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ABSTRACT

In order to better understand what threatens vulnerable populations' access to primary care, it is important to understand the factors associated with closing safety-net clinics. This paper examines how a clinic's financial position, productivity, and community characteristics are associated with its risk of closure. We examine patterns of closures among private-run primary care clinics (PCCs) in California between 2006 and 2012. We use a discrete-time proportional hazard model to assess relative hazard ratios of covariates, and a random-effect hazard model to adjust for unobserved heterogeneity among PCCs. We find that lower net income from patient care, smaller amount of government grants, and lower productivity were associated with significantly higher risk of PCC closure. We also find that federally qualified health centers (FQHCs) and non-FQHCs generally faced the same risk factors of closure. These results underscore the critical role of financial incentives in the long-term viability of safety-net clinics.

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INTRODUCTION

Millions of low-income and uninsured Americans who lack access to private physician practices rely on the healthcare safety net. Safety-net providers— consisting of publicly and privately supported hospitals, community health centers, local health departments, and other providers that care for a disproportionate share of vulnerable populations— form a vital component of America's healthcare system. The Centers for Disease Control and Prevention estimates that community health centers alone encounter 31 million visits annually, the majority made by patients who are publicly insured or uninsured. (Hing & Hooker, 2011)

Despite a well-documented growth of safety-net primary care clinics in recent years, there is little understanding about how well these clinics have survived the constant threats from increasingly difficult financial conditions. Given that low-income and uninsured people have difficulty accessing healthcare elsewhere (Andersen et al., 2002), closures of safety-net primary care clinics may lead to poorer health outcomes in vulnerable populations. Researchers find that Medicaid and uninsured patients have to travel significantly further for care when a safety-net clinic closes (Bazzoli, Lee, Hsieh, & Mobley, 2012), and that longer travel distance can reduce healthcare utilization, especially in rural areas (Gresenz, Rogowski, & Escarce, 2007).

While the federal government has invested additional funding to expand certain types of safety-net clinics under the Affordable Care Act (ACA), there is a widespread concern that many others will continue to operate in a volatile environment with declining funding support in their states. (Adashi, Geiger, & Fine, 2010) Opinion surveys reveal that safety-net clinics are deeply concerned about the threats of financial instability, limited capacity, and difficulty in recruiting and retaining staff. (Lewin & Baxter, 2007) However, little is known about the extent to which such economic factors contribute to actual closures of safety-net clinics.

In this study, we fill this gap by assessing how variations in clinic and community characteristics influence clinic closures. We employ data on private safety-net clinics in California between 2006 and 2012, a period during which the state saw dramatic growth in the uninsured population (Lavarreda, Snyder, & Brown, 2013) and cuts in funding of state and local health departments (Willard, Shah, Leep, & Ku, 2012) as a result of the 2009 economic crisis. Therefore, the study period provides us with an appropriate window to examine the effects of the healthcare environment on clinic viability.

New Contribution

Despite the numerous case studies documenting the deteriorating financial condition of many safety-net clinics and concerns about clinic survival under tightened funding policies, there is little understanding of how clinics respond to financial stress. Moreover, existing literature has largely been qualitative. Using a recent longitudinal dataset of safety-net clinics in California, our study addresses this gap by assessing the relationship between economic factors and the risk of closure in safety-net clinics. We examine variables frequently cited as threats to clinic survival in previous studies. A better understanding of the influence of these risk factors provide important insights for policies aimed at providing an adequate and sustained supply of safety-net clinics in underserved communities.

CONCEPTUAL FRAMEWORK

Our conceptual framework is based on the economic theory of firm entry and exit, which predicts that in the long run, a firm would leave the market if it does not generate sufficient revenue to cover its total expenses (Pakes, Ostrovsky & Berry, 2007). This implies that the probability of closure for a safety-net clinic i in a given period is:

$$p_i = \Pr\{\hat{\pi}[\theta_i; s(n,z)] - F_i < 0\},$$

where $\hat{\pi}$ and F represent the clinic's the expected net income and fixed cost in the next period, respectively. The clinic's net income $\hat{\pi}[\theta_i; s(n, z)]$ has two elements: θ_i is a vector of facility-level parameters, and s is a vector of community-level parameters, including the number of firms in the market and other exogenous profit shifters captured by vector z. Assuming zero fixed cost to simplify the model, the survival of clinic i depends on its future net income.

We consider a clinic's past financial status and productivity as key parameters in vector θ_i. In contrast to physician offices that largely rely on income from private payers, safety-net clinics rely heavily on revenue from Medicaid reimbursement, as well as various sources of funding from federal, state, and local government (Grogan & Gusmano, 2009). As such, a clinic's net income can be written as:

$$\pi = Total\ revenue - Total\ expense$$
$$= Net\ patient\ revenue + Grants - Total\ expense$$
$$= Net\ patient\ income + Grants$$

Note that both net patient income and grants can reduce a clinic's chance of closure, but the two factors may be correlated, complicating the independent effect of each. Clinics that provide more uncompensated care, and thus have less net patient income, are likely to receive more government funding. Comparative statics analysis predicts that conditional on net patient income, more government funding decreases a clinic's probability of closure. This forms our main hypothesis. In addition, we expect that greater clinic productivity, as measured by the average number of visits per full-time equivalent (FTE), would decrease the risk of closure because holding everything else constant, an increase in clinic productivity would increase net income.

Variations in the local healthcare environment, as captured by parameters in vector $s(n, z)$, may also affect safety-net clinics' viability. A greater number of clinics in a community may increase competition among clinics for patient volume and grants, leading to more closures. Similarly, a larger number of physicians in a community could imply lower volume for clinics, and thus more closures, if physicians and clinics provide substitutable services. In addition, previous research documents that the closure or downsizing of local hospital ambulatory care departments may threaten safety-net clinics if a large proportion of uninsured patients are shifted from those facilities to safety-net clinics (Lewin & Baxter, 2007). Lastly, local demographic changes that lead to increased demand for uncompensated care, such as a surge in the number of people without health insurance, can also create financial stress for safety-net clinics (Schwartz & Artiga, 2007). In sum, we hypothesize that clinics are more likely to close in communities where there are greater numbers of safety-net clinics, greater numbers of physicians, larger shares of uninsured population, and where hospitals have relatively smaller ambulatory primary care capacity.

METHODS

Data on California Primary Care Clinics

Our primary data come from the California Office of Statewide Health Planning and Development (OSHPD) Primary Care Clinics Annual Utilization Data between 2006 and 2012.[1] The data contain comprehensive clinic information including a unique identifier, license status (open/closed), facility location, FQHC status, staffing, patient population characteristics, and financial information such as operating revenues and expenses.

Licensed under the California Department of Public Health, private safety-net clinics are known as "primary care clinics" (PCCs), and operate in various forms including Federally Qualified Health Centers (FQHCs), FQHC "look-alikes", Rural Health Clinics (RHCs), family planning clinics, free clinics, and other types of private nonprofit community clinics (Saviano & Powers, 2005).[2] As of 2012, a total of 1,019 PCCs served 5.2 million people, or about one in seven Californians. Roughly one-third (36%) of PCCs' operating revenue comes from federal and state grants, and the rest comes from patient revenue. Medicaid is the most common PCC payer source, accounting for 37% of patient revenue.

Outcome Variable and Covariates

We identify closure based on PCC license status in the prior year and the year after: a PCC shut down in year *t* if it reported open in year *t* but not *t+1*. Using a county identifier, the PCC dataset was linked with variables of community characteristics, collected from various sources as detailed below.

At the facility level, net patient income (net patient revenue minus operation expense) and government grants are used to describe a clinic's financial status. To account for the fact that PCCs' financial reporting period may not match a calendar year and to smooth out the fluctuation in financial status, we calculate the three-year averages of net patient income and grants. We include interactions between these two covariates in regressions in order to test the hypothesis that conditional on net patient income, higher government funding is associated with lower risk of clinic closure.

Clinic productivity is measured by two variables (Akscin, Barr, & Towle, 2007): the number of visits per FTE clinician (including physicians, physician assistants, family nurse practitioners, and other Medicaid billable providers) and the number of visits per FTE staff (such as registered nurses, unlicensed medical assistants, and administrative staff). In addition, indicators of rural clinic, FQHC, and free clinic are included.

A variety of community characteristics are used to capture changes in local healthcare environment and demographics. We use the total number of PCCs per 10,000 county residents to determine the extent to which a county was a competitive market for PCC. To capture the role of local hospitals' primary care capacity, we obtain the number of visits to hospital outpatient departments (ODs) from OSHPD Hospital Annual Financial data[3], and calculate the ratio of total OD visits to PCC visits in a county. In addition, the number of primary care physicians per 10,000 county residents and percent of uninsured population are obtained from the Area Health Resource Files. We defined primary care physicians as all physicians licensed by the American Medical Association in family practice and general practice, general internal medicine, and general pediatrics. (Shi & Starfield, 2001) Finally, annual county population growth and the percent of Medi-Cal enrollees in population are collected from the California Department of Public Health. All county-level covariates are assigned with prior-year *(t-1)* values in order to address the concern that PCC closures may influence the local healthcare environment contemporaneously.

Statistical Analysis

To estimate the probability of clinic closure controlling for time-varying covariates, we employ a discrete-time proportional hazard ratio regression model (Cameron & Trivedi, 2005). Suppose there are clinics $i = 1, \ldots, N$, existing in county j at time $t=0$. The hazard rate clinic i is defined as the probability of closure in interval t and $t+1$, given survival to time t $(t=0, \ldots 6)$. The functional form of the hazard rate is specified as a log-logistic hazard model:

$$h_t\left(X_{ijt}\right) = 1 - exp\left[- exp(\tau(t) + X'_{it}\beta)\right], \qquad (1)$$

where $\tau(t)$ represents the dependence of the hazard rate on duration, specified as $log(t+1)$, and vector X_{it} is an array of time-varying covariates summarized as above. We estimate the model using maximum likelihood method, which accommodates for right-censored and left-truncated data. To account for possible non-linear relationships of covariates and the outcome variable, we represent each covariate by tertile indicators (the lowest tertile being the reference group). Relative risks (RRs) with 95% confidence intervals (CIs) are calculated. Standard errors are adjusted to account for clustering of PCCs within counties.

We further extend model (1) to account for unobserved heterogeneity among clinics by estimating a random-effect model with a clinic-specific error term u_i. We assume that u_i is normally distributed with zero mean, uncorrelated with X_{it} , and estimate the proportion of variance in closure risk that's explained by clinic-level heterogeneity. To test the proportional hazards assumption, we re-estimate the model with interactions between facility-level covariates and the baseline hazard function. We then perform likelihood-ratio tests to compare models with and without time-dependent covariates, with the null hypothesis being that all covariates satisfy the proportional hazard assumption. Finally, about half of the sample was comprised of FQHCs, which receive additional federal grants as well as enhanced reimbursement from Medicare and Medicaid. To test whether closure risks varied by FQHC status, we estimate random-effect model on subsamples of FQHC and non-FQHC clinics. All statistical analyses are performed using STATA version 12 (StataCorp, College Station, Texas).

RESULTS

Our data identify 1,379 unique PCCs in 55 counties in California between 2006 and 2012, comprising a sample of 6,884 PCC-year observations. Figure 1 shows that the demand for PCCs spiked in 2009 and continued to grow throughout the study period. While the total number of PCCs in operation also rose steadily from 845 to 1,084, a total of 300 PCCs closed. Possibly due to rising demand during the economic downturn, the annual number of PCC closures fell between 2006 and 2009, but the number started to climb again in later years.

Table 1 reports summary statistics and differences between closing versus existing PCCs, in terms of facility and community characteristics. Compared with non-closure PCCs, those that closed during the study period were more likely to be rural clinics (0.05 vs. 0.02, $p<0.001$), and less likely to be FQHCs (0.41 vs. 0.55, $p<0.001$) or free clinics (0.03 vs. 0.04, $p=0.008$). On average, PCCs relied heavily on government funding, and non-closing PCCs received relatively more funding to cover larger deficits in net patient income (net patient revenue minus operating expenses). Comparison of community characteristics indicates that closures were more likely to occur in counties with more PCCs per capita (0.38 vs. 0.34, $p=0.02$), with slightly more primary care physicians (9.51 vs. 9.05, $p<0.001$), smaller shares of Medi-Cal enrollees (17.69 vs. 18.97, $p<0.001$), and greater population growth (57.66 vs. 41.6, $p<0.001$).

Figure 2 depicts the survival rates of PCCs over time, stratified by key variables of interest. By the end of 2012, 83% (CI, 0.79-0.86) of PCCs with the lowest clinician productivity were still in operation, compared with 90% (CI, 0.87-0.93) of PCCs with the highest productivity. A similar pattern is found when the sample is stratified by staff productivity and by the level of grant support. By contrast, there were significant overlaps between the survival curves of PCCs in different tertiles of net patient income. Thus, exploratory analyses reveal that a clinic's productivity and government funding support were associated with higher rates of survival.

Table 2 reports the relative hazard ratios of PCC closure based on discrete-time proportional hazard models. The unit of analysis is an individual PCC in a given year. The standard model (Column 1) estimates that net income from patient care was associated with significantly lower risk of closure (RR, 0.27; 95% CI, 0.14-0.50). Within each tertile of net patient income, increased amount of government grants was also associated with lower risk of closure, although such effect cannot be precisely measured for the highest tertile of net patient income group. In addition, PCCs with more visits per FTE clinician (RR, 0.66; 95% CI, 0.50-0.88) and more visits per FTE staff (RR, 0.68; 95% CI, 0.49-0.95) were at lower risk of closure. Overall, these findings are consistent with our hypothesis that poor financial status and lower productivity lead to greater closure risk of a clinic.

PCCs were more likely to close in communities with greater number of primary care physicians per capita (RR, 1.44; 95% IC, 1.02-2.04). Other community characteristics, including the total number of PCCs per capita, hospital OD-PCC visits ratio, share of uninsured population, share of Medi-Cal enrollees, and population growth rate, had little to no association with the risk of closure.

The random-effect hazard model (Column 2) retains similar results. If anything, the estimated effects of independent variables on closure risk are somewhat augmented after controlling for unobserved facility-level heterogeneity. Specifically, the random-effect model estimates that the risk of closure was 53-84% lower in clinics with more net patient income, and 17-35% lower in clinics with greater productivity. The ρ statistic reports that 62% of the total variance was due to differences across clinics, and likelihood-ratio test rejects the hypothesis that rho equals zero.

Table 3 shows that the time-dependent hazard rates were constant within strata of facility-level covariates. At 5% significance level, likelihood-ratio tests fail to reject that the null hypothesis that all covariates satisfy the proportional hazards assumption.

Results from Table 4 suggest that FQHCs and non-FQHCs generally faced the same risk factors of closure. Net patient income, government funding, and productivity were important predictors of closure risk, regardless of a clinic's FQHC status. There is some evidence that a greater proportion of patient visits made to hospital ODs relative to PCCs in a county was associated with lower risk of closure among FQHCs, which is consistent with our hypothesis. But in general, variations in community characteristics were not significantly associated with variations in closure rates. Facility-level heterogeneity explained 64% of total variance among FQHCs and 55% of total variance among non-FQHCs.

CONCLUSION AND DISCUSSION

While the nation's safety net has largely weathered various threats over the last decade, researchers have consistently documented concerns among safety-net providers regarding their sustainability in an increasingly challenging operating environment. (Cunningham, Bazzoli, & Katz, 2008; Jacobson et al., 2005) In this study, we provide evidence that poor financial status and low productivity put clinics at greater risk of closure; however, local environment characteristics in general have little correlation with clinic closure. While quantitative studies on the role of financial performance and clinic closures nationally are lacking, the evidence from California is in broad agreement with related qualitative studies. For instance, a qualitative study of FQHCs in 12 nationally representative communities (Katz et al., 2011) documented an important role of patient revenue and external funding support in FQHC development. In addition, our findings are consistent with existing evidence on the relationship between financial stress and safety-net hospital closures (Bazzoli, Lindrooth, Kang, & Hasnain-Wynia, 2006; Shen, Hsia, & Kuzma, 2009; Hsia, Kellermann, & Shen, 2011).

Some of our results merit further discussion. The finding that increased government funding is more strongly associated with a lower risk of closure among clinics with lower patient revenues suggests that government grants can help individual clinics survive financial hardship through covering shortfalls in patient revenue. However, the caveat should be made that lowperforming clinics (e.g. those with highly excessive capacity) should be allowed to lose grants to other clinics with growing demand, even if that means an increased risk of closure for them.

Although some researchers suggest that safety-net providers serving communities with greater needs from uninsured and Medicaid populations are under more stress (Lewin & Baxter, 2007), our analysis did not find a significant relationship between community demographics and PCC closure risk. On the other hand, the finding that PCCs tend to close in communities where hospital ODs serve a smaller share of patients implies that shifting the burden of care from other providers to PCCs in a community may be associated with greater PCC closure risk.

Our findings provide several implications for the health care reform. With the implementation of Medicaid eligibility expansion and state insurance marketplaces, 3.7 million previously uninsured Californians are expected to gain insurance coverage (Nardin et al. 2013). However, the percentage of physicians accepting new Medicaid patients in California is significantly lower than the national average (Hing, Decker, & Jamoom, 2015), particularly due to low reimbursement rates (Zuckerman & Goin, 2012). Therefore, safety-net patients are likely to continue visiting PCCs for convenience and affordability, and the growing demand for PCCs in California is likely to gain momentum in the coming years (Ku et al, 2011). Our results suggest that additional economic incentives will be needed to sustain the viability of private PCCs in order to help meet the growing demand. Noting that the operation of private safety-net clinics relies heavily on patient revenue, our results further imply that enhanced reimbursement will be needed to preserve safety-net clinics supply.

To a certain extent, improved financial incentives are built in the ACA through federal subsidies to new Medicaid and insurance marketplace enrollees. PCCs may also have temporarily benefited from an ACA provision that increased Medicaid payments for primary care physicians in 2013-2014. However, as of the completion of this analysis, the California state government does not plan to extend the Medicaid primary care fee increases through 2015. It is estimated that expiration of temporary rate increase would lead to a 59% decrease in Medicaid primary care fees in California, the steepest reduction across all states. (Zuckerman, Laura, & Kristen, 2014) More research will be needed to understand safety-net clinics' survival strategies in face of dual pressures from substantial fee cuts and growing demand.

Our analysis has several limitations. First, our dataset of primary care clinics is not a comprehensive record of safety-net primary care providers in California. Publicly operated clinics, such as those operated by county and city governments, serve as another important source of care for underserved populations in California, but are not captured in the data. Nevertheless, since there is no existing literature on the pattern of safety-net health center closures, this study provides a helpful first step in determining the extent to which closure is correlated with frequently cited risk factors.

Second, other aspects of PCC market dynamics, such as openings and mergers, are not addressed in this analysis. Noting that there has been a net increase in the total number of PCCs in CA during the study period, further study is warranted to examine whether the net expansion of PCCs has improved access to care in needy communities. Last, our community characteristics vary at the county level and thus may not capture small-area heterogeneity correlated with PCC closings. Future research may include sub-county analyses, for example at the hospital service area level, to further understand within-market variations in PCC closings.

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[1] Primary Care and Specialty Clinics Annual Utilization Data are available to the public and can be obtained at http://www.oshpd.ca.gov/hid/Products/Hospitals/Utilization/PC_SC_Utilization.html

[2] While all private not-for-profit clinics are required to file for licensure and to report annual data to OSHPD, clinics operated by government (county and city clinics), by tribal organizations, and by hospital outpatient departments are not required to be licensed by the state, and thus do not report data.

[3] Hospital Annual Financial Data are available to public and can be obtained from the OSHPD website at: http://www.oshpd.ca.gov/HID/Products/Hospitals/AnnFinanData/CmplteDataSet/index.asp

Figure 1. Number of Primary Care Clinics in Operation and Closed in California, 2006-2012

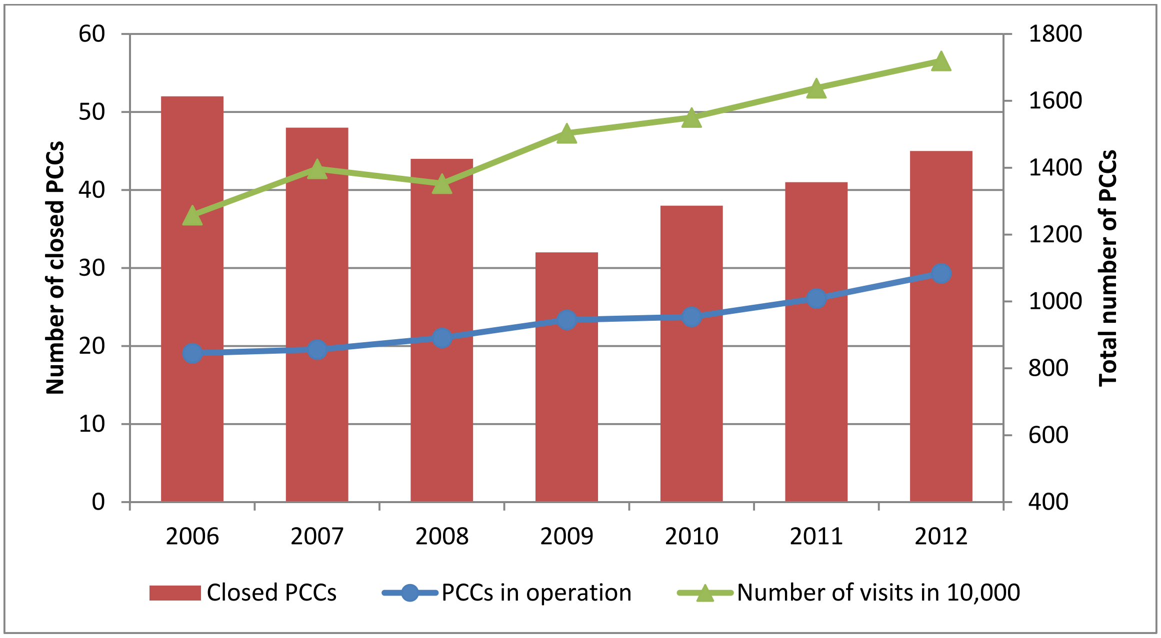

Figure 2. Cumulative Survival Curves of Primary Care Clinics by Key Clinic Characteristics

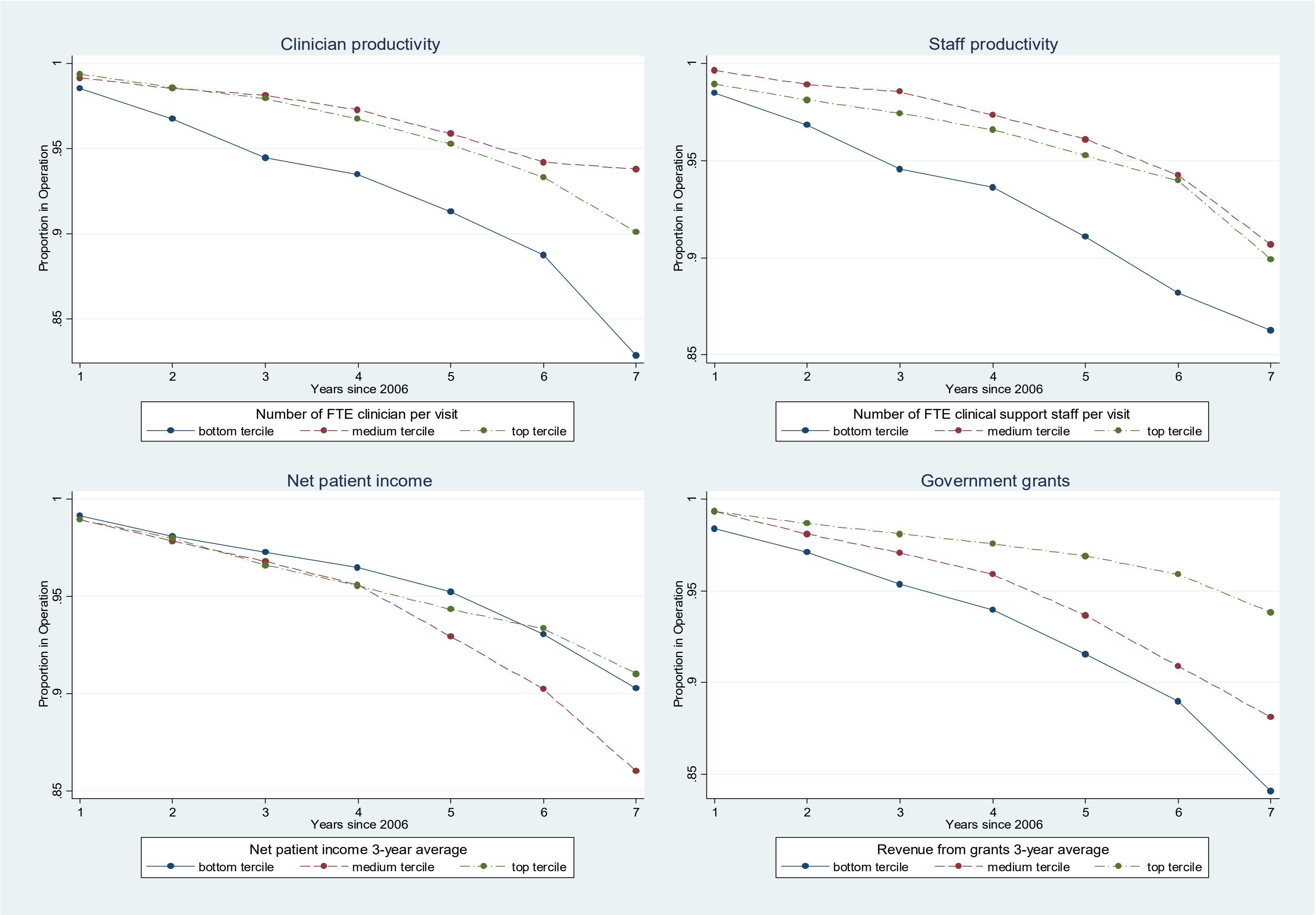

Table1. Summary Statistics of Facility and Community Characteristics By PCC Closing Status

	Full Sample	Not closed	Closed	P-value
	Clinic Characteristics			
Rural clinic	0.03	0.02	0.05	<.001
FQHC	0.53	0.55	0.41	<.001
Free clinic	0.04	0.04	0.03	0.008
Visits per FTE clinician	3.82 [8.27]	3.82 [4.72]	3.79 [18.48]	0.961
Visits per FTE staff	1.76 [12.63]	1.66 [11.34]	2.34 [18.48]	0.257
Net patient income	-598.58 [1506]	-638.37 [1585]	-362.81 [865]	<.001
Income from government grants	767.95 [1465]	825.55 [1539]	426.68 [835]	<.001
	Community Characteristics			
PCCs per capita	0.34 [0.30]	0.34 [0.28]	0.38 [0.41]	0.002
Visits to hospital OD over PCCs	0.73 [1.08]	0.71 [0.81]	0.83 [2.05]	0.065
Primary care physicians per capita	9.12 [2.52]	9.05 [2.48]	9.51 [2.73]	<.001
Percent of uninsured	20.09 [3.76]	20.12 [3.81]	19.89 [3.47]	0.052
Percent of Medi-Cal enrollees	18.78 [6.19]	18.97 [6.14]	17.69 [6.35]	<.001
Percent of 3-year population growth	43.92 [77.28]	41.6 [79.71]	57.66 [59.11]	<.001
Number of observations	6884	5890	944	

Note: Visits per FTEs are presented in units of 1,000 visits. Net income from operation and income from government funding are presented in units of $1,000 dollars. PCCs per capita and primary acre physicians per capita are presented in units of 10,000 county residents. FQHC= federally qualified health centers. FTE = full-time equivalent. PCC=primary care clinic. OD=outpatient department. P-values represent the statistical significance of a two-sided t-test with unequal variances. Medi-Cal = Name of the Medicaid program in California.

Table 2. Proportional Hazard of PCC Closures

	Relative Risk [95% CI]					
	Standard Hazard Model			Random-effect Hazard Model		
Rural clinic	1.64	*	[0.92 - 2.92]	2.05	*	[0.88 - 4.80]
FQHC	0.76	*	[0.56 - 1.04]	0.70	*	[0.48 - 1.04]
Free clinic	0.60		[0.32 - 1.14]	0.57		[0.23 - 1.42]
Net patient income						
Medium	0.63		[0.30 - 1.32]	0.47	*	[0.22 - 1.03]
High	0.27	***	[0.14 - 0.50]	0.16	***	[0.07 - 0.39]
Low NPI*Government grants						
Medium	0.66		[0.35 - 1.25]	0.48	*	[0.20 - 1.15]
High	0.26	***	[0.14 - 0.50]	0.17	***	[0.07 - 0.40]
Medium NPI*Government grants						
Medium	0.57	***	[0.39 - 0.83]	0.51	***	[0.31 - 0.83]
High	0.16	***	[0.06 - 0.44]	0.10	***	[0.03 - 0.41]
High NPI*Government grants						
Medium	0.74		[0.36 - 1.55]	0.65		[0.31 - 1.37]
High	0.22	*	[0.04 - 1.28]	0.18		[0.02 - 1.51]
Visits per FTE clinician						
Medium	0.66	***	[0.50 - 0.88]	0.65	**	[0.45 - 0.94]
High	0.80		[0.59 - 1.08]	0.83		[0.56 - 1.24]
Visits per FTE staff						
Medium	0.68	**	[0.49 - 0.95]	0.63	**	[0.43 - 0.91]
High	0.73	*	[0.53 - 1.00]	0.67	**	[0.45 - 1.00]
PCCs per capita						
Medium	0.86		[0.66 - 1.13]	0.82		[0.50 - 1.34]
High	1.03		[0.82 - 1.31]	0.95		[0.54 - 1.66]
Visits to hospital ODs over PCCs						
Medium	0.81		[0.59 - 1.12]	0.75		[0.48 - 1.17]
High	0.75	*	[0.54 - 1.04]	0.69		[0.39 - 1.21]
Primary care physicians per capita						
Medium	1.36	**	[1.00 - 1.85]	1.44	*	[0.94 - 2.22]
High	1.44	**	[1.02 - 2.04]	1.72	**	[1.00 - 2.94]
Percent of uninsured						
Medium	1.00		[0.75 - 1.33]	0.95		[0.64 - 1.41]
High	1.15		[0.81 - 1.64]	1.14		[0.68 - 1.90]
Percent of Medi-Cal enrollees						
Medium	0.94		[0.74 - 1.19]	1.08		[0.68 - 1.71]
High	1.01		[0.76 - 1.35]	1.13		[0.68 - 1.86]
Percent of 3-year population growth						
Medium	1.05		[0.77 - 1.44]	1.07		[0.78 - 1.48]
High	1.09		[0.81 - 1.45]	1.14		[0.79 - 1.66]
ρ				0.62		
χ^2				6.29	***	
Number of observations	6,802			6,802		

Note: Table reports relative risks of discrete-time proportional hazard models of PCC closure. All regressions include a baseline hazard function $\tau(t) = \log(t + 1)$. 95% confidence intervals are reported in brackets, with standard errors clustered by county. FQHC= federally qualified health centers. NPI = net patient income. FTE = full-time equivalent. PCC=primary care clinic. OD=outpatient department. Medi-Cal = Name of the Medicaid program in California. ρ denotes the total variance contributed by the clinic-level variance. χ^2 denotes the likelihood-ratio test statistics of ρ=0. *** P<.01; ** P<.05; * P<.1

Table 3. Validation of the Proportional Hazards Assumption

Variables interacted with $\tau(t)$	Relative Risk	95% CI
Rural	0.66	[0.30 - 1.45]
χ^2 (p-value)	1.06	(0.304)
FQHC	0.98	[0.69 - 1.40]
χ^2 (p-value)	0.01	(0.921)
Free	0.74	[0.27 - 1.99]
χ^2 (p-value)	0.38	(0.547)
Visit per FTE clinician, medium	0.69*	[0.45 - 1.06]
Visit per FTE clinician, high	0.93	[0.61 - 1.42]
χ^2 (p-value)	3.00	(0.224)
Visits per FTE staff, medium	1.28	[0.81 - 2.02]
Visits per FTE staff, high	0.85	[0.57 - 1.29]
χ^2 (p-value)	2.57	(0.277)
Net patient income, medium	1.47*	[0.99 - 2.19]
Net patient income, high	1.15	[0.72 - 1.83]
χ^2 (p-value)	3.74	(0.154)
Government grants, medium	1.10	[0.74 - 1.64]
Government grants, high	0.66*	[0.42 - 1.03]
χ^2 (p-value)	4.99	(0.083)

Note: Each regression includes the main effects of all covariates and interactions of $\tau(t)$ and a specific covariate. Table reports relative risks of interaction terms. 95% confidence intervals are reported in brackets, with standard errors clustered by county. FQHC= federally qualified health centers. FTE = full-time equivalent. χ^2 denotes the likelihood-ratio test statistics of the interaction terms. *** P<.01; ** P<.05; * P<.1

Table 4. Proportional Hazard of Closures among FQHCs and Non-FQHCs

	Relative Risk [95% CI]					
	FQHCs			Non-FQHCs		
Rural clinic	1.06		[0.33 - 3.43]	2.43	*	[0.89 - 6.63]
Free clinic	2.68		[0.79 - 9.05]	0.36	*	[0.13 - 1.01]
Net patient income						
Medium	0.37	*	[0.12 - 1.16]	0.66		[0.28 - 1.57]
High	0.25	**	[0.08 - 0.77]	0.18	***	[0.07 - 0.47]
Low NPI*Government grants						
Medium	0.36	*	[0.11 - 1.16]	0.69		[0.24 - 1.99]
High	0.13	***	[0.05 - 0.40]	0.28	**	[0.11 - 0.75]
Medium NPI*Government grants						
Medium	0.50	**	[0.26 - 0.97]	0.53	**	[0.30 - 0.96]
High	0.14	***	[0.03 - 0.61]	0.15	*	[0.02 - 1.30]
High NPI*Government grants						
Medium	0.12	***	[0.03 - 0.50]	1.79		[0.77 - 4.17]
High				1.38		[0.14 - 13.97]
Visits per FTE clinician						
Medium	0.93		[0.58 - 1.50]	0.49	***	[0.28 - 0.83]
High	1.46		[0.85 - 2.51]	0.61	*	[0.37 - 1.00]
Visits per FTE staff						
Medium	0.56	**	[0.36 - 0.90]	0.81		[0.50 - 1.31]
High	0.77		[0.47 - 1.27]	0.67		[0.41 - 1.09]
PCCs per capita						
Medium	0.58		[0.28 - 1.19]	0.99		[0.55 - 1.78]
High	0.67		[0.32 - 1.43]	1.21		[0.62 - 2.35]
Visits to hospital ODs over PCCs						
Medium	0.52	**	[0.29 - 0.92]	1.17		[0.65 - 2.11]
High	0.57		[0.26 - 1.24]	0.99		[0.49 - 1.99]
Primary care physicians per capita						
Medium	1.12		[0.62 - 2.04]	1.58		[0.91 - 2.75]
High	1.19		[0.63 - 2.23]	1.95	*	[0.98 - 3.87]
Percent of uninsured						
Medium	1.15		[0.70 - 1.90]	0.80		[0.47 - 1.35]
High	1.29		[0.68 - 2.46]	1.05		[0.52 - 2.10]
Percent of Medi-Cal enrollees						
Medium	0.71		[0.41 - 1.22]	1.34		[0.75 - 2.39]
High	0.63		[0.35 - 1.13]	1.69		[0.83 - 3.45]
Percent of 3-year population growth						
Medium	0.91		[0.56 - 1.48]	1.18		[0.79 - 1.76]
High	0.96		[0.58 - 1.58]	1.26		[0.76 - 2.07]
ρ	0.64			0.55		
χ^2	6.15	***		5.07	***	
Number of observations	3,579			3,223		

Note: Table reports relative risks of discrete-time proportional hazard models of PCC closure. All regressions include a baseline hazard function $\tau(t) = \log(t + 1)$. 95% confidence intervals are reported in brackets, with standard errors clustered by county. NPI = net patient income. FTE = full-time equivalent. PCC=primary care clinic. OD=outpatient department. Medi-Cal = Name of the Medicaid program in California. ρ denotes the total variance contributed by the clinic-level variance. χ^2 denotes the likelihood-ratio test statistics of ρ=0. *** P<.01; ** P<.05; * P<.1