Disease (%)	0.81	1.3	p< 0.001
Also Enrolled in Medicaid (%)	22.4	20.5	0.007
<i>Average Annual Rate per Patient, 36-24 Months Before Exit</i>			
No. of Primary Care Visits	6.4	5.9	p< 0.001
No. of PCPs Seen	1.8	3.9	p< 0.001
No. of Specialty Care Visits	9.9	9.9	0.59
No. of Specialists Seen	4.1	9.7	p< 0.001
No. of Emergency Department Visits	0.64	0.67	p< 0.001
No. of Inpatient Department Visits	0.36	0.41	p< 0.001
Annual Spending (\$)	8064.97	9447.20	p< 0.001
Prob. of Death (%)	0.0029	0.0042	p< 0.001

Notes: See Table 1 for description of outcomes. Values are as of 3 years before a PCP's exit.

Appendix 4 Additional Results

Table A16: Additional Outcomes

Type	Mean	Impact	Type	Mean	Impact
Count of PCP Departures	1.3	0.50*** (0.046) 38.7%	Type of Visit Prob. of Any PCP EM Visit	3.2	-0.57*** (0.016) -17.7%
Count of Strong Departures	0.061	0.083*** (0.0078) 136.0%	Prob. Visit Pre-Existing PCP	3.1	-0.73*** (0.015) -24.0%
Prob. of Enrolling in MA	0.028	0.0019* (0.00092) 6.9%	Prob. Form New PCP Relationship	0.14	0.17*** (0.0041) 117.1%
	5530.8	105.5 (67.3) 1.9%	Prob. of Any SP EM Visit	3.1	0.23*** (0.0099) 7.2%
ED Classification Outcomes					
No. of ED Visits, Preventable	0.043	0.0035*** (0.0012) 8.2%	Prob. Visit Pre-Existing SP	2.5	0.16*** (0.0088) 6.4%
No. of ED Visits, Not Preventable	0.19	0.014*** (0.0034) 7.1%	Prob. Form New SP Relationship	0.57	0.063*** (0.0036) 11.1%
No. of ED Visits, Primary Care Treatable	0.18	0.0077** (0.0030) 4.2%	Timing of Visits Mo. Since Visited Any PCP	2.8	0.13*** (0.013) 4.5%
No. of ED for Non-Emergent	0.36	0.015*** (0.0046) 4.2%	Mo. Since Visited Any SP	2.1	-0.036*** (0.0059) -1.7%
No. of ED for Injury	0.29	0.0070* (0.0039) 2.4%			

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A17: Treatment Effect of PCP Unexpectedly Leaving Practice

Type	Mean	Impact Year 1 Post Exit	Impact Year 2 Post Exit	Impact Year 3 Post Exit	Impact Year 4 Post Exit
Total PCP, SP, UC, and ED Utilization	15.8	-0.26*** (0.090) -1.7%	-0.46*** (0.097) -2.9%	-0.61*** (0.10) -3.8%	-0.64*** (0.11) -4.0%
Utilization of Services					
No. of Primary Care Visits	5.3	-0.75*** (0.058) -14.0%	-0.77*** (0.060) -14.4%	-0.80*** (0.063) -15.1%	-0.84*** (0.065) -15.7%
Prob. Form New PCP Relationship	0.035	0.054*** (0.0022) 153.8%	0.017*** (0.0015) 49.8%	0.015*** (0.0016) 42.6%	0.014*** (0.0015) 38.8%
No. of Patients Visting PCP at Least Once	0.85	-0.11*** (0.0047) -12.5%	-0.11*** (0.0048) -12.6%	-0.10*** (0.0048) -12.3%	-0.11*** (0.0048) -12.8%
No. of PCP Visits, Intensive Margin	6.2	-0.69*** (0.22) -11.2%	-0.69*** (0.19) -11.1%	-0.50** (0.21) -8.1%	-0.55** (0.23) -8.9%
No. of Specialist Visits	9.3	0.43*** (0.063) 4.7%	0.30*** (0.068) 3.3%	0.19** (0.074) 2.0%	0.18** (0.077) 1.9%
No. of Urgent Care Visits	0.013	0.0021 (0.0012) 16.5%	0.00019 (0.0012) 1.5%	-0.00082 (0.0014) -6.5%	0.00085 (0.0015) 6.7%
Tot. Spending	9483.1	191.7 (138.0) 2.0%	-163.5 (141.3) -1.7%	-100.9 (147.4) -1.064%	-38.0 (153.9) -0.40%
Tot. Out of Pocket	1183.4	49.0** (20.6) 4.1%	7.0 (20.8) 0.59%	5.4 (21.5) 0.46%	16.4 (22.9) 1.4%
Aggregate Markers for Poor Care					
No. of ED and Inpatient Visits	0.96	0.042*** (0.012) 4.3%	0.0072 (0.012) 0.74%	0.0066 (0.013) 0.68%	0.018 (0.014) 1.8%
Medications					
No. of Filled Prescriptions	24.0	-0.18 (0.13) -0.75%	-0.028 (0.16) -0.12%	-0.19 (0.19) -0.80%	-0.28 (0.21) -1.2%
No. of Chronic Med RX Fills	9.0	0.026 (0.056) 0.29%	0.031 (0.067) 0.35%	-0.014 (0.078) -0.15%	-0.12 (0.084) -1.3%
Preventive Care					
Prob. of a Flu Vaccine	0.45	-0.039*** (0.0046) -8.5%	-0.029*** (0.0044) -6.5%	-0.025*** (0.0045) -5.5%	-0.031*** (0.0046) -6.8%
No. of Annual Exams	0.014	-0.043*** (0.0072) -316.7%	-0.041*** (0.0074) -304.5%	-0.048*** (0.0078) -353.5%	-0.049*** (0.0083) -359.9%
No. of Preventive Screens	1.5	-0.067*** (0.021) -4.3%	-0.079*** (0.023) -5.1%	-0.12*** (0.027) -7.8%	-0.11*** (0.030) -7.3%

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Total service utilization includes primary care, specialty care, urgent care, emergency department, and inpatient utilization. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on a sample that follows patients for four years post-departure.

Table A18: Treatment Effect of a PCP Leaving a Clinic with Practice Size Match

Type	Mean	Impact	Type	Mean	Impact
Utilization of Clinic Based Services			Medications		
No. of Specialist and Primary Care Visits	14.9	-0.42*** (0.052) -2.8%	No. of Filled Prescriptions	26.2	0.043 (0.088) 0.16%
No. of Primary Care Visits	5.4	-0.89*** (0.034) -16.3%	No. of Chronic Med RX Fills	9.7	0.047 (0.036) 0.49%
No. of Specialist Visits	9.5	0.46*** (0.038) 4.9%	Aggregate Markers for Poor Care		
No. of Urgent Care Visits	0.017	0.0030*** (0.00078) 17.5%	Prob. of Death	0.045	0.000077 (0.00097) 0.17%
Tot. Spending	9536.1	95.1 (85.8) 1.00%	No. of Inpatient Visits	0.44	0.0064 (0.0047) 1.5%
Preventive Care			No. of Emergency Department Visits	0.75	0.031*** (0.0055) 4.1%
Prob. of a Flu Vaccine	0.48	-0.028*** (0.0025) -5.9%	No. of ED Visits, Not Preventable	0.11	0.0070*** (0.0020) 6.1%
No. of Annual Exams	0.096	-0.035*** (0.0044) -36.3%	No. of ED Visits, Primary Care Treatable	0.38	0.017*** (0.0036) 4.6%
No. of Preventive Screens	1.6	-0.013 (0.014) -0.79%	Treated PCP Sample Size	8307	
			Control PCP Sample Size	8307	

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. See Section 1.1 for how medications were defined.

Table A19: Additional Results

Type	Mean	Impact	Type	Mean	Impact
Additional Medication Results			Preventive Care in Retail Setting		
No. of RX Starts	2.1	0.14*** (0.013) 6.6%	Prob. of a Flu Vaccine by Retail	0.18	0.012*** (0.0017) 6.6%
No. of RX Ends	1.9	0.033** (0.014) 1.7%	No. of Preventive Screens by Retail	0.017	0.0034** (0.0012) 20.3%
No. of RX Classes Started	1.6	0.100*** (0.012) 6.2%	Additional Screens		
No. of RX Classes Ended	1.3	0.0047 (0.012) 0.35%	No. of Depression Screens	0.018	0.0064 (0.0049) 35.2%
No. of RX Switches	0.30	0.026*** (0.0028) 8.7%	No. of Mammography Screens	0.77	-0.0030 (0.0067) -0.39%
No. of Opioid RX	1.5	-0.040*** (0.0098) -2.7%	No. of Colorectal Cancer Screens	0.17	0.0058 (0.0046) 3.3%
No. of Benzo RX	0.24	-0.011 (0.0076) -4.5%	No. of Diabetes Screens	0.092	-0.016*** (0.0033) -17.8%
No. of SSRI RX	1.6	0.010 (0.0096) 0.65%	No. of BMI Screens	0.029	-0.0073** (0.0035) -25.5%
No. of Antihypertensive RX	4.6	0.042** (0.018) 0.90%	No. of Tobacco Screens	0.035	-0.0014 (0.0023) -3.9%
No. of Antidiabetic RX	1.4	-0.0072 (0.0096) -0.52%	No. of Bone Density Screens	0.090	0.012*** (0.0012) 13.5%
No. of Statin RX	2.1	-0.0093 (0.010) -0.45%	No. of Cholesterol Screens	0.72	-0.039*** (0.0062) -5.4%
Sampling of Sub-Specialties					
No. of Nephrologist Visits	0.14	0.023*** (0.0035) 15.8%			
No. of Cardiologist Visits	0.92	0.057*** (0.0078) 6.2%			
No. of Gastroenterologists Visits	0.19	0.021*** (0.0030) 11.1%			
No. of Surgeon Visits	0.73	0.0092 (0.0066) 1.2%			

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. “RX Start” signifies that the patient had not been on that particular prescription before. “RX End” signifies that the prescription fill was the last prescription of that particular drug. “RX Classes Started” tags a new drug in a class of drugs that the patient was not previously prescribed. “RX Classes Ended” tags the end of a class of drugs. “RX Switches” is a different drug within the same class of drugs.

Table A20: Treatment Effect of a PCP Leaving a Clinic by Heterogeneity
Test for Importance of Costs of Starting a New Relationship

	Clinic Also Closed		Clinic Stayed Open				
			Individual		Team		
Type	Mean	Impact	Mean	Impact	Mean	Impact	P-Value
No. of PCP Visits at Clinic	4.5	-3.9*** (0.051) -86.7%	4.7	-2.1*** (0.072) -45.2%	4.1	-1.7*** (0.042) -40.9%	p< 0.001
No. of PCP Visits at Other Clinics	1.1	2.6*** (0.050) 227.2%	1.1	1.4*** (0.057) 121.7%	1.070	0.98*** (0.033) 91.3%	p< 0.001
Prob. Visit Pre-Existing SP	2.6	0.25*** (0.015) 9.6%	2.6	0.15*** (0.017) 6.0%	2.5	0.088*** (0.011) 3.5%	<i>Notes:</i> 0.003
Prob. of a Flu Vaccine by Specialist	0.038	0.023*** (0.0023) 59.8%	0.039	0.020*** (0.0022) 50.2%	0.044	0.012*** (0.0014) 26.6%	0.003
Treated PCP Sample Size	2851		293		7293		
Control PCP Sample Size	10437		2301		8136		

The table displays results from the difference-in-differences specification outlined in Section 5.3. Bolded estimates indicate that the groups are significantly different at the 5% level. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. See Section 4.2 for variable definitions and Section 4.2 for more details on how heterogeneity was defined.

Table A21: Treatment Effect of a PCP Leaving a Clinic by Heterogeneity
Test for Importance of Costs of Starting a New Relationship
Matching on Practice Size

	Clinic Also Closed		Clinic Stayed Open				
			Individual		Team		
Type	Mean	Impact	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.7	-1.2*** (0.062) -21.9%	5.8	-0.71*** (0.069) -12.1%	5.1	-0.66*** (0.040) -12.9%	0.38
No. of Patients Visting PCP at Least Once	0.89	-0.17*** (0.0053) -19.7%	0.88	-0.085*** (0.0054) -9.7%	0.86	-0.087*** (0.0039) -10.1%	0.91
Prob. Form New PCP Relationship	0.14	0.32*** (0.0077) 222.8%	0.14	0.11*** (0.0079) 73.4%	0.14	0.072*** (0.0046) 52.4%	p< 0.001
No. of Specialist Visits	9.7	0.78*** (0.058) 8.0%	9.6	0.35*** (0.073) 3.6%	9.3	0.23*** (0.050) 2.5%	0.13
Prob. Visit Pre-Existing SP	2.6	0.25*** (0.015) 9.7%	2.6	0.15*** (0.019) 5.7%	2.5	0.081*** (0.012) 3.2%	0.010
Tot. Amount of Preventive Care	2.1	-0.095*** (0.024) -4.4%	2.3	-0.098*** (0.031) -4.2%	2.1	-0.047** (0.021) -2.3%	0.15
Tot. Amount of Preventive Care by SP	0.36	0.18*** (0.0099) 50.3%	0.39	0.13*** (0.014) 32.0%	0.35	0.10*** (0.0084) 28.6%	0.07
No. of Emergency Department Visits	0.72	0.043*** (0.0082) 6.0%	0.81	0.034*** (0.010) 4.2%	0.75	0.019*** (0.0074) 2.5%	0.30
No. of ED Visits, Primary Care Treatable	0.36	0.018*** (0.0054) 5.1%	0.41	0.020*** (0.0067) 4.8%	0.38	0.016*** (0.0048) 4.1%	0.76
Tot. Spending	9845.80	280.00** (126.90) 2.8%	10113.5	-47.7 (151.3) -0.47%	9118.1	10.3 (112.8) 0.11%	0.27

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A22: Treatment Effect of a PCP Leaving a Clinic by Heterogeneity
Test for Importance of Costs of Starting a New Relationship
Matching on Team v. Individual Model

	Clinic Also Closed		Clinic Stayed Open				
			Individual		Team		
Type	Mean	Impact	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.7	-1.3*** (0.062) -22.5%	5.8	-0.75*** (0.069) -12.9%	5.1	-0.64*** (0.041) -12.6%	0.05
No. of Patients Visting PCP at Least Once	0.89	-0.18*** (0.0053) -19.9%	0.88	-0.087*** (0.0055) -9.9%	0.86	-0.087*** (0.0040) -10.2%	0.59
Prob. Form New PCP Relationship	0.14	0.32*** (0.0077) 221.4%	0.15	0.10*** (0.0078) 71.7%	0.14	0.071*** (0.0046) 51.3%	p< 0.001
No. of Specialist Visits	9.7	0.76*** (0.059) 7.8%	9.6	0.31*** (0.073) 3.2%	9.3	0.22*** (0.050) 2.4%	0.35
Prob. Visit Pre-Existing SP	2.6	0.25*** (0.015) 9.7%	2.6	0.14*** (0.019) 5.4%	2.5	0.082*** (0.012) 3.3%	0.03
Tot. Amount of Preventive Care	2.1	-0.10*** (0.024) -4.7%	2.3	-0.086*** (0.031) -3.7%	2.1	-0.033 (0.021) -1.6%	0.08
Tot. Amount of Preventive Care by SP	0.36	0.18*** (0.0097) 49.4%	0.39	0.13*** (0.014) 33.0%	0.35	0.10*** (0.0086) 28.7%	0.07
No. of Emergency Department Visits	0.72	0.049*** (0.0083) 6.8%	0.80	0.039*** (0.010) 4.9%	0.75	0.025*** (0.0075) 3.3%	0.33
No. of ED Visits, Primary Care Treatable	0.36	0.023*** (0.0054) 6.4%	0.41	0.025*** (0.0068) 6.1%	0.37	0.020*** (0.0049) 5.5%	0.93
Tot. Spending	9850.50	342.90*** (126.30) 3.5%	10055.8	18.2 (150.2) 0.18%	9109.4	62.6 (112.7) 0.69%	0.43

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A23: Treatment Effect of a PCP Leaving a Clinic by Patient Status

Type	25th Percentile Threshold						50th Percentile Threshold						75th Percentile Threshold					
	Individual			Team			Individual			Team			Individual			Team		
	Mean	Impact	P-Value	Mean	Impact	P-Value	Mean	Impact	P-Value	Mean	Impact	P-Value	Mean	Impact	P-Value	Mean	Impact	P-Value
No. of Primary Care Visits	5.6	-0.66*** (0.042) -11.9%	5.0	-0.72*** (0.047) -14.3%	0.37	6.1	-0.81*** (0.082) -13.4%	5.2	-0.69*** (0.035) -13.3%	0.12	7.3	-1.2*** (0.23) -15.7%	5.2	-0.67*** (0.032) -12.9%	0.03			
No. of Specialist Visits	9.5	0.40*** (0.046) 4.2%	9.2	0.13** (0.059) 1.4%	p< 0.001	9.6	0.40*** (0.079) 4.1%	9.3	0.28*** (0.043) 3.0%	0.12	9.6	0.60*** (0.17) 6.2%	9.4	0.30*** (0.039) 3.2%	0.10			
No. of Emergency Department Visits	0.76	0.030*** (0.0068) 3.9%	0.74	0.017* (0.0094) 2.3%	0.30	0.80	0.038*** (0.012) 4.8%	0.74	0.022*** (0.0067) 3.0%	0.17	0.90	0.048* (0.027) 5.4%	0.75	0.025*** (0.0059) 3.3%	0.37			
No. of ED Visits, Primary Care Treatable	0.38	0.012*** (0.0043) 3.0%	0.37	0.017*** (0.0059) 4.6%	0.44	0.41	0.012 (0.0075) 2.9%	0.37	0.014*** (0.0042) 3.9%	0.94	0.47	0.0085 (0.018) 1.8%	0.37	0.013*** (0.0037) 3.6%	0.89			
Treated PCP Sample Size	3871		3715		1071		6515		293		7293							
Control PCP Sample Size	7878		2559		4981		5456		2301		8136							

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A24: Treatment Effect of a PCP Leaving a Clinic by
Length of PCP-Patient Relationship

	Age 75+: 3 Year		4-14 Year		P-Value
No. of Primary Care Visits	5.2	-0.69*** (0.076) -13.2%	5.9	-0.99*** (0.051) -16.7%	p< 0.001
Prob. Form New PCP Relationship	0.026	0.029*** (0.0021) 108.7%	0.028	0.056*** (0.0017) 196.6%	p< 0.001
Prob. Visit Pre-Existing PCP	3.0	-0.52*** (0.035) -17.5%	3.4	-0.76*** (0.024) -22.2%	p< 0.001
No. of Specialist Visits	9.5	0.23* (0.12) 2.4%	9.6	0.62*** (0.065) 6.5%	0.004
Prob. Visit Pre-Existing SP	2.6	0.068*** (0.029) 2.6%	2.7	0.20*** (0.016) 7.4%	p< 0.001
Tot. Amount of Preventive Care by SP	0.23	0.060*** (0.014) 25.8%	0.25	0.13*** (0.0093) 52.6%	p< 0.001
Not Preventable ED, Inpatient Use, and Death	0.74	0.015 (0.023) 2.1%	0.72	0.017 (0.012) 2.4%	0.94
No. of ED Visits, Primary Care Treatable	0.37	-0.015 (0.011) -4.2%	0.32	0.016*** (0.0059) 4.8%	0.02
Treated PCP Sample Size	4584		6048		
Control PCP Sample Size	4584		6048		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A25: Treatment Effect of a PCP Leaving a Clinic by Patient Status
Matching on Practice Size

Type	High Risk			Not High Risk			Func.			No Func.			Minority			White			Male-Female Match			Female-Female Match		
	Mean	Impact		Mean	Impact		Mean	Impact		Mean	Impact		Mean	Impact		Mean	Impact		Mean	Impact		Mean	Impact	
No. of Primary Care Visits	7.0	-1.086*** (0.052) -15.5%		4.9	-0.84*** (0.033) -17.3%		5.0	-0.80*** (0.032) -16.1%		6.5	-1.1*** (0.057) -17.1%		5.3	-0.98*** (0.084) -18.5%		5.4	-0.89*** (0.035) -16.4%		5.4	-0.65*** (0.038) -12.2%		5.0	-0.57*** (0.089) -11.3%	
<i>p-value</i>				p< 0.001						p< 0.001														
Prob. Form New PCP Relationship	0.030	0.044*** (0.0013) 146.7%		0.043	0.067*** (0.0015) 154.2%		0.041	0.066*** (0.0015) 162.6%		0.035	0.048*** (0.0015) 138.5%		0.025	0.057*** (0.0026) 231.5%		0.043	0.064*** (0.0014) 147.9%		0.044	0.034*** (0.0014) 78.8%		0.030	0.020*** (0.0028) 66.3%	
<i>p-value</i>				p< 0.001						p< 0.001														
No. of Specialist Visits	13.6	0.58*** (0.077) 4.3%		8.1	0.41*** (0.039) 5.1%		8.4	0.43*** (0.040) 5.1%		12.6	0.56*** (0.072) 4.5%		8.1	0.59*** (0.092) 7.3%		9.7	0.44*** (0.041) 4.6%		9.4	0.29*** (0.044) 3.0%		9.7	-0.065 (0.15) -0.68%	
<i>p-value</i>				0.17						0.06														
Tot. Amount of Preventive Care	1.9	-0.071*** (0.023) -3.7%		2.1	-0.080*** (0.017) -3.9%		2.0	-0.083*** (0.016) -4.1%		1.9	-0.062** (0.024) -3.3%		1.5	-0.069* (0.035) -4.6%		2.1	-0.066*** (0.017) -3.1%		1.2	-0.044** (0.016) -3.7%		1.6	-0.083*** (0.033) -5.3%	
<i>p-value</i>				0.65						0.32														
No. of ED and Inpatient Visits	1.5	0.057*** (0.017) 3.8%		0.77	0.029*** (0.0070) 3.7%		0.74	0.024*** (0.0070) 3.2%		1.5	0.067*** (0.016) 4.4%		1.056	0.029 (0.022) 2.7%		0.94	0.038*** (0.0073) 4.0%		0.98	0.025*** (0.0082) 2.6%		1.00	0.013 (0.031) 1.3%	
<i>p-value</i>				0.002						0.010														
Treated PCPs (N)	8125			8108			8203			7395			4032			7996			5467			1467		
Control PCPs (N)	8125			8108			8203			7395			4032			7996			8271			1971		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. Relationship specifications drop 12% of patients contained in the main sample because their PCP’s NPI did not match to a UPIN, the PCP identification scheme used from 2002-2016. Further, patients with ages < 75 as of $t = -36$ were dropped from analyses to avoid censoring due to only observing patients once they become Medicare eligible (typically at age 65).

Table A26: Treatment Effect of a PCP Leaving a Clinic by Market Heterogeneity
Test for Importance of Local Availability

Type	Low PCP Density		High PCP Density		P-Value
	Mean	Impact	Mean	Impact	
No. of Primary Care Visits	5.3	-0.61*** (0.032) -11.6%	5.4	-0.55*** (0.066) -10.2%	0.35
Prob. Form New PCP Relationship	0.046	0.033*** (0.0011) 71.9%	0.042	0.024*** (0.0024) 58.0%	0.001
No. of Specialist Visits	9.5	0.30*** (0.036) 3.2%	8.8	0.28*** (0.077) 3.2%	0.77
No. of Emergency Department Visits	0.75	0.028*** (0.0053) 3.7%	0.74	0.0068 (0.012) 0.92%	0.10
No. of ED Visits, Primary Care Treatable	0.38	0.012*** (0.0034) 3.2%	0.37	0.0036 (0.0079) 0.96%	0.32
No. of ED Visits, Not Preventable	0.12	0.0082*** (0.0019) 7.0%	0.12	0.0029 (0.0040) 2.4%	0.24
Treated PCP Sample Size	6172	1414			
Control PCP Sample Size	8619	1818			

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. Bolded estimates indicate that the groups are significantly different at the 5% level. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. See Section 4.2 for more details on how heterogeneity and variables were defined. Density is defined by the number of PCPs within a 30 mile radius divided by the population. Above average areas are high PCP density and below average areas are low PCP density. Figure 9 shows monthly estimates.

Table A27: Treatment Effect of a PCP Leaving a Clinic
With More Than One Similar Clinic Option

Similar TIN Surrounding Clinic that Closed					
	No Similar Clinic		At Least One Similar Clinic		
Type	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.7	-1.2*** (0.072) -20.9%	5.7	-1.3*** (0.093) -23.7%	0.20
No. of UC and Specialist Visits	9.8	0.85*** (0.065) 8.8%	9.7	0.74*** (0.077) 7.7%	0.28
No. of ED and Inpatient Visits	0.92	0.059*** (0.012) 6.4%	0.93	0.043*** (0.013) 4.7%	0.38
Similar TIN Surrounding Open Clinics					
	No Similar Clinic		At Least One Similar Clinic		
Type	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.4	-0.51*** (0.065) -9.3%	5.3	-0.65*** (0.033) -12.3%	0.05
No. of UC and Specialist Visits	9.3	0.44*** (0.064) 4.7%	9.4	0.25*** (0.039) 2.6%	0.010
No. of ED and Inpatient Visits	0.96	0.042*** (0.012) 4.4%	0.96	0.021*** (0.0073) 2.2%	0.14

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Data only includes patients who lost a PCP and clinic. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure. Table ?? contains additional results. The bins were determined as above average and below average, where average clinic is not surrounded by a clinic with the same TIN. TIN density is calculated as whether there exists a non-focal clinic with the same TIN as the focal clinic, what I term a “sister clinic.” The average clinic does not have a sister clinic, so I compare clinics with zero to those with at least one sister clinic.

Table A28: Treatment Effect of a PCP Leaving a Clinic
by Urban/Rural Area

	Rural Area		Urban Area		
Type	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.5	-0.88*** (0.066) -16.0%	5.3	-0.52*** (0.032) -9.9%	p< 0.001
No. of UC and Specialist Visits	7.6	0.37*** (0.065) 4.8%	9.9	0.30*** (0.037) 3.0%	0.34
No. of ED and Inpatient Visits	1.059	0.040*** (0.015) 3.8%	0.94	0.022*** (0.0067) 2.3%	0.26
No. of ED Visits, Primary Care Treatable	0.43	0.022*** (0.0079) 5.0%	0.36	0.0069** (0.0034) 1.9%	0.09
Treated PCP Sample Size	1605		5981		
Control PCP Sample Size	1688		8749		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3, which only follows patients for one year post-departure. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level.

Table A29: Treatment Effect of a PCP Leaving a Clinic by Heterogeneity
Test for Importance of Local Availability

Matching on Practice Size					
	Low PCP Density		High PCP Density		
No. of Primary Care Visits	5.3	-0.64*** (0.037) -12.0%	5.3	-0.44*** (0.070) -8.3%	0.010
No. of Patients Visting PCP at Least Once	0.86	-0.083*** (0.0035) -9.6%	0.86	-0.068*** (0.0064) -7.9%	0.04
Prob. Form New PCP Relationship	0.14	0.079*** (0.0041) 56.2%	0.13	0.066*** (0.0080) 50.2%	0.14
Prob. Visit Pre-Existing PCP	3.0	-0.45*** (0.018) -15.3%	2.9	-0.38*** (0.033) -12.8%	0.04
No. of Specialist Visits	9.5	0.32*** (0.041) 3.3%	8.8	0.20** (0.086) 2.2%	0.21
Tot. Amount of Preventive Care	2.2	-0.053*** (0.018) -2.5%	2.1	-0.048 (0.035) -2.2%	0.89
No. of Emergency Department Visits	0.77	0.025*** (0.0058) 3.3%	0.75	0.023 (0.014) 3.0%	0.87
Matching on Individual v. Shared					
No. of Primary Care Visits	5.3	-0.65*** (0.037) -12.3%	5.4	-0.49*** (0.070) -9.1%	0.04
No. of Patients Visting PCP at Least Once	0.86	-0.084*** (0.0035) -9.7%	0.86	-0.071*** (0.0066) -8.3%	0.09
Prob. Form New PCP Relationship	0.14	0.077*** (0.0041) 54.8%	0.13	0.067*** (0.0080) 49.9%	0.24
Prob. Visit Pre-Existing PCP	2.9	-0.46*** (0.018) -15.7%	3.0	-0.40*** (0.034) -13.5%	0.09
No. of Specialist Visits	9.5	0.31*** (0.042) 3.3%	8.9	0.16* (0.087) 1.8%	0.12
Tot. Amount of Preventive Care	2.1	-0.045*** (0.018) -2.1%	2.2	-0.039 (0.035) -1.8%	0.89
No. of Emergency Department Visits	0.77	0.028*** (0.0060) 3.7%	0.74	0.023* (0.014) 3.1%	0.70

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3. “Prob.” indicates that the outcome is the yearly probability and “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Data relies on the main sample shown in Table 1, which only follows patients for one year post-departure.

Table A30: Treatment Effect of a PCP Leaving a Clinic
Utilization of Clinic Based Services by Closing Clinic Practice Size

Within Closed Clinics	1 PCP		2+ PCPs		
Type	Mean	Impact	Mean	Impact	P-Value
No. of Primary Care Visits	5.7	-1.2*** (0.065) -20.9%	5.4	-2.0*** (0.17) -37.2%	p< 0.001
No. of Specialist Visits	9.9	0.95*** (0.063) 9.6%	9.0	0.29*** (0.12) 3.2%	p< 0.001
No. of ED and Inpatient Visits	0.93	0.056*** (0.011) 6.0%	0.88	0.058*** (0.020) 6.6%	0.91
Tot. Spending	10092.6	246.7* (135.5) 2.4%	8337.7	432.3 (267.5) 5.2%	0.52
Treated PCP Sample Size	2416		435		
Control PCP Sample Size	6129		4308		

Notes: The table displays results from the difference-in-differences specification outlined in Section 5.3, which only follows patients for one year post-departure. “No.” indicates that the outcome is the yearly number. Regressions are at the PCP-year level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Clinics with 1-3 PCPs were compared to those with 4-100 PCPs because 3 PCPs was the median practice size (7 is the mean). Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level.

Table A31: Treatment Effect of PCP Leaving Practice
by Whether Open Clinic Practices on Team or Individual Model by Clinic Size

	1-3 PCPs	4-100 PCPs
No. Actual Clinic Visits		
Shared	-1.7*** (0.12) 3.1 -54.0%	-1.7*** (0.047) 3.9 -43.5%
Individual	-2.4*** (0.12) 4.4 -53.5%	-2.1*** (0.087) 4.4 -48.4%
No. Other PCP Clinic Visits		
Shared	0.99*** (0.078) 1.6 61.9%	1.0052*** (0.036) 1.2 86.7%
Individual	1.4*** (0.095) 1.4 103.2%	1.4*** (0.070) 1.2 116.0%
Treated Shared	599	5183
Control Shared	2307	2198
Treated Individual	592	1212
Control Individual	5322	610

Notes: The table displays results from the difference-in-differences specification outlined in 5.3. Regressions are at the PCP level and contain pre-departure PCP fixed effects. Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. Bolded estimates mean that shared and panel groups are significantly different at the 5% level and † means that small and large groups are significantly different at the 5% level. Data relies on the main sample shown in Table 1, which only follows patients for one year post departure.

Table A32: Effects by Clinic Size

	All Departures & All Clinics		
	1 PCPs	2-3 PCPs	4+ PCPs
No. of Primary Care Visits	-1.1***† (0.17) 5.4 -20.5%	-0.61***† (0.062) 5.3 -11.5%	-0.74*** (0.050) 5.3 -13.9%
No. of PCP Visits at Clinic	-2.3***† (0.18) 4.0 -58.1%	-1.8***† (0.067) 4.1 -44.7%	-1.8*** (0.056) 4.3 -42.1%
No. of PCP Visits at Other Clinics	1.2*** (0.11) 1.5 80.7%	1.2***◇ (0.049) 1.2 98.2%	1.078***◇ (0.042) 0.99 108.9%
Prob. Form New PCP Relationship	0.040*** (0.0047) 0.051 77.7%	0.036*** (0.0023) 0.044 82.3%	0.035*** (0.0021) 0.045 76.8%
No. of Specialist Visits	0.59*** (0.16) 9.9 5.9%	0.37*** (0.072) 9.6 3.9%	0.19** (0.070) 9.3 2.0%
No. of Emergency Department Visits	0.054** (0.025) 0.93 5.8%	0.034*** (0.011) 0.78 4.3%	0.024** (0.011) 0.73 3.3%
No. of Urgent Care Visits	-0.0028 (0.0036) 0.025 -11.3%	0.0038** (0.0015) 0.015 25.8%	0.0019 (0.0017) 0.021 8.8%
No. of Inpatient Visits	-0.0097 (0.018) 0.48 -2.0%	0.028***◇ (0.0091) 0.44 6.3%	-0.0054◇ (0.0090) 0.43 -1.2%
Treated PCP Sample Size	364	2224	4998
Control PCP Sample Size	6129	2833	1475

Notes: Stars indicate significance at the 10% (*), 5% (**), and 1% (***) level. † (◇) indicates that estimates from clinics with 1-3 PCPs (10+ PCPs) and 4-9 PCPs are significantly different at the 5% level.

Appendix 5 Event Study Plots

The following plots are from the matched difference-in-difference model described in the methods. Point estimates for every months interacted for whether the observation was a treatment or control observation are plotted. Relative time is relative to the last month the PCP is observed practicing in $t = 0$.

Figure A3: Pre-Period and Event Plots per Patient, Relative to $t = -12$

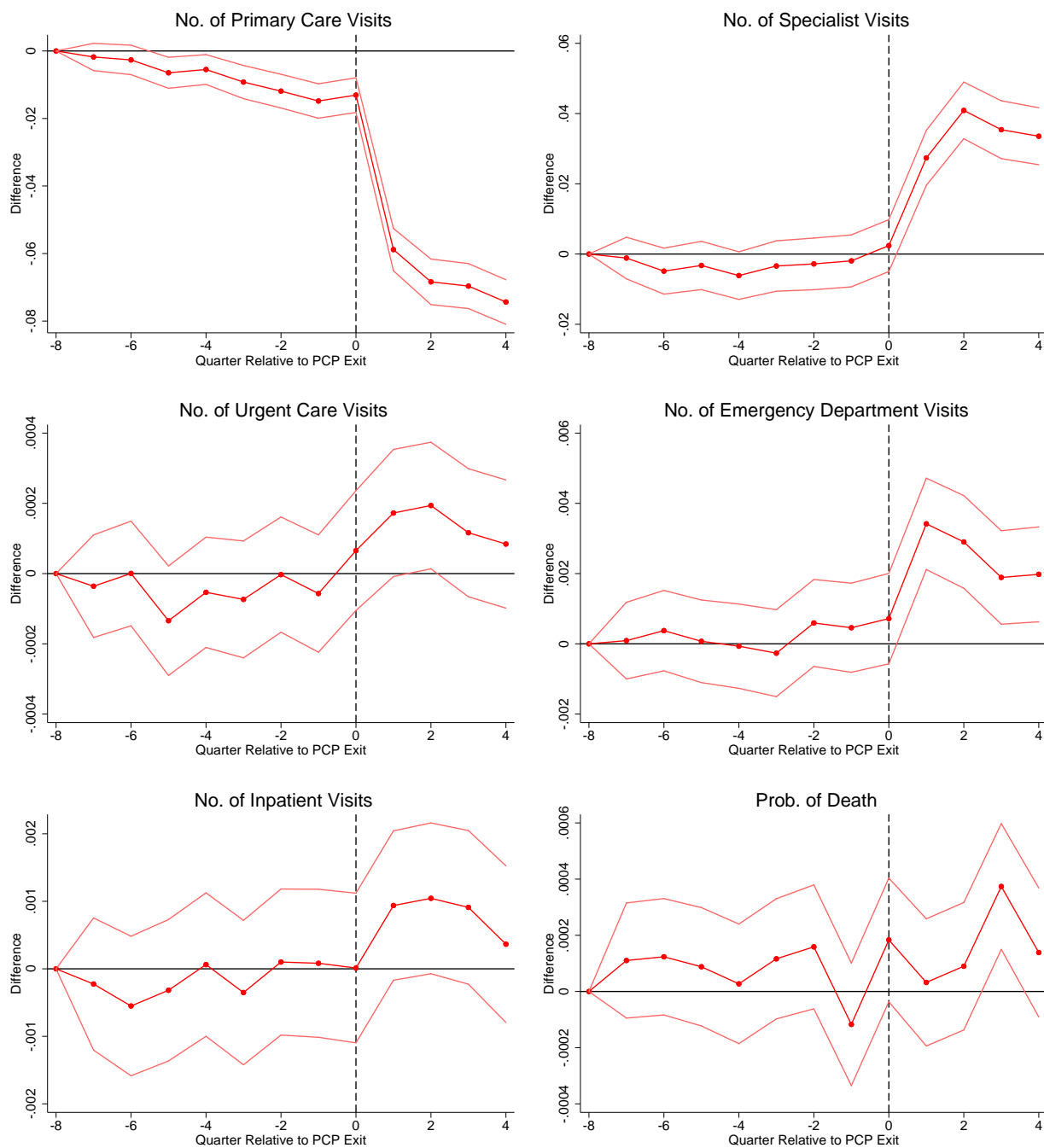
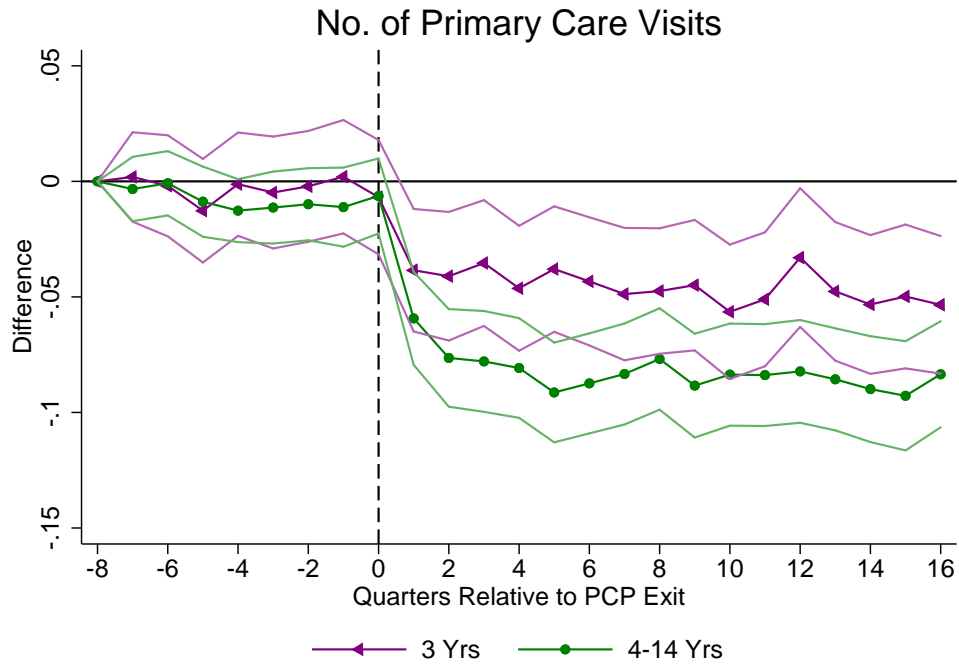


Figure A5: Effects of a PCP Leaving on PCP Visits
by Length of Relationship



Notes: Event study graphs plot each coefficient from the difference-in-differences specification outlined in Section 5.3. “No.” indicates that the outcome is the monthly number. Regressions are at the PCP-month level, contain pre-departure PCP fixed effects, and cluster at the PCP-match level. Event studies rely on the a sample that follows patients 4 years post-departure. See Table A24 for pooled estimates across outcomes.