You Had Me At Hello: The Effects of Disruptions to the Patient-Physician Relationship.

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> The care of the patient must be completely personal. The significance of the intimate personal relationship between physician and patient cannot be too strongly emphasized, for in an extraordinarily large number of cases both diagnosis and treatment are entirely dependent on it, and the failure of the young physician to establish this relationship accounts for much of his ineffectiveness in the care of patients. -Francis Peabody, 1927

As US health care costs continue their precipitous rise towards 20% of GDP, considerable focus has been placed on care coordination. For instance Berwick and Hackbarth (2012) estimate that poor care coordination has resulted in $25 billion to $45 billion in waste in 2011 alone. These coordination costs exist largely because care has become more fragmented (Rebitzer and Votruba 2011) leading patients to have multiple interactions across a variety of caregivers and locations.

To put this in context, consider an anecdote chronicled by a general internist (Press 2014). A patient booked an appointment with his primary care physician due to pain and fever. After tests revealed a tumor, the patient saw 11 clinicians in addition to his primary care physician over the course of 80 days. The primary care physician in this tale communicated repeatedly with each of these specialists, with the patient and with the patient's spouse. While the patient's care was fragmented across 12 providers, he received well coordinated care due to continuity with his primary care provider, who was able to maintain a full awareness of the patient's situation. Not all patients have this type of continuity, though, with as many as 4-11% of patients switching physicians each year (Sorbero et al. 2003), often involuntarily (Mold, Fryer, and Roberts 2004; Safran et al. 2001).

In this paper, I present a theory of continuity. I theorize that a patient and his physicians learn about each from their repeated interactions. In simple patients, there is little value to this information. But in complex patients, this stock of information allows the provider to move from the diagnostic phase to the treatment phase of an ailment more quickly. This results in more time spent treating the patient and ultimately better outcomes. This expectation of better outcomes then allows a provider to shift his margin for referring a patient to specialty care - ultimately helping the patient and saving the system from additional costs.

In this paper I consider a situation where a provider leaves a medical practice in order to test this theory and estimate the effects of discontinuity in the patient - primary care provider relationship. Using unique data from the Military Health System I construct a 10-year panel of patients. In the military, physicians are routinely pulled from their practices and deployed oversees creating a plausibly exogenous source of physician turnover.

I find that there is a steep 35 % increase (8.2 percentage points) in the probability of using specialty care after a patient's physician deploys. I also find a 23 % increase (2.3 pp) in emergency department use and a 50 % increase (0.7 pp) in inpatient admissions.

I also test whether these effects are driven by an access to care crunch rather than discontinuous care. Using patients assigned to other providers within the practice, I separately estimate access to care effects. Overall I find a significant drop in primary care utilization and a smaller increase in specialty care utilization. I find virtually no change for these individuals on emergency department utilization or inpatient admissions.

Understanding the effects of discontinuity in care has important implications for both policy and practice. Relatively little policy focus has been placed on this interpersonal relationship (Guthrie et al. 2008) however. In fact policies have been largely associated with discontinuity in the physician-patient relationship. For instance, the rise of managed care has been associated with annual contracts that may lead to forced discontinuities (Flocke, Stange, and Zyzanski 1997). While the Centers for Medicare and Medicaid Services (CMS) has focused on care coordination as a potential cost-saving tool (McClellan et al. 2010), there has been significant patient churn in accountable care organizations (Hsu et al. 2017) and Medicaid policy often require patients to frequently change policies (Cutler, Wikler, and Basch 2012). Additionally the individual market under the Affordable Care Act (ACA) potentially leads to annual changes in primary care physicians. Narrow and changing networks often prevent an enrollee from developing a personal relationship with her physician (Buettgens, Nichols, and Dorn 2012). The US system of employer based health insurance also contributes to the frequency of discontinuities. There is an approximately 21% average annual private insurance cancellation rate, about one third of which is due to changes in employer group offerings (Cebul et al. 2008).

Research has shown that patients place relatively low value on this interpersonal relationship. Dahl and Forbes (2016) found that only about one third of individuals are willing to pay higher premiums to maintain their relationship with a primary care physician. Meltzer (2001) found that while about 10 % of individuals were willing to pay more than $750 to be cared for by their primary care physician rather than a hospitalist, most individuals were willing to pay only about $62. This may be because patients tend to assume care will be continuous. Haggerty (2013) found that patients experience continuity as security and confidence and that patients assume providers are communicating until a gap emerges.

My research contributes to three streams of literature. First, there is a significant literature on continuity and fragmentation of care (Cebul et al. 2008; Agha, Frandsen, and Rebitzer 2017). Next, there is a small literature on the effects of forced discontinuities such as through insurance changes or physician turnover (Kikano et al. 2000; Waldman et al. 2004). Finally, there is a large stream of literature on the transference of information (Polanyi 1958; Jensen and Meckling 1992).

My work builds on previous research in several important ways. First, much of the previous work has suffered from the endogeneity of the patient's decision to either discontinue a relationship or to maintain a regular physician at all. Due to military rules, patients in my sample are required to maintain enrollment in a managed care plan with an assigned primary care provider. Second, previous research has generally had to contend with loss of other forms of continuity as well as the loss of the patient-physician relationship. For instance a patient may change from having no physician to having a physician or move to a physician that is not on a shared medical record. Because my patients are static, universally covered with no out of pocket costs, and on a shared electronic medical record I am able to isolate the effects of the loss of the relationship. Third, I have a high level of patient continuity unlike commercial claims where there is high turnover. I have a ten year panel covering 718,000 patients that incorporates at least several years of medical information on each patient. While most administrative data relies on billing claims, this data is pulled directly from the Military's electronic medical record that includes additional variables such as the patient's chief complaint. I use this data to form an index of patient complexity that is not subject to physician coding preferences. Additionally, I have access to individual military personnel records. This allows me to observe considerably more information about both the patients and the medical practices than most previous work. Fourth, most previous studies have focused on elderly and/or chronically ill individuals. My population, conversely, tends to be younger and healthier - potentially identifying a lower threshold for the effects of discontinuity in care. Finally, I am able to observe the adoption of a recent innovation in care coordination during my period: the patient centered medical home. I find that this care model vastly reduces the affects of the discontinuity in care.

The paper continues as follows. In the next section I review the literature on care coordination. In section 3 I present a conceptual framework and economic theory. In section four a provide an in depth look at the Military Health System. In section five I present my empirical strategy and results. In section 6 I discuss the results and conclude with a particular emphasis on the managerial and policy implications of my research.

Previous Literature

While continuity of care has no single accepted definition (Freeman et al. 2001), it can be thought of as the extent to which care is coordinated and uninterrupted over time (Shortell 1976; Haggerty et al. 2003). While a continuing relationship between an individual patient and his primary care provider may be simplest means of achieving continuity (Starfield et al. 1976), this requires patients to make two key trade-offs. First, patients may desire increased access to care - either gaining an appointment more quickly or at a more opportune time than their primary care provider can entertain (Freeman et al. 2001; Rubin et al. 2006). Second, the patient and provider may decide together that a patient will benefit more from seeing a specialist than seeing each other again (Meltzer 2001). In each case, a trade-off is made between relational continuity and the increased coordination costs that come with fragmenting care among more physicians.

As care becomes more fragmented, however, the health care system has responded with ways of managing these coordination costs. The literature identifies at least three dimensions of continuity beyond relational: informational, managerial, and longitudinal (Saultz 2003; Haggerty et al. 2003). Informational continuity, the extent to which a provider has access to information about the patient including past medical experiences (Saultz 2003), includes patient medical records or other provider to provider communication. Managerial continuity builds on informational continuity referring to the extent to which a patient's medical management is consistent and responsive (Haggerty et al. 2003). For example, multiple providers following a single treatment plan can potentially increase the level of managerial continuity. Finally, a level beyond managerial, longitudinal continuity refers to a patient receiving care from a team of providers that coordinate the patient's care among each other, including preventive services (Saultz 2003). The patient centered medical home, further discussed later in this chapter, is a means of enhancing longitudinal continuity.

The medical literature contains significant body of empirical research into continuity.

Van Walraven et al (2010) conducted a broad review of the continuity literature finding a significant association between increased continuity and decreased system utilization in eight of nine high-quality studies. Empirical research on relational continuity specifically, though, is somewhat limited. The few studies that exist have primarily focused on indirect outcomes such as patient satisfaction rather than health outcomes finding that a continuous relationship increased the odds that a patient would be satisfied with a consultation (Hjortdahl and Laerum 1992). Other work considered the relationship between relational continuity and preventive medicine (Ettner 1999) or trust in ones physician (Mainous et al. 2001). Van Servellen et al (2006) reviewed the continuity literature, focused solely on clinical trials. They found that while 14 studies included relational continuity, all of these also involved at least one other continuity dimension, generally managerial.

There is also some evidence that physicians behave differently when treating a patient with whom they have a relationship. For instance Johnson, Rehavi and Chan (2016) considered obstetricians delivering other providers' patients and found a statistically significant difference in C-section rates than when delivering their own patients.

Like continuity, fragmentation is a concept without a standard accepted definition. On a broad level, fragmentation refers to health care providers that make decisions with only a portion of the relevant information (Elhauge 2010). This can occur when a patient sees multiple specialists or primary care physicians.

Researchers have attempted to quantify the effects of fragmentation and discontinuous care. Petersen and colleagues (1994) considered a change in house staff coverage in New York and found that adverse events were strongly associated with coverage from a physician on a different team. Similarly Meltzer (2001) while analyzing the rise of hospitalists, found that patients admitted to the hospital during the week lost most of the benefits of having a hospitalist if they were still admitted when the hospitalists had a weekend off. Johnston and Hockenberry (2008) considered changes in both patient outcomes and the cost of care due to increased specialization. They found that fragmented care resultant from specialization lead to better outcomes but also increased cost. Agha, Frandsen and Rebitzer (2017) found that 60% of fragmentation was independent of patient preferences and that primary care fragmentation lead to an increase in hospitalizations.

Another body of literature has considered forced discontinuity of care. Several papers have looked at effects on patients whose insurance changed forcing discontinuity in care. Kikano and coauthors (2000) surveyed over 1,800 insured patients and found those who had a forced discontinuity ranked their quality of primary care lower. Other work found that patients who had a forced discontinuity experienced anger, frustration, and general dissatisfaction (Kahana et al. 1997).

Information Transfers

One of the challenges with care coordination is that information varies in its transferability. Michael Polanyi (1958) noted that not all information can be written down. For example a pianist may know the appropriate pressure to place on the keys but may not be able to describe it. A patient may know that he is in pain but a description of the pain may elude words. This concept separates explicit information which can be written down or codified, from tacit knowledge.

Substantial work has pointed to limited information transfer between physicians. For instance Kripalani et al (2007) conducted a systemic review of the literature concerning hospital-based and primary care physician communication and found common deficits in information transfer. Other work found that nearly a quarter of primary care physicians were not even aware that their patient had been admitted to the hospital and less than half of primary care physicians received a discharge summary within two weeks (Bell et al. 2009).

Jensen and Meckling (1992) define a spectrum of specific to general knowledge based on the difficulty in transmitting information. Specific knowledge can be thought of as information that is idiosyncratic to specific circumstances. For instance, where in an operating room the forceps are kept is specific because while it is certainly able to be transferred, it is particular to that hospital. There has been some work on the role of specific knowledge in health care. Huckman and Pisano (2006) considered cardiac surgeons that worked in multiple hospitals. They found that there was a volume-outcomes affect for a particular hospital but that effect did not transfer to other hospitals in which that surgeon worked. Similarly, other work has found a customer-specific learning curve. Clark, Huckman, and Staats considered outsourced radiology services. They found that repeated interactions with a particular customer lead to an increased ability to meet that customer's needs .

Conceptual Framework

The conceptual framework reflects the fact that medical professionals must balance their time between diagnostic work to determine a patient's ailments and therapeutic work to ameliorate the problem. The patient and the physician, through a shared decision making process, continue diagnostic processes until they reach a sufficient level of certainty regarding the probable cause and best treatment options and then move to therapeutic processes. As the strength of their relationship increases, the physician builds a stock of information about the patient, allowing him to choose the most appropriate diagnostic procedures and more quickly understand what is ailing the patient. More effort can then be spent treating the ailment.

Formally, the provider produces health for the patient using a production function with two types of inputs, information and therapy, so that

$$H = I^{\frac{1}{\alpha}} T$$

and constrained by his supply of labor $L = D + T$. Therapy includes all elements of care designed to increase the patients health rather than discover new information. This includes procedures that treat the patient's ailment as well as counseling and prescribing.

Of course, not all ailments are equal with some being easily observable and others require significant diagnostic effort. For instance a patient with a broken arm may only require a simple x-ray while a patient with an auto-immune disease may require numerous tests to determine the diagnosis. The exponent $\frac{1}{\alpha}$ on I represents the returns to that information so that α increases with patient complexity. The information component is made up of two components: the stock of patient-specific information available to the provider K and diagnostic conversations, tests and procedures meant to gather new information so that

$$H = (D + K)^{\frac{1}{\alpha}} T$$

Considering comparative statics

$$\frac{\partial D}{\partial K} \leq 0$$

An increase in the information available would lead to a decrease in the amount of diagnostic work the provider should optimally engage in. This can be seen conceptually in figure 1 & 2. Here the X axis represents patient complexity and the Y axis represents the providers supply of labor. In Figure 1 the provider has no stock of information about the patient. In the most simple case ($\alpha = 0$), the provider does not need information and spends his full supply of labor treating the ailment. In the most complex case ($\alpha = 1$) however, the provider splits his time equally.

In figure 2, the provider is able to complement his diagnostic work with a stock of patient-specific information. In the simple case, there's no change to the production function. However, as the patient becomes more complex, the share of time spent diagnosing is reduced relative to the case of no stock of information. In this stylized example, instead of splitting his time equally, the stock of information allows the provider to spend 60% of his time treating and only 40% diagnosing.

Next consider the case when information goes up and patient complexity increases.

$$\frac{\partial^2 H}{\partial \alpha \partial K} < 0$$

Even as information increases, more complex patients are likely to have worse health outcomes. However, figure 3 shows outcomes with and without a stock of information for patients of varying complexity. The outcome with information is always as good and frequently greater than the outcome in the absence of information.

However, there is a third choice beyond test and treat. The physician can also refer the patient to specialty care if he does not feel capable of handling the situation. At the extremes, this is easy. A patient with cancer ($\alpha \to 1$) will be referred to oncology; an otherwise healthy patient with the common cold ($\alpha \to 0$) will be treated. However, a physician must balance the well-being of his patient with the additional resource use of specialty care. This means each physician will have some margin for which they feel indifferent about referring or treating a patient.

More formally, the patient and provider have an expected value of the health outcome that the provider can produce given the stock of information and the probability distribution of health outcomes. If this health probability is below some threshold, the provider prefers to refer the patient to a specialist. This is shown in figure 4. The horizontal line at .8 is the provider's refer threshold. [1] As the amount of patient specific information increases, the complexity level at which an expectation of sufficient health outcomes for the physician to treat rather than refer shifts further to the right along the complexity dimension.

The model drives three hypotheses. First, because of the change in production function, it will take a patient more visits to his primary care doctor in order to receive an equivalent amount of treatment.

*Hypothesis 1A:*An average patient will require more primary care encounters after a discontinuity in care.

[1]This is somewhat of a simplification. It would actually be the minimum of either the provider's refer threshold or the patient's choice to seek specialist care.

However, there's no conceptual reasons why a discontinuity would cause a patient to become sick or hurt. Therefore the probability of using any care will not change.

Hypothesis 1B: A patient's probability of using primary care will not increase

Third, although health is a function of both treatment and diagnostic work, treatment is the only part that adds value. That is, the information component of the production function is one at most which reduces to $H = T$. Therefore, on average, patients will always have worse outcomes after a discontinuity.

Hypothesis 2: Patients will have worse outcomes after a discontinuity in care.

Because the expectation of worse outcomes, a provider will be more likely to refer a patient to specialty care after a discontinuity.

Hypothesis 3: There will be an increase in specialty care after a discontinuity

Empirical Setting

The Military Health System (MHS) is an integrated system that both delivers health care in military hospitals and clinics ("direct care") and is also a payer for care sought in a non-military setting ("purchased care"). Additionally, the MHS integrates public health, graduate medical education, medical research, and operational medicine departments (*Final Report to the Secretary of Defense: Military Health System Review* 2014). I focus my overview on the direct and purchased care components with primary focus on primary care in the direct care system. Finally, I discuss one particular idiosyncrasy of Army Medicine that disrupts relational continuity of care into order to provide physicians for operational assignments. [2]

[2]For a more comprehensive review of the Military Health System, see *Evaluation of the TRICARE Program: Fiscal Year 2017 Report to Congress* 2017.

TRICARE Insurance

Tricare is the payment portion of military medicine and operates much like a traditional insurance offering. Tricare beneficiaries have several plans from which to choose, with the exception of active duty military that are required to enroll in Tricare Prime. Tricare Prime is the staff-model health maintenance organization (HMO) plan associated with the direct care system. Patients are assigned a primary care provider who must provide a referral for specialty care in return for low or zero out of pocket costs. In particular, active duty service members and their families do not pay enrollment fees and have $0 deductibles and co-insurance when care is provided in the direct care system.

Access to care standards require these patients be referred to the purchased care network if a timely appointment is not available in a geographically close military facility. These patients can also use a "point of service" option to seek care in the purchased care network without a referral but face a 50% copay.

Purchased Care

The Purchased care system is dual-tiered. Network providers have agreed to accept Tricare negotiated rates. However, Tricare Select beneficiaries have the option of seeing non-network 'authorized' providers for an additional copay. These providers can also legally charge 15% above the Tricare allowable charge. At times, the patient may have to pay the full cost out of pocket and then file for reimbursement when seeing non-network authorized providers. Similar to Medicare, Tricare allowable inpatient charges are reimbursed according to a diagnosis related group (DRG) prospective payment methodology. Outpatient charges are reimbursed based on resourced based relative value units (RBRVU).

Direct Care

The direct-care system provides inpatient and outpatient care, as well as optometry, pharmacy and dental services in 55 hospitals and 373 Clinics across the United States and Europe. Organization follows a hub and spoke model so that below the service's medical headquarters there is a "parent" hospital that provides administrative support to individual "children" clinics. While typically located on military posts, in recent years many children clinics have opened outside of military posts in the communities where military family members live.

The MHS uses three types of employment contracts with its medical providers. First, active military rotate through the various facilities, generally on three year tours though there is considerable variation in how often these individuals move. This makes up about 70% of physician staff. Second, civil service employees have a more traditional employment relationship with the DoD that includes a defined benefit retirement plan and health care benefits. These employees tend to remain in the same clinic or hospital for many years and make up about 25% of the physician staff. Finally, the DoD uses contracted labor to fill in manpower shortfalls. These are generally one year contracts with staffing companies though these contracts are often renewed for multiple years. The government does not provide any benefits for these individuals, though their staffing company might.

Primary Care

Tricare Prime uses a gatekeeper model for primary care in which the a Primary Care Manager (PCM) is responsible for coordinating a patient's care. In addition to physician's, physician's assistants and nurse practitioners are eligible to serve as primary care managers. Each PCM will have a set panel of patients for whom that provider is responsible. When one of these providers permanently leaves a hospital or clinic, her patients are automatically reassigned to a new provider and a letter is mailed to the patient informing him of the change. Generally, whomever replaces the departed physician will assume her entire panel, although there are many exceptions to this rule.

At times, physicians will be temporarily assigned outside of their assigned clinics. This can be due to other military responsibilities, or to cross-level manpower if a different clinic is short-handed for an extended period of time. When this occurs, the provider remains responsible for her panel of patients and appointments are offered with other providers in the clinic until either the physician returns or the patient requests a change in primary care manager through Tricare.

With frequent disruptions to the provider patient relationship, providing continuity of care is a major hurdle for the MHS. Military physicians move between hospitals, as well as operational assignments. Active duty patients also move approximately once every three years. Complicating personnel manning, physicians can be sent for temporary assignment to other facilities based on patient demand. Finally, physicians are pulled from the direct care system in order to meet contingency operations in theaters of war through the professional filler system (PROFIS). The MHS tracks how often patients see their assigned provider. While the organizational goal is 65% of the time, according to internal reports the organizational average is about 58%.

Professional Filler System

The primary source of discontinuities in this study is through military physician deployments. Deployments in this sense refer to temporarily serving outside of the United States in conjunction with a military operational mission. This could be due to combat or due to a humanitarian aid mission. Military physicians are generally not assigned to operational units so that they can practice medicine in hospitals when not needed in combat. The Army, however, maintains a list of individual physicians that would augment each unit should an operational unit deploy. This system is called the Professional Filler System (PROFIS) and those on this list can be thought of as an "on-call" status for a specific unit (US Army, 2015) . Periodically, hospitals are told that they must provide the names of a certain quantity of physicians for this. Individual hospitals have discretionary power for how they choose, and how often they rotate these individuals. Often the assignment is based on whose 'turn' it is to deploy. That is, who hasn't deployed in the past or whoever is newest to the hospital. About 10% of military physicians are in the PROFIS system. When a deployment is needed, the individual assigned to that unit in the PROFIS system is informed of the location and length of the deployment, generally between 6 months and one year. Only a small proportion of those assigned to a PROFIS unit actually deploy.

Deployments themselves are pseudo-random. For deployments with longer lead-time (e.g 6 months) each hospital chooses the providers that are entered into the PROFIS system but not the unit to which that provider is assigned. Unit deployments are based on operational needs. It is incredibly improbable that Army Forces Command makes deployment decisions based on the assigned medical doctor. At times, the assigned doctor will not be able to deploy with that unit. For example if the provider gets hurt while preparing to deploy. If this occurs, the hospital is supposed to choose another eligible provider. In practice, however, there is often little choice. As an administrator at a small hospital relayed to me:

> Yeah. It's more, usually more of a warm body scenario. Okay, I've got five active duty providers, three are already in a PROFIS position, one has this other tasking that make them non-PROFIS, so you're left. Guess what, you get to fill this position.

Upon learning of deployment, the physician is not officially given any additional administrative time to prepare despite numerous preparatory tasks. For instance a provider pending deployment must update his will, get a power of attorney, go through medical screening, and prove that he is competent with a firearm. There are also additional clinical tasks such as preparing and transitioning patients.

Formally, patients remain assigned to their primary care manager and are not informed of the deployment. When a patient calls to book an appointment, the patient is informed that his physician is unavailable and offered an appointment with an alternative provider. The patient always has the choice to go online and request his primary care provider be changed to another available provider in the clinic. Informally, some providers will inform their patients, especially if they have a longer lead time prior to the deployment.

There is no formal guidance in transitioning patients from one provider to another. From speaking with military providers it seems there is considerable heterogeneity in how the actual transitions occur but that different clinics have developed informal routines for transitioning the more complex patients.

While there are no changes to empanelling or appointing procedures, at least one provider told me he would work with front office staff to only see his empaneled patients while preparing to deploy.

> I can recall multiple patients that when I left I had transferred to [clinic name] to continue care with the recommendation that they get an [medical out processing from the military], and I can recall a couple patients specifically in the [unit] that ... There was one guy, he was like on a cane, not walking very well, so he was not deployed. I came back... and there sits this soldier still there... and still not walking well. It really bothered me that he didn't, you know, he didn't get better. You know, was it my fault because I left? Did he get the care he needed? I have no idea.

1 Data

The data for this project comes primarily from the Defense Health Agency's medical data repository (MDR) which includes a complete longitudinal record of care for all Tricare beneficiaries. The data is separated by source of care - either through the direct care system or purchased from the civilian network. I combine this data with individual personnel records obtained from the Defense Manpower Data Center (DMDC).

Direct Care Data

Due to the use of a common electronic medical record, detailed encounter-level data is available for the direct care system. Each outpatient observation is a specific patient visit with the national provider identification numbers (NPI) for up to three providers, the provider's specialty and up to 13 distinct common procedural terminology (CPT) codes as well as up to 10 International Classification of Diseases (ICD) diagnosis codes. CPT codes are a reporting mechanism that annotate what a provider did during a patient visit. [3] Other data include the chief complaint, the appointment type such as new or follow-up, the hospital department, and workload values in relative value units (RVU). In addition I observe any hospital inpatient admissions.

Purchased Care Data

The purchased care data comes from individual claims and provides much less detail compared to the direct care data. However, I am able to observe patient appointments, the location and specialty of the appointment, the CPT codes performed and any diagnoses.

Personnel Files

The military personnel records include demographics such as race, age, gender & education level as well as a where each Soldier was stationed. I am also able to observe patient and physician deployments.

Sample Construction

My sample includes all active duty Soldiers that served for at least two years and had patient encounters in the direct care system in at least two separate years between 2007-2016. I begin with 2007 because provider NPI's were not available prior to late 2006. It's not uncommon for a Soldier to have a "break in service" meaning that one leaves the military

[3]The MHS used ICD-9 codes through September 30, 2015 and ICD-10 codes beginning October 1, 2015.

and then reenters. In these cases I keep only the first period of service. I also exclude any observations after a Soldier deploys to a war zone during the panel. If a deployment occurs within a quarter of his provider's deployment then I also exclude that individual. Sample construction is detailed in table 1 below.

I eliminate the first year of data in some regressions. I do this because the data is left censored and I require at least four quarters to calculate some controls. Results are not sensitive to the specification however.

Dependent Variables

I consider how much care an individual consumes. I quantify this by considering whether patients increase their use in either primary and specialty care. I consider both the extensive margin of the probability of any use of care and the intensive margin of how much care is consumed contingent on using care. I use emergency department visits [4] and inpatient hospital admissions as a measures of patient outcomes.

Independent and Control Variables The primary independent variable for the analysis is an indicator for a patient's primary care provider deploying. I code this as 1 if any primary care physician that a patient sees deploys within a year after the encounter. This is a broad definition intended to include all possible discontinuities. In addition, I use an indicator for the year prior to a physician's deployment. I use this because this is the maximum period in which a provider is likely to be aware of a pending deployment. This allows me to consider any anticipatory behavior. I also control for several time-varying covariates including education, rank, the length of time a patient been located at a specific installation.

Table 2 shows descriptive statistics. The median patient is 26 and uses one primary care appointment each quarter. This seems a bit high but is likely a function of my setting. Active duty military do not receive a set number of sick days. Instead, they must see a primary care physician to be excused from training whenever they fall ill.

Table 3 displays a comparison of means for those who do and do not experience a provider

[4] ED use can conceptually be considered either a utilization measure or an outcome.

deploying. Those who experience a discontinuity are slightly different demographically. They are slightly less white and more likely to be female. They tend to use more primary care and less specialty care. Similarly, I compare primary care physicians that do and do not ever deploy. Table 4 shows this comparison of means. Physicians that deploy tend to see more active duty patients and conduct fewer tests (measured by BETOS code) per encounter. This is likely driven by physicians assigned to operational units (not PROFIS) that exist in the dataset. I can only observe deployments and not a physician's assigned unit so I include these physicians here. However, because these physicians deploy with their patients they fall out of the sample and so do not drive the results. In robustness (not shown) I exclude any patient assigned to an operational base [5] and the results are substantially the same.

2 Methodology

My primarily analysis uses a difference in differences approach that treats a physician deployment as a discrete event. Because the treatments occur at different time periods for different individuals I follow Bertrand and Mullainathan (2003) and use the base form:

$$Y_{it} = \alpha + \beta_1^* I(t \geq deployment) + \beta_2^* 1(t = notification) + \gamma^* X_{it} + \theta_i + \delta_t + \epsilon_{it}$$

where y_{it} represents an outcome of interest for individual i at time t, and β_1 represents the effect of the PCM deployment. β_2 represents any anticipatory effects. I don't observe the date a physician is selected for a deployment. However, in discussions with military providers, one year seems to be the earliest an individual is likely to know of a deployment. I return to this in the section on anticipatory behavior. X_{it} are a vector of time-varying controls. θ represents a vector of individual fixed-effects and δ_t represent a vector of quarter-year fixed-effects. Standard errors are clustered at the military installation level to account

[5] Military bases can be divided by function. Operational bases main function is to train and deploy Soldiers as needed. Other institutional bases provide support activities such as supply or schooling.

for potential serial correlation among individuals that are affected by the same deployment.

All of the dependent variables are heavily skewed. I therefore conduct a log transformation to allow for linear estimation. I add one to each observation in order to deal with the numerous zeros. In some specifications, I also include a linear probability model where the left side variable is one for any value greater than zero. This allows me to estimate the change in the extensive margin of how likely an event is to occur in addition to the overall volume change. I have also run a Poisson maximum likelihood estimation (not shown) as well that is able to handle the numerous zero values without requiring a transformation. The results are not sensitive to the specification.

A key assumption of differences in differences is the parallel trends assumption. The timing of the deployment should not be correlated with the patient's health or physician's performance prior to the deployment. I use an event-study methodology to evaluate the these assumptions. The event study takes the form:

$$Y_{it} = \beta_{Q=t-t*} + \theta_i + \delta_t + \epsilon_{it}$$

Where Q is the quarter relative to the quarter of the physician deployment $t*$. This allows me to consider the incremental changes over time before and after the deployment. I omit the time period $t*-5$ as that is the time-period prior to the earliest likely notification of a deployment and simplifies interpretation of the coefficient estimates as a difference relative to a baseline pre-period regardless of any anticipatory effects.

3 Results

Utilization

Hypothesis 1A predicts that there will be an overall increase in primary care visits. Figure 5 shows the change in primary care usage over time relative to the discontinuity. The grey box represents the reasonable notification period. There's a small increase in primary care usage that begins during the notification period and then dissipates over the course of two quarters. This seems consistent with the conceptual story of an increase in primary care visits that may degrade over time as more information is generated in a new patient-physician relationship.

Table 5 Column 1 shows the results for the log model of primary care. The 0.043 coefficient indicates a small but significant 4% increase over a base of approximately 1.58 primary care visits per quarter. the equates to about one additional primary care visit for every 4 individuals annually. With an average of 5200 patient discontinuities each year in my sample, this equates to over 1300 additional primary care visits each year.

Hypothesis 1B predicts that there will be no increase, however, on the extensive margin. In other words, those who are using care will use more of it, but an individual's probability of needing any care is unlikely to increase based on a discontinuity. I test this with the linear probability model of primary care utilization. Table 6 column 1 shows the results of this regression. The post-discontinuity coefficient is extremely small and not significant. This would seem to support the hypothesis that those who need some primary care will require more primary care after a discontinuity than they would have otherwise, but that a discontinuity will not drive a need for primary care.

Hypothesis 3 predicts an increase in specialty care after a discontinuity if providers expect that lack of patient-specific information could cause worse outcomes. Figures 6 shows the change in specialty care utilization over time relative to the discontinuity. The visual increase is not only stark, but also appears to be enduring. Table 5 column 2 shows the main equation regression results. The coefficient on the post estimator indicates nearly a 15% increase in total utilization. Column 2 of table 6 shows the linear probability model results. The probability of any visit increases 8.2 percentage points, a massive 35% increase after a discontinuity from 23% to 31.2% probability of using specialty care in a given quarter. This finding is consistent with the model's prediction, although the timing of the increase presents questions regarding the mechanism. I return to this in the anticipatory behavior section.

Hypothesis 2 is that patients will have worse health outcomes after a discontinuity. I operationalize health outcomes using two conventional measures: emergency department visits and inpatient admissions. Both outcomes are expensive for the health system and generally considered undesirable for the patient.

Figure 7 show the event study of emergency room use. Similar to the use of specialty care, there is a rise during the notification period that levels out in the post-period but does not return to pre-period levels. It's not immediately clear why ED use would begin before the discontinuity. However, one possible explanation is that physicians are distracted during the anticipatory period and provide a lower level of care. Alternatively, this increase may be due to reduced access to care as physicians prepare for deployment however, I don't find that when I test empirically. I'll address this more later when I consider access to care effects. Table 5 column 3 shows the regression coefficients for the log of emergency department utilization. I find a 2.5 % increase on an average of 0.16 visits per quarter for an overall 1.6 percentage point increase in annual ED use around a discontinuity. Table 6 Column 3 shows the linear probability model which indicates a 2.3 percentage point increase in the probability of using the emergency department each year on a base of 0.1 visits per quarter or a 23% increase.

Figure 8 shows the change over time in inpatient admissions. While there is a visual increase, it appears to be small in magnitude. This interpretation is reinforced by the difference in differences regression coefficient indicates about a 0.6 percent increase in inpatient admissions after a discontinuity. The linear probability estimate in column four shows a similar 0.7 percentage point increase, raising an individuals probability of being admitted in a given year from 1.4% to 2.1% or an extremely large 50% increase in probability [6]. Taken together, the increases in emergency department utilization and inpatient admissions support the theory that discontinuities lead to negative health outcomes.

[6]Soldiers that become pregnant do not deploy with their units and are likely to experience discontinuities. By running the regressions on non-operational bases these individuals should be dropped from the sample, however future analysis will consider admitting diagnoses

Anticipatory Behavior

While the evidence is supportive of a causal relationship between a discontinuity and increased utilization, the increase during the notification period presents evidence of anticipatory behavior. The purpose of this section is to explain the patterns found during this period. A primary concern is what types of patients are seen during the notification period. one provider I spoke with indicated that he prioritizes his established patients during this period. I empirically test this by reforming my panel so that the unit of analysis is the physician quarter. I consider all patients that a physician sees and whether these are new or existing patients based on whether there have been any previous dyadic interactions. I use three total (two previous) interactions to define an existing patient. I then conduct an event study on the proportion of existing patients that a physician sees each quarter. Figure 9 shows the results of the event-study. A clear pattern emerges that supports the assertion that a provider sees more of his existing patients during the notification period, and that the magnitude increases as the physician gets closer to deploying.

Second, it's reasonable to think that providers preparing to move may find their available time limited.

Figure 10 shows an event-study of patient encounters before and during the notification period. As suggested by the provider, encounters per quarter diminishes in advance of the deployment.

Further evidence of anticipatory behavior is the increase in specialty care visits during the pre-period. As a provider I spoke with told me:

> "If I'm getting ready to leave and I've got some questions as to whether I should or should not refer, that does have an impact. In general, I will refer because it helps me ensure that the best possible things are going to happen for the patient. He's going to have a good outcome because I've already referred him. There won't be any question or problem with the new person coming in having to make that

decision because I'll have already made it and written the consult."

This would seem to indicate that the increase in specialty care during the pre-period is likely to be initial specialty visits while the sustained increase in the post-period is more likely the continuation of these visits.

I empirically test this theory using a linear probability model that regresses the probability of a first specialty visit among only the patients that had any specialty visits in a quarter. Table 7 shows the results of this regression. Looking at the coefficients on both the Post and notification indicators, the probability increases in both periods. There is an approximately 4.5 percentage point increase in initial specialty care visits after a discontinuity, and an even greater 6.2 percentage point increase during the notification period.

Considering the totality of the analysis, a story emerges that providers change their behavior in anticipation of an upcoming discontinuity. However, even after accounting for this period, the discontinuity still has an effect on patient care and utilization.

Alternative Hypothesis - Access to Care

Access to care is an alternative mechanism that could affect patients after a deployment. If the remaining providers in a practice must assume the deploying provider's patient panel, it may limit access for all patients in the practice. In this section I want to estimate the effects of access to care separate from the effects of discontinuities in care.

Because access to care would theoretically effect any patient in a practice even if that person's provider does not deploy, I am able to use the effect of a provider's deployment on other patients in the same clinic to estimate the impact of reduced access to care. I use the same main equation as in the main sample with several differences. First, I exclude the treated group once they enter the notification period. Second, I code the post indicator to all individuals in a clinic when a physician from that clinic deploys. I drop the observations from the sample, the second quarter in which a provider deploys so that an individual is only treated once. There are instances in which multiple providers deploy from the same clinic in the same quarter. I code these as a single disruption and include them. To account for the notification period, I also include an indicator for whether any provider in the patient's clinic in currently in the notification period. Finally, I expand my definition of deployment to include any physician that ceases to see patients in that clinic and is not replaced. This could be for other military taskings other than operational assignments but would have the same effect on access. Table 8 shows the results of the regressions. The coefficients indicate a drop off in primary care after the discontinuity which seems plausible given that there are fewer providers and the treated individuals are using more primary care, and a small increase in specialty care. There's no effect on the outcome variables. While a more detailed analysis of access to care is needed, this would seem to support the contention that restricted access to care is not driving the results.

Conclusions

This study has provided an examination of the effects of disruptions to the patient physician relationship through a natural experiment peculiar to the military. Using plausibly exogenous physician deployments, I test for a relationship between discontinuity of primary care and health care utilization. Overall, I find a 35 percent increase in specialty care (8.2 percentage points) and a 23 percent increase in emergency department use (2.3 percentage points). While my data doesn't support a particular cost estimate, these sites tend to be significantly more expensive than primary care. These estimates are also likely a lower bound estimate as military Soldiers tend to be a particularly young and healthy population, have access to a consistent electronic medical record and are required to maintain a healthy weight and an exercise regime.

While the military may not be fully generalizable, these effects are particularly relevant given that the the military uses an HMO staffing model similar to Kaiser-Permanente and Geisinger (*Final Report to the Secretary of Defense: Military Health System Review* 2014).

This model has been upheld as the gold standard in integrated care (Curry and Ham 2010). Yet the findings indicate that even in this setting there can be a lack of care coordination with provider turnover potentially leading to negative consequences.

The findings are also applicable to current policy discussions around care coordination. Specifically, the accountable care organizational model has focused on coordinating care, yet early research shows that it may increase physician turnover and patient churn (Hsu et al. 2017). Alternatively, though, the patient centered medical home organizational model buffered the effects to a substantial degree and may offer a method for increased coordination.

Additionally, this study has implications for Medicare Advantage. Medicare Advantage (MA) is the Medicare managed care option with about two thirds of enrollees in HMO plans (Hackbarth, Berenson, and Miller 2009). A defining trade-off of these types of plans is lower premiums for a narrower network of providers. As providers opt in and out of these networks, this research presents potential downsides to narrow network plans.

This study also found that providers anticipate their turnover and attempt to prepare some of their patients for the change with a 15 percent (4 percentage point) increase in specialty care during the anticipatory period. Most of the increase coming from new referrals to a particular specialty. These new referrals tend to endure however. As organizations prepare for provider turnover they may consider developing a plan to transition patients to a new primary care provider that could potentially limit any unnecessary referrals.

Limitations

There are some limitations to this work. First, caution should be taken in generalizing from a military setting. The patients in my panel are universally insured with zero co-pays or deductibles. The physicians in my setting are salaried and not subject to typical fee for service incentives. Both patients and physicians in my setting move frequently. They are likely more used to discontinuous care than in a typical civilian setting. This may bias my estimates toward zero.

A further limitation is that I am not able to observe the exact date a provider is notified that he will deploy. Likewise demographic information about the providers would add significant detail.

In the dissertation this paper is based on, I used BETOS codes to determine diagnostic and therapeutic procedures as a test of the theory. This proved to be problematic given the broad nature of BETOS. Future analysis should use a more refined metric.

Future Work

While my research has expanded on one aspect of the effects of physician turnover, it also opens up several avenues for further research. This study focused on the macro effects of turnover, yet future work will want to consider how organizational management changes affect the consequences of turnover. For instance adoption of service line management or changes in other forms of continuity may impact the affects of discontinuity. Future work will also want to consider other disruptions to the provider patient relationship. For instance the increased use of hospitalists highlight the trade-off between specialization and relational continuity. Likewise, changes in access policies may impact the relationship.

Additionally work will also want to expand relational continuity beyond primary care. Many patients, especially those who are chronically ill, may rely more on their specialist than on their primary care physician. Future work should consider disruptions to specialty care relationships.

Finally, physician turnover may not only affect patients, but could have an impact on work teams. The sub-analysis on patient centered medical home provided preliminary evidence that teams can reduce coordination costs. Future research may consider how disruptions in medical teams affect coordination of care.

4 Tables

	Individuals	Observations
Initial Sample	2,029,511	
With Records	1,173,618	21,079,720
Before Break in Service	1,173,618	20,933,143
8 quarters of data	892,195	19,877,216
Within 12 quarters of deployment if treated	745,161	6,730,509
No deployment within 1 quarter of discontinuity	679,214	5,811,747
Not all controls available	615,715	5,304,540

Notes: Individuals includes all patients with at least one encounter in the dataset. Patients without records are not service-members. Observations are patient quarter-years. Deploying patients are dropped in the quarter in which they deploy. The first four quarters are dropped to avoid left censoring with the time on station control

Table 1: Sample Construction

	Median	Mean	Standard Dev	Probability
Emergency Dept Visits per quarter	0	0.163	0.64	0.010
Specialty Visits per quarter	0	0.897	3.31	0.23
Primary Care Visits per quarter	1	1.58	2.14	0.619
Inpatient Admissions	0	0.015	0.143	0.014
Primary Care Continuity	.127	.224	.289	
Age	26	28.23	8.05	
N	4,800,968			

Notes: Observations are quarter-patient for any quarter more than one year prior to a discontinuity. Primary Care visits may seem high due to military policies that require a visit if a Soldier cannot be present for duty. Specialty care is largely driven by physical therapy and behavioral health. Primary care continuity is calculated as a rolling four quarter Bice-Boxerman index

Table 2: Summary Statistics

Variable	Control	Treatment	T_Statistic
Male	0.845	0.762	-12.01
White	0.677	0.636	-9.5
College	0.225	0.201	-2.41
Age	28.22	28.57	1.21
Charlson Index	0.013	0.011	-1.61
Continuity (BB)	0.225	0.193	-6.84
ED Visits per Quarter	0.163	0.166	0.488
Specialty Visits per Quarter	0.905	0.702	-6.40
PC Visits per Quarter	1.571	1.693	3.435
Inpatient Admissions per Quarter	0.015	0.014	-2.687
Individuals	563,653	52,062	

Notes: Control group are patients who never undergo a deployment-related discontinuity. Treatment group are dropped at the point of a second discontinuity. Means are calculated four quarters before a patient undergoes a discontinuity. Standard errors are clustered by military post. Complexity metric is an average of the complexity level of a patient's complaints based on average evaluation and management code. Primary care continuity is calculated as a rolling four quarter Bice-Boxerman index

Table 3: Comparison of Patients Who Do and Do Not Undergo A Deployment Related Discontinuity in Primary Care

Variable	Control	Treatment	T_Statistic
Encounters per Quarter	100.36	134.92	2.14
Tests per Encounter	0.100	0.075	-3.23
Procedures per Encounter	0.097	0.101	0.720
Patient Complexity (E&M)	2.679	2.692	0.925
Unique Providers	21,065	3,741	

Notes: Table shows average for all of a provider's encounters. Control group is physician's who never deploy. Treatment is physician's who ever deploy. Means are calculated four quarters before a physician deploys. Standard Errors are clustered by Military Post. Tests and procedures are calculated by mapping CPT codes to BETOS categories and then considering proportion per encounter.

Table 4: Comparison of Providers By Deployment Status

	(1) Log of PC Visits	(2) Log of Spec Visits	(3) Log of ED Visits	(4) Log of Admissions
Post	0.043**	0.148***	0.025***	0.006***
	(0.014)	(0.010)	(0.005)	(0.001)
Notification Period	0.138***	0.054***	0.020***	0.003***
	(0.010)	(0.007)	(0.004)	(0.000)
Controls	Yes	Yes	Yes	Yes
Person FE	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
N	5,304,540	5,304,540	5,304,540	5,304,540
adj. R^2	0.262	0.345	0.142	0.035

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Post indicator indicates individual has undergone a discontinuity in care due to a provider deployment. Notification period indicator is 1 if within four quarters before a discontinuity. Control variables include age, education level, military rank group, and an indicator for whether a patient has been as the same installation for at least one year. Standard errors are clustered by military installation.

Table 5: Main Equations Log-Model Estimates

	(1)	(2)	(3)	(4)
	Prob of PC Visits	Prob of Spec Visits	Prob of ED Visits	Prob of Admissions
Post	0.012	0.082***	0.023***	0.007***
	(0.009)	(0.006)	(0.006)	(0.001)
Notification Period	0.085***	0.035***	0.020***	0.004***
	(0.007)	(0.005)	(0.004)	(0.001)
Controls	Yes	Yes	Yes	Yes
Person FE	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
N	5,304,540	5,304,540	5,304,540	5,304,540
adj. R^2	0.178	0.263	0.119	0.026

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Post indicator indicates individual has undergone a discontinuity in care due to a provider deployment. Notification period indicator is 1 if within four quarters before a discontinuity. Control variables include age, education level, military rank group, and an indicator for whether a patient has been as the same installation for at least one year. Standard errors are clustered by military installation.

Table 6: Main Equations Linear Probability Model Estimates

	(1)	(2)
	Prob Spec	Prob First Spec
Post	0.082 ***	0.045 ***
	(0.005)	(0.006)
Notification Period	0.035 ***	0.062***
	(0.004)	(0.005)
N	5,304,540	2,785,368
adj. R^2	0.26	0.17

Notes: Dependent variable in all columns is the probability that a specialist visit is an initial encounter with a specialty clinic conditional on having any specialty care appointment. Post indicator indicates individual has undergone a discontinuity in care due to a provider deployment. Notification period indicator is 1 if within four quarters before a discontinuity. Control variables include age, education level, military rank group, and an indicator for whether a patient has been as the same installation for at least one year. Standard errors are clustered by military installation.

Table 7: Effect of Discontinuity on Probability of First Specialty Care Visit

	(1)	(2)	(3)	(4)
	Log of PC Visits	Log of ED Visits	Log of Spec Visits	Log of Admissions
Post Disruption	-0.220***	0.000	0.026***	0.001***
	(0.017)	(0.0024)	(0.005)	(0.000)
Lagged Disruptions	0.017***	0.001***	0.003***	0.000*
	(0.003)	(0.000)	(0.001)	(0.000)
Controls	Yes	Yes	Yes	Yes
Person FE	Yes	Yes	Yes	Yes
Quarter-Year FE	Yes	Yes	Yes	Yes
N	3,605,347	3,605,347	3,605,347	3,605,347
adj. R^2	0.252	0.130	0.332	0.036

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Regression restricted to those that were not in the treated group. Post Disruption is an indicator variable for at least one provider deploying out of a patient's clinic. Lagged disruptions is an indicator for the individual's clinic having at least one physician deploy over the next four quarters. Dependent variable in column 1 is the log of primary care visits. Dependent variable in column 2 is the log of emergency department visits. Dependent variable in column 3 is the log of specialty care visits. Dependent variable in column 4 is the log of inpatient admissions. Control variables include age, education level, military rank group, and an indicator for whether a patient has been as the same installation for at least one year. Standard errors are clustered by military installation.

Table 8: Main Equations Restricted to Non Treated Patients

5 Figures

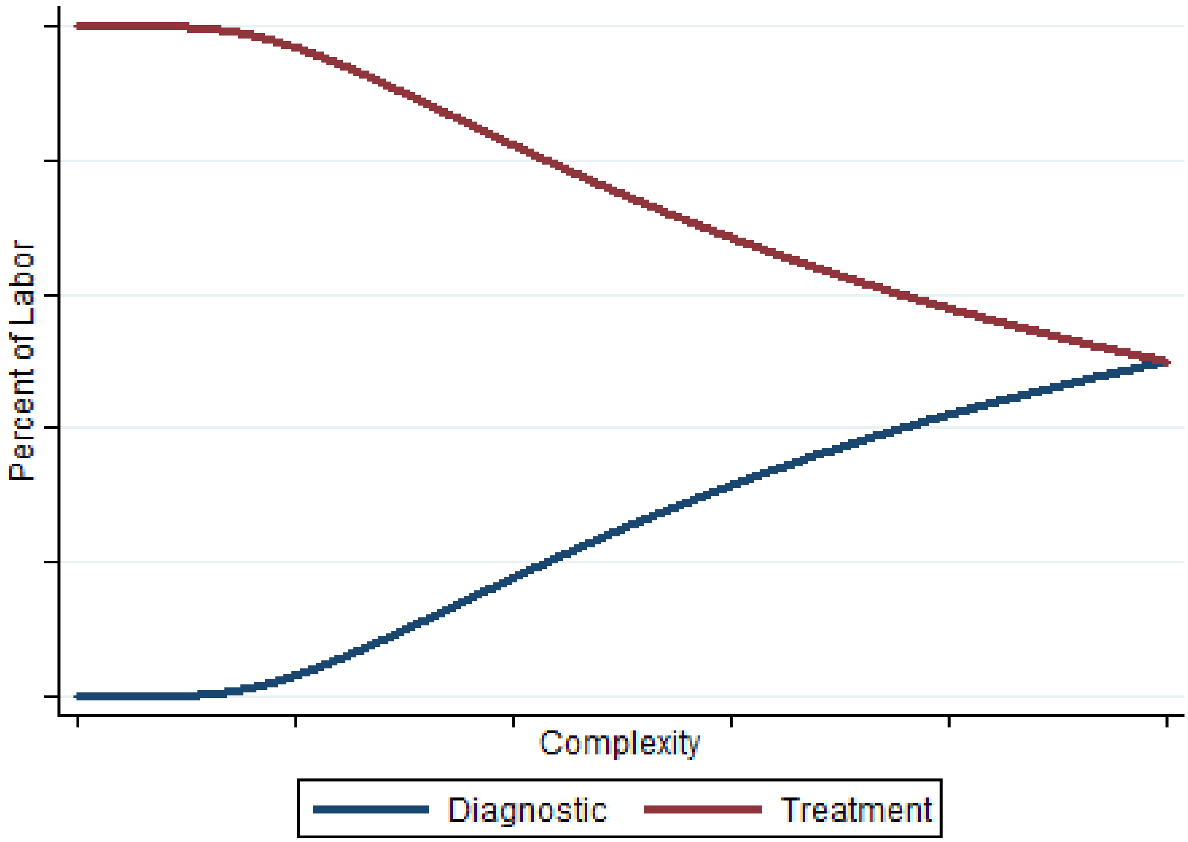


Figure 1: Provider Production Without A Stock OF Patient Specific Information

Notes: Author's rendition of provider production function with two inputs: Diagnostics and Therapies. Complexity on the X axis refers to returns to information in treating a patient. The Y axis is the provider's time constraint

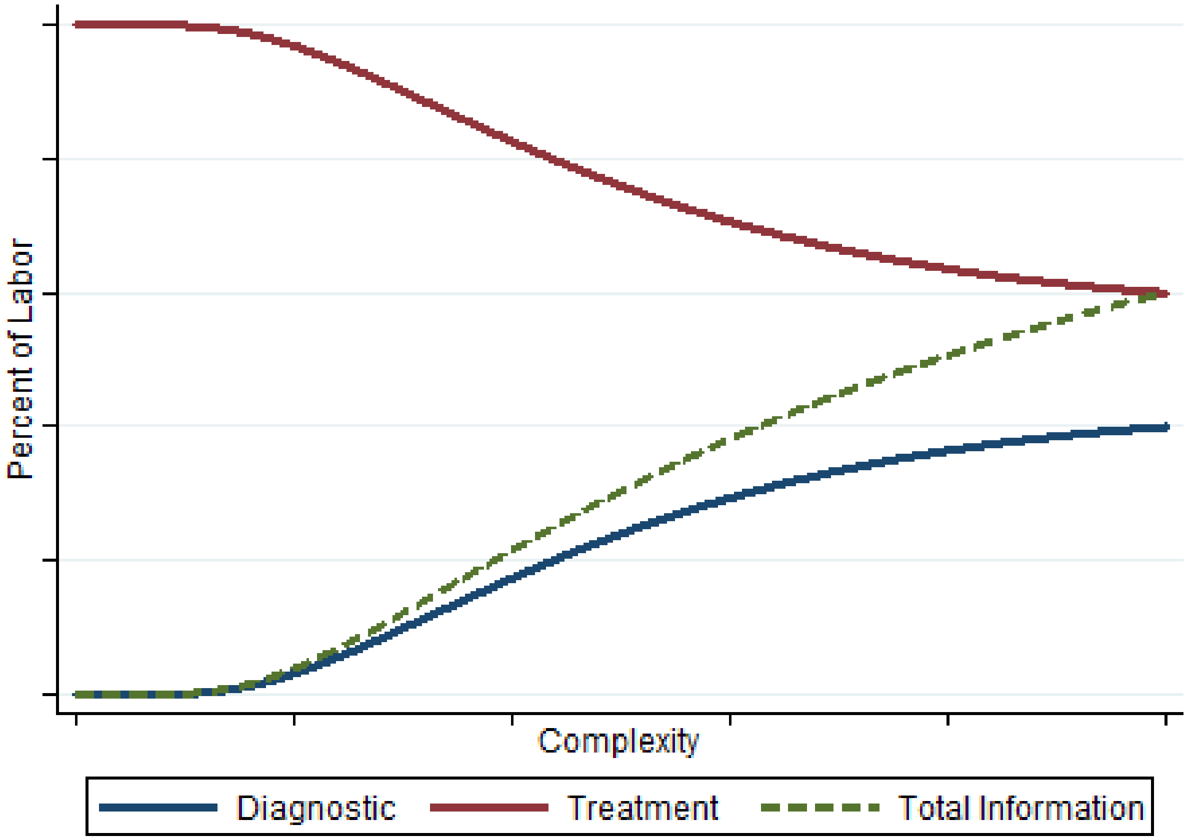


Figure 2: Provider Production With A Stock OF Patient Specific Information

Notes: Author's rendition of provider production function with two inputs: Diagnostics and Therapies and combined value of stock of information and diagnostics. Complexity on the X axis refers to returns to information in treating a patient. The Y axis is the provider's time constraint

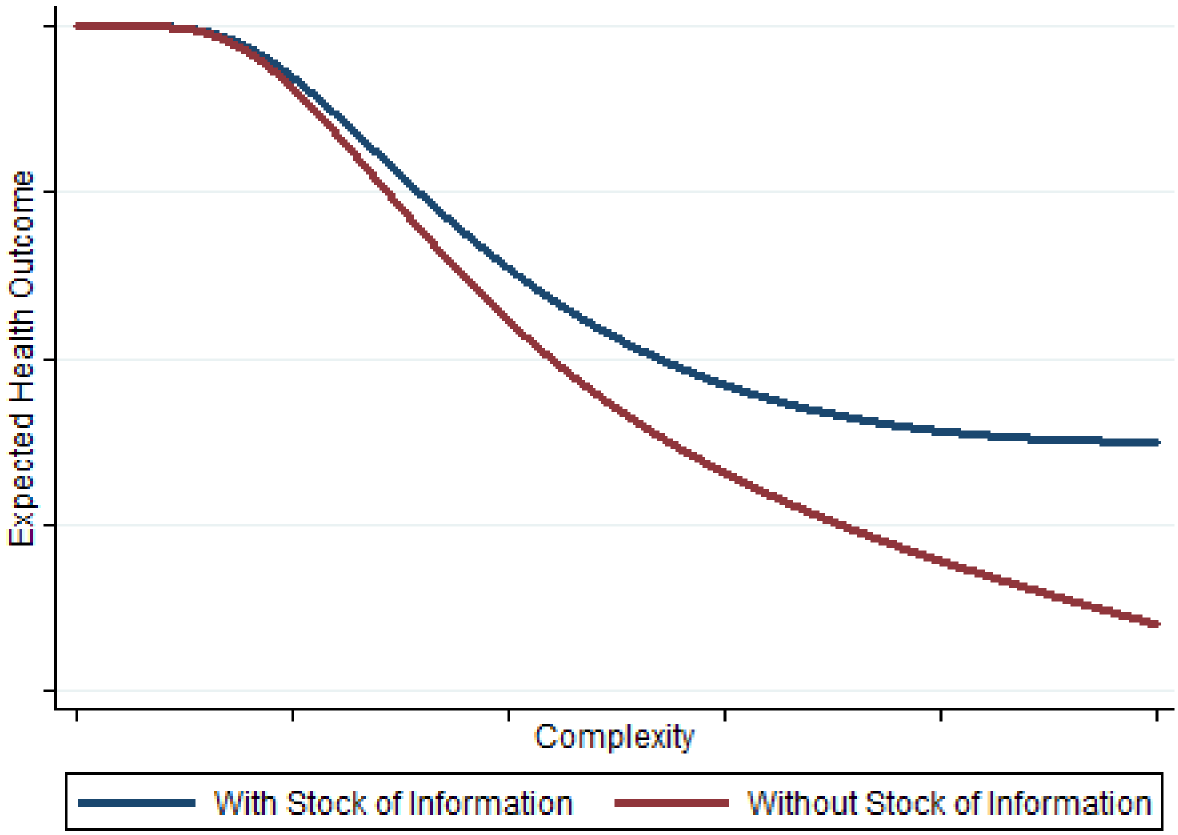
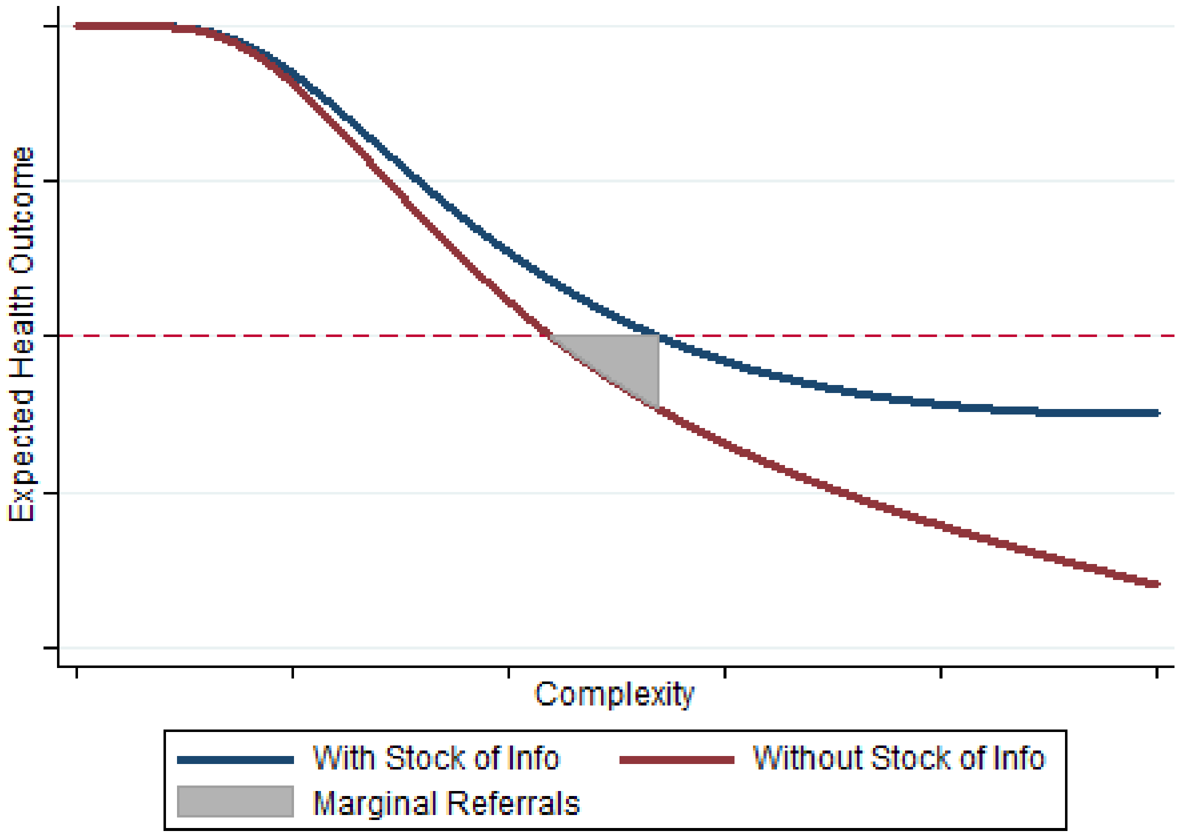


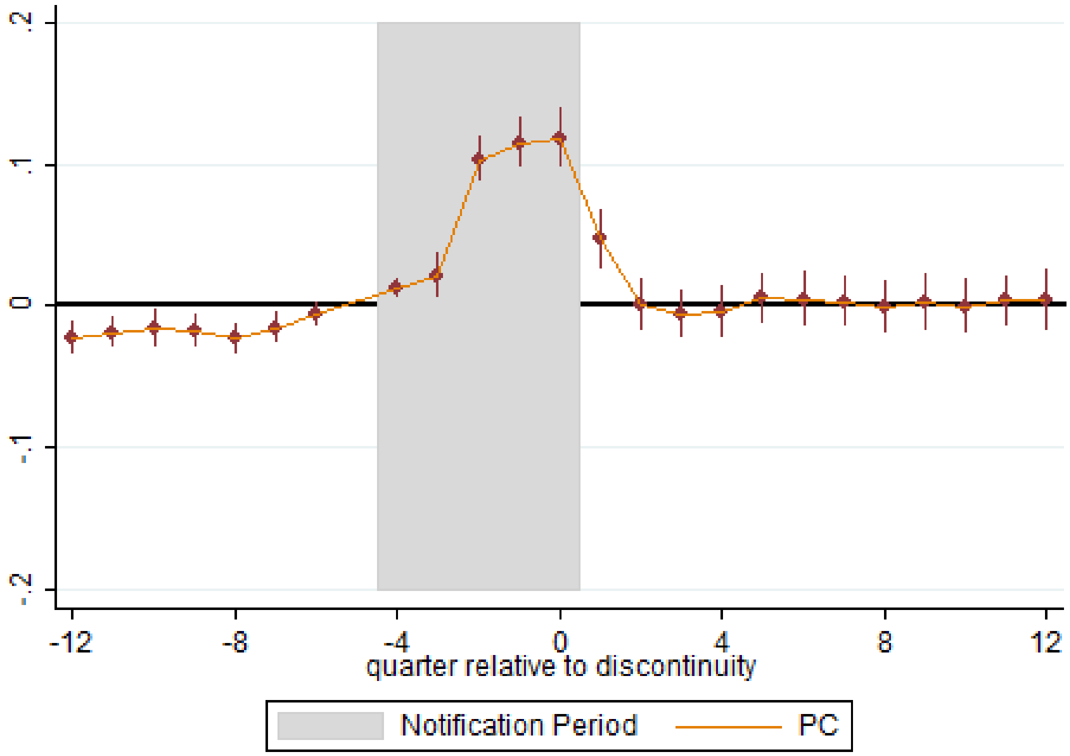
Figure 3: Difference In Outcomes Based on Information

Notes: Author's rendition of provider health outcomes with full information and no information. Health is modeled as a 0-1 variable on the Y axis. Complexity on the X axis refers to returns to information in treating a patient.



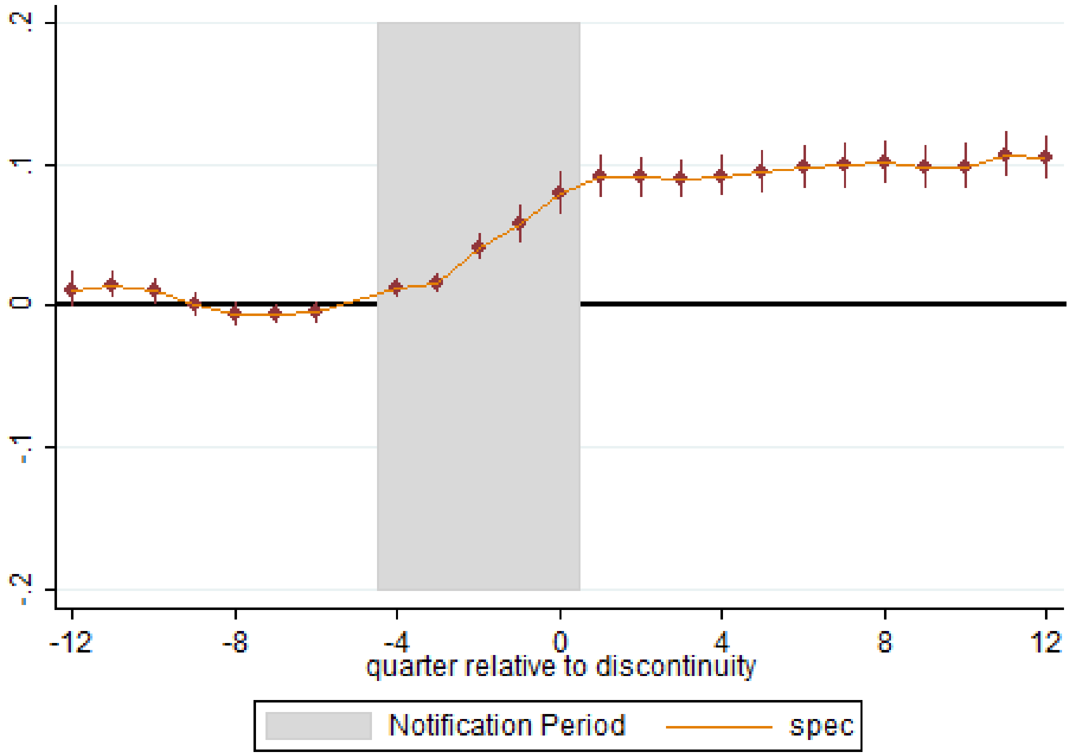
Notes: Author's rendition of provider health outcomes with full information and no information. Health is modeled as a 0-1 variable on the Y axis. Complexity on the X axis refers to returns to information in treating a patient. The vertical line at .8 is the provider's referral threshold. Information shifts the complexity level of the marginal referral from about .4 to about .5

Figure 4: Difference In Outcomes Based on Information With Referral Threshold



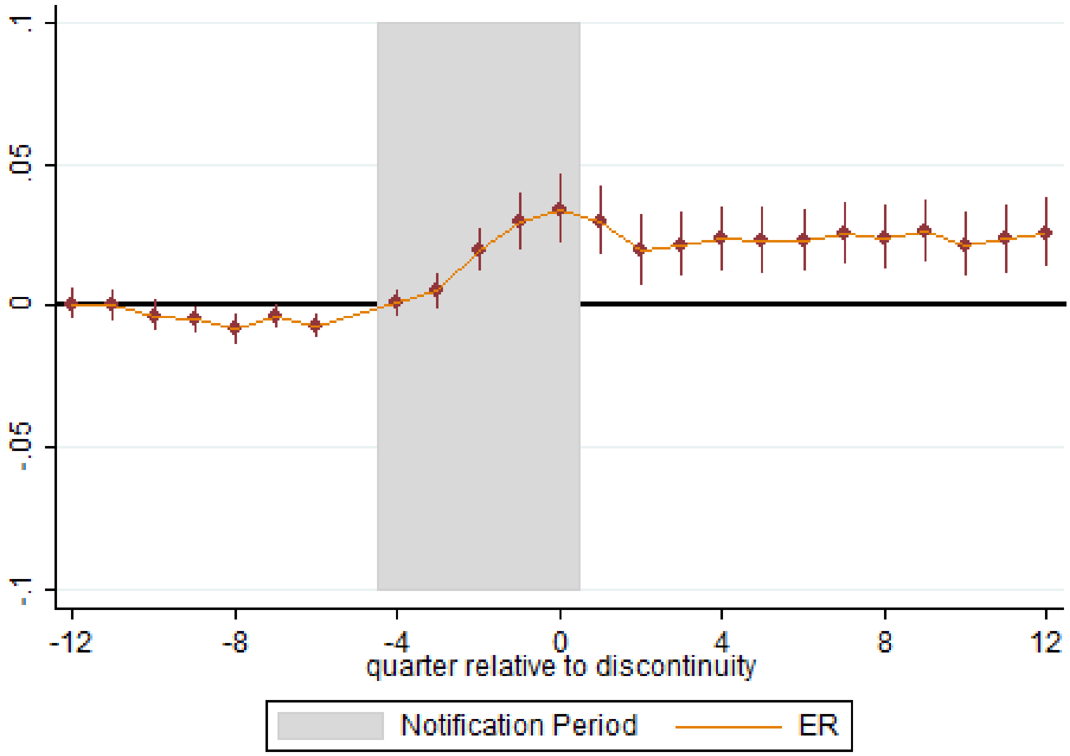
Notes: Graphical portrayal of change in log of primary care utilization. X axis is quarter-years relative to provider deployment. Y access is log of primary care visits. Dots are point estimates. Vertical lines are 95% confidence intervals. Dashed line is a functional approximation of the utilization in absence of a discontinuity. Grey box is the notification period. Regression includes person and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 5: Effect Of Discontinuity On Primary Care Visits



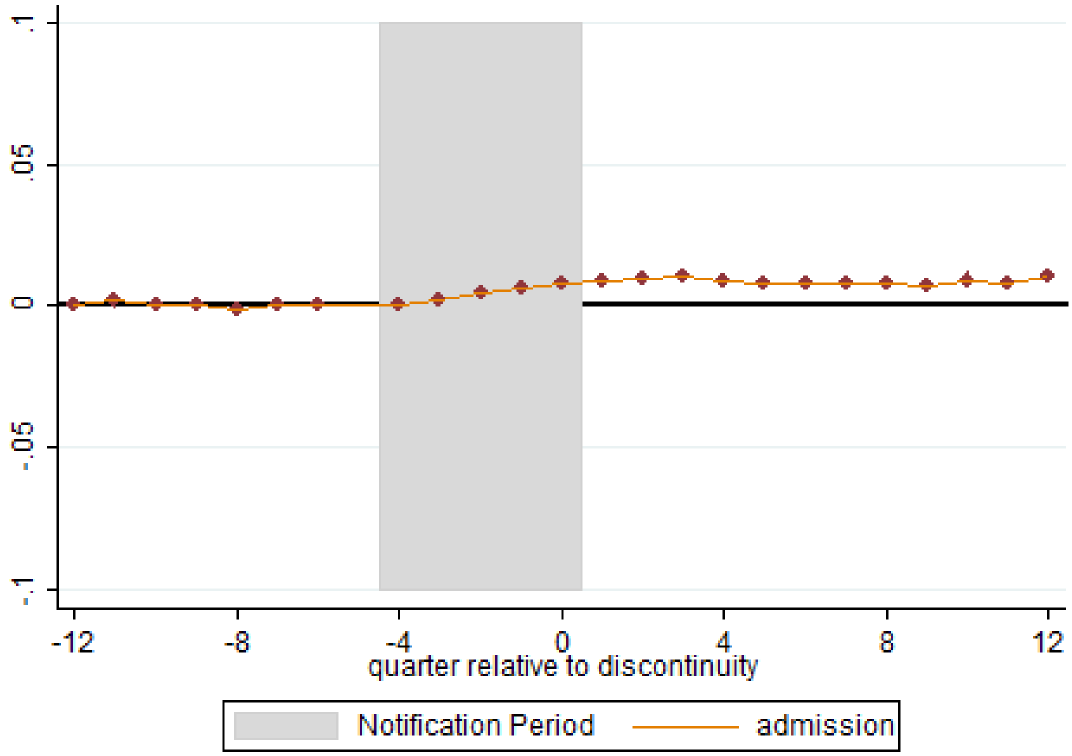
Notes: Graphical portrayal of change in specialty encounters on time relative to discontinuity. X axis is quarter-years relative to provider deployment. Y access is log of specialty visits. Dots are point estimates. Vertical lines are 95% confidence intervals. Grey box is the notification period. Regression includes person and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 6: Effect of Discontinuity on Specialty Care Utilization



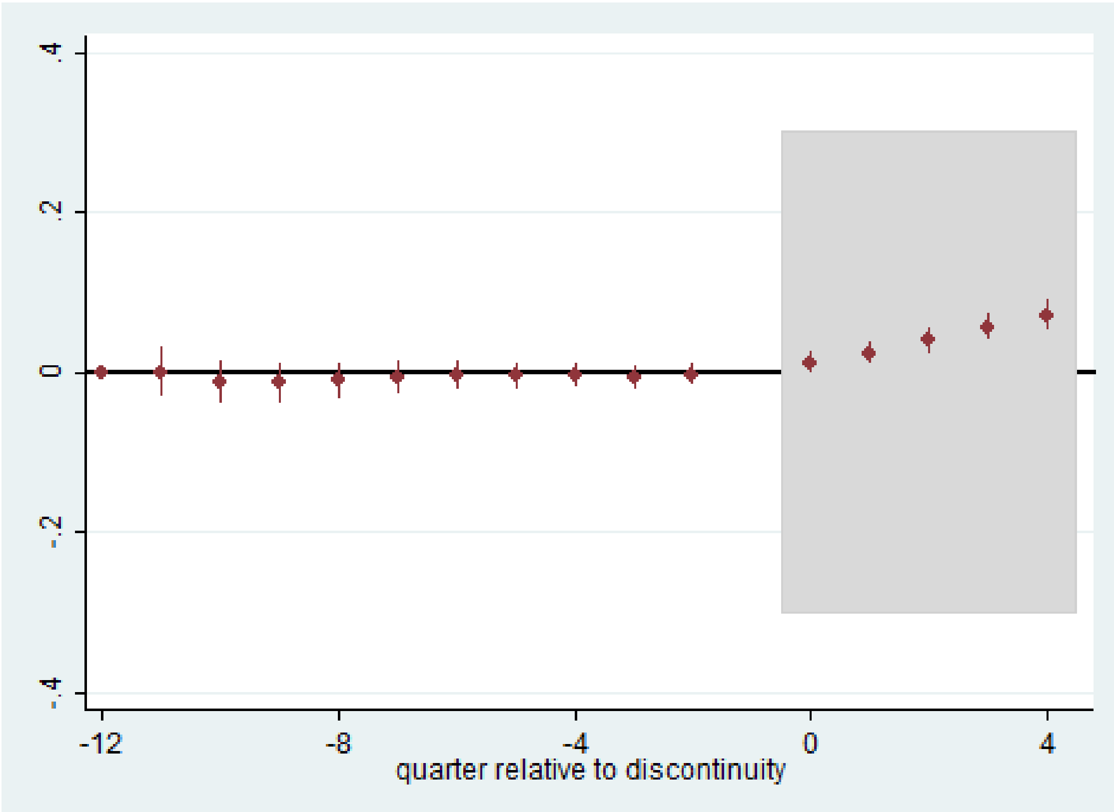
Notes: Graphical portrayal of change in emergency department use on time relative to discontinuity. X axis is quarter-years relative to provider deployment. Y access is log of emergency department visits. Dots are point estimates. Vertical lines are 95% confidence intervals. Grey box is the notification period. Regression includes person and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 7: Effect of Discontinuity on Emergency Department Utilization



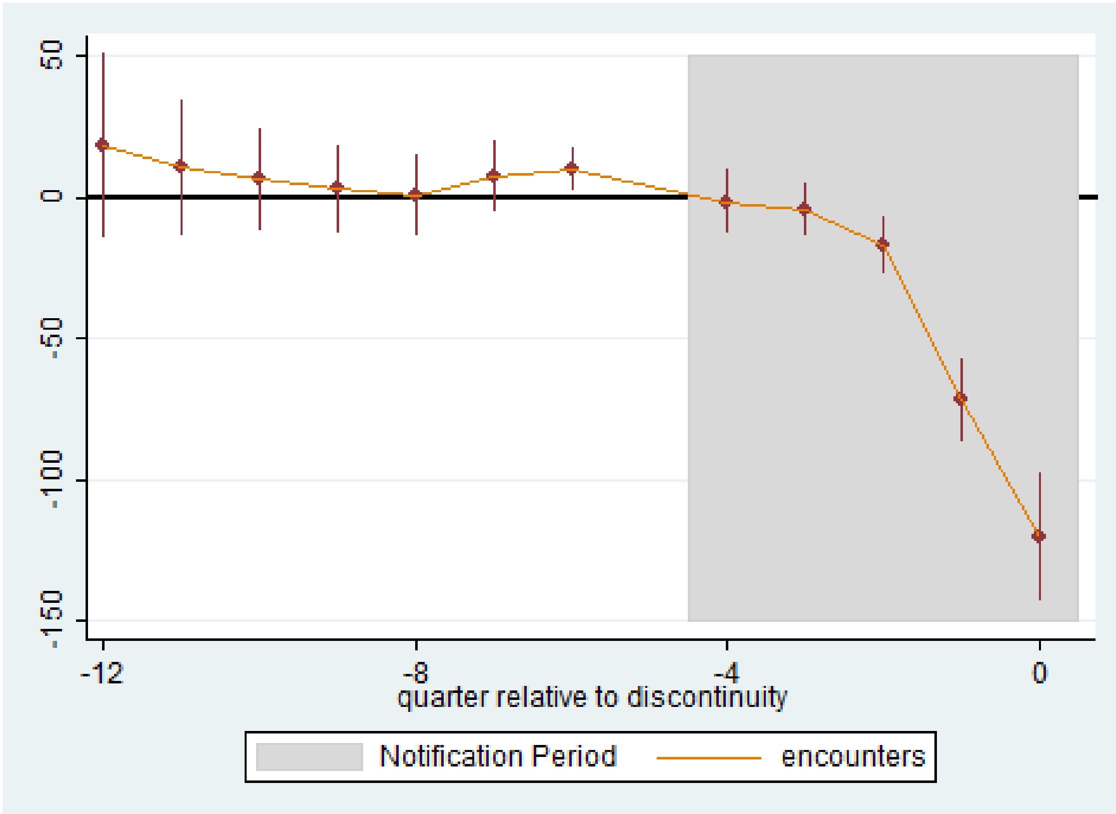
Notes: Graphical portrayal of change in inpatient admissions on time relative to discontinuity. X axis is quarter-years relative to provider deployment. Y access is log of inpatient admissions. Dots are point estimates. Vertical lines are 95% confidence intervals. Grey box is the notification period. Regression includes person and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 8: Effect of Discontinuity on Inpatient Admission



Notes: Graphical portrayal of change in which patients a physician sees. X axis is quarter-years relative to provider notification. Y proportion of existing patients among all a provider's patient encounters. Existing patients are those that have seen the provider at least twice previously. Dots are point estimates. Vertical lines are 95% confidence intervals. Grey box is the notification period. Regression includes provider and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 9: Proportion of Existing Patients in Deploying Provider Encounters



Notes: Graphical portrayal of change in number of patient encounters as a provider prepares to deploy. X axis is quarter-years relative to provider deployment. Y is number of patient encounters a provider sees centered at 0. Dots are point estimates. Vertical lines are 95% confidence intervals. Grey box is the notification period. Regression includes provider and quarter-year fixed effects. Standard Errors are clustered by military installation.

Figure 10: Patient Encounters Relative to Physician Deployment

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