Title

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Journal

Academic Emergency Medicine, 26(2)

ISSN

1069-6563

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Publication Date

2019-02-01

DOI

10.1111/acem.13494

Peer reviewed

HHS Public Access

Author manuscript

Acad Emerg Med. Author manuscript; available in PMC 2020 February 01.

Published in final edited form as:

Acad Emerg Med. 2019 February ; 26(2): 129–139. doi:10.1111/acem.13494.

Access to Federally Qualified Health Centers and emergency department use among uninsured and Medicaid-insured adults: California, 2005–2013

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Abstract

Background—While improved access to safety net primary care providers, like Federally Qualified Health Centers (FQHCs), is often cited as a route to alleviate potentially preventable emergency department (ED) visits, no studies have longitudinally established the impact of improving access to FQHCs on ED use among Medicaid-insured and uninsured adults. We aimed to determine whether improved access to FQHCs was associated with lower ED use by uninsured and Medicaid-insured adults.

Methods—Using data from the Uniform Data System, US Census Bureau, and California Office of Statewide Health Planning & Development, we conducted a longitudinal analysis of 58 California counties from 2005 to 2013. For each county-year observation, we employed three measures of FQHC access: geographic density of FQHCs (delivery sites per 100 square miles), FQHCs per county resident (delivery sites per 100,000 county residents) and the proportion of Medicaid-insured or uninsured residents ages 19–64 that utilized FQHCs. We then used a fixed

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Author Contributions: JBN and RYH contributed to the conception and design of the study and acquired the data. FL carried out the initial analyses. JBN, SC, EV, and RYH contributed to the analysis and interpretation of the data. JBN and SC drafted the initial manuscript. JBN, SC, FL, EV, and RYH critically reviewed and revised the manuscript, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

Supplemental Information linked to the online version of the paper at Wiley-Blackwell:

- Table S1
- Supplemental Results

effects model to examine the impact of changes in the measures of FQHC access on ED visit rates by Medicaid-insured or uninsured adults in each county.

Results—Increasing geographic density of FQHCs was associated with a 26–35% decrease in ED use by uninsured but not Medicaid-insured patients. Increasing numbers of clinics per county resident and higher percentages of Medicaid-insured and uninsured adults seen at FQHCs were not associated with reduced rates of ED use among either uninsured or Medicaid-insured adults.

Conclusions—We were unable to detect a consistent association between our measures of FQHC access and ED use by Medicaid-insured and uninsured non-elderly California adults, underscoring the importance of investigating additional drivers to reduce ED use among these vulnerable patient populations.

Keywords

healthcare access; primary care; emergency department use; federally qualified health centers

INTRODUCTION

Over a decade ago, the National Academy of Medicine described emergency departments (EDs) as the “safety net of the safety net,” catching patients who fall through the cracks of primary care and social services systems.[1] Today, EDs still fill that gap in our healthcare system; emergency physicians provide the majority of visits for new health problems by uninsured and Medicaid-insured patients.[2] Given the lack of easily accessible primary care or urgent care, EDs may also see patients who do not require care in an emergency setting, but seek care in EDs because they play an important role as safety net providers.[3] While estimates differ, some portion of visits may represent potentially preventable ED use. In the context of ED overcrowding,[4,5] which reduces quality of care,[6] increases adverse outcomes, and impairs ED access, the inefficiency represented by patients who only go to the ED because they cannot obtain care elsewhere in a more appropriate setting can be seen as a socially undesirable outcome.[7]

As the nation’s primary care safety net providers, Federally Qualified Health Centers (FQHCs) are poised to help alleviate the growing demand for low-cost, high-quality primary care services and mitigate preventable use of the ED by vulnerable populations. FQHCs include community health clinics, public housing centers, school clinics, and other health care and social service delivery sites funded by enhanced Medicaid reimbursements and more than $9 billion in block grants in 2016 from the Health Resources and Services Administration (HRSA) within the US Department of Health and Human Services.[8] With over 9,000 delivery sites serving over 20 million patients in 2012,[9] FQHCs provide essential access to high quality healthcare for medically underserved populations.[10,11]

Much of the current discussion regarding which policies to implement to reduce ED use is based on the assumption that increased access to primary care is the solution to overuse of the ED.[4,12,13] However, the link between primary care availability and ED use remains largely unproven. While FQHCs comprise a minority of primary care providers in the United States, they are a crucial public health tool for filling market gaps in care for

underserved populations and play a prominent role in this policy debate. Previous studies relating FQHC access and acute care use at the community level have either been cross-sectional,[14] focused on hospitalizations,[15] or limited to a single clinic.[16] Studies involving individual patients have either focused on Medicare-Medicaid dual-eligible patients,[17] who represent a small proportion of the overall patients seen at FQHCs, or have been cross-sectional analyses of Medicaid-insured patients.[18,19]

As a result, the question remains, is the longitudinal growth and expansion of the FQHC program over the past decade reducing ED use? By employing a longitudinal fixed effects model over 58 California counties from 2005–2013, we tested our hypothesis that FQHC access is inversely associated with ED use by Medicaid-insured and uninsured adults at the county level.

METHODS

Sample

We examined the impact of changes in FQHC access from 2005 to 2013 on ED use within 58 counties in California. We included all FQHCs that report data to HRSA in our sample and specifically examined the impact of FQHC access on rates of ED use per county of residents in two populations: Medicaid-insured and uninsured adults aged 19–64. We chose to study Medicaid-insured and uninsured patients specifically given previous work indicating that these groups are the most likely to use the ED for primary care-preventable conditions.[20,21] In addition, they are target populations served by the FQHC system and are most likely to be affected by changes in access to FQHCs.

Data Sources

We obtained data on the number of patients served at a FQHC and number of sites per county from HRSA's publicly available Uniform Data System (UDS). To calculate geographic density of FQHC sites in each county, we used 2010 county land mass information from the US Census Bureau. To calculate clinics per county resident, we used county population estimates from the California Department of Finance. For our outcome measure, we obtained comprehensive records of all ED visits in California from the Office of Statewide Health Planning and Development (OSHPD).

We used Small Area Health Insurance Estimates files from the US Census Bureau to estimate a denominator of uninsured adults by county and the California Department of Health Care Services Medi-Cal enrollment counts from the Medi-Cal Eligibility Data System to similarly establish a denominator of Medicaid-insured adults by county. These sources allowed us to establish a denominator both for our predictors of percentage of Medicaid-insured or uninsured adult county residents seen at FQHCs, as well as for individual use in our model to generate rates of ED use per population among Medicaid-insured or uninsured adults. We then used the Area Health Resource Files (AHRF) from HRSA to obtain potentially time-variant county characteristics to use as covariates in our model.

Predictors

We measured FQHC access in each county-year by geographic density of FQHC delivery sites, FQHC delivery sites per county resident, and percentage of Medicaid-insured or uninsured adult residents served at a FQHC. The process of creating these measures is outlined in Figure 1. We categorized our access measures into quartiles based on their overall distributions over the study period because all of their estimated effects violated the assumption of log-linearity. We assigned the lowest quartile of each measure as the reference group and compared each higher quartile to that group in our regressions.

Geographical Clinic Access

HRSA funds FQHCs through block grants given to "grantees," which operate multiple sites, for which they are required to list basic information, including location, in the UDS. We calculated the number of sites by ZIP code using this data; however, because most other data were presented at the grantee rather than site level, there were frequent inconsistencies in the raw listing of site information. To ensure validity, we manually verified each site's years of operation using online documentation or phone calls to the clinics or grantees directly. Due to this manual verification, we were unable to include clinic measures from later-acquired 2013 data.

We included clinics for all years that services were provided, even if they were not listed in the UDS during the entire period, which is different from the unverified patient counts captured through the grantee's reports in the UDS. We included all types of California FQHC delivery sites listed in the UDS in our clinic count because in addition to medical care provided at traditional primary care centers, services provided at for instance, dental clinics, homeless healthcare centers, school, or social services centers, (e.g. dental care, case management) influence factors driving underserved patients to the ED.[22–25]

We merged the final counts of clinics by year and ZIP code into the OSHPD ED visit files, which were collapsed to the county level using an OSHPD county indicator. We then divided the delivery site count per county by the county's land mass to get density of FQHCs per 100 square miles. This predictor provided a proxy measure for geographic access to care, indicating roughly how difficult it would be for patients to travel to receive care at a FQHC.

Clinics Per County Population

We also included an additional measure of access to clinics, FQHC sites per 100,000 county residents, as a way to account for population density as well as geographic density of clinics. This measure was prepared similarly as above, but we divided clinic counts per county by the county's population in each year to obtain our final predictor.

Percentage of Medicaid or Uninsured Residents Served

We first abstracted the number of California FQHC patients from the UDS by grantee, ZIP code, and year. A patient is defined by HRSA as anyone who has had at least one visit for face-to-face services – regardless of the volume or scope of services received. Each patient is counted once per grantee, regardless of how many visits that patient makes. If a patient received care at multiple grantees, he or she may be counted multiple times. To determine

the number of adult patients served, we multiplied each grantee's ZIP code patient counts by the proportion of their patients between ages 19–64. We then multiplied this total by the grantee's proportion of Medicaid-insured or uninsured adult patients.

We totaled all the grantees' adult patient counts by insurance type (Medicaid or uninsured) in a given ZIP code to get the total number of Medicaid-insured or uninsured adults served by any FQHC in that ZIP code. We collapsed this data to the county level using the Housing and Urban Development ZIP code to county crosswalk files for the year in question. We used the 2010 crosswalk files for years prior to 2010 given the lack of crosswalk files for those years. If ZIP codes crossed more than one county, the patient counts were divided between the counties by the resident ratio, or the proportion of residential addresses in that ZIP code in each county. We then divided the patient counts by the number of uninsured or Medicaid-insured adult residents of the county-year in question to arrive at the proportion of uninsured or Medicaid-insured adults in that county seen at an FQHC. We used county codes to link this patient data to OSHPD ED use data. Because patient location data were not reliable prior to 2008, this predictor was limited to 2008–2013.

Outcome

We included all ED visits in each county by Medicaid-insured and uninsured patients ages 19–64. ED visits were assigned to a county based on each patient's reported residential county. The county population of Medicaid-insured or uninsured adults was included as an offset in our negative binomial models, leading to a final outcome measure of ED visit rates per corresponding population.

Covariates

We included nine variables from the AHRF that we anticipated might impact ED use in a given county based on previous literature,[4,15] including: percent of population living in poverty, median household income, unemployment rate, primary care doctors per population, short-term hospital beds per population, percent of population with a college degree, and health professional shortage area status.

Statistical Analysis

We used negative binomial models to estimate the dependence of the number of ED visits in each county and year on our three measures of FQHC access. The models included county as a fixed effect and controlled for pre-specified factors that potentially changed over the study period within counties. Accordingly, access effect estimates depend solely on within-county contrasts across years, avoiding bias stemming from fixed but unmeasured county-level confounders. We included year as a series of indicator variables to flexibly control for secular trends and used robust standard errors to account for over-dispersion. In addition to estimating ED visit rate ratios by quartile of the access measure, we also tested for the overall trend across quartiles using orthogonal linear combinations in the coefficients for the quartiles. To examine a potential mechanism for the association between geographic density of FQHCs and ED use, we conducted an additional analysis in which we determined whether geographic clinic density was associated with the proportion of Medicaid or uninsured county residents seen at FQHCs in the following year. We also conducted the

same analysis looking at the association between clinics per county resident and the proportion of Medicaid or uninsured county residents seen at FQHCs in the following year for completeness. We performed analyses using SAS 13.1 (Cary, NC) and STATA 14.0 (College Station, TX). Two-tailed significance was assessed at $p < 0.05$. The UCSF Committee on Human Research approved this study.

RESULTS

From 2005–2012, the number of FQHC sites in California increased from 910 to 1197, with the average number of sites per county rising from 18 to 24. FQHC density by county also rose, with most counties rising in number of FQHC sites per 100 square miles (Figure 2) and sites per 100,000 county residents. The number of patients ages 19–64 served by a FQHC in California grew from 1.4 million in 2008 to over 2 million in 2013, rising from approximately 6% to 8% of the California adult population.

Using geographic density of FQHC clinics as a measure of access, we found that ED use by Medicaid-insured adults did not change significantly as counties added clinics and crossed into higher quartiles of FQHCs per 100 square miles (p=0.45 for overall linear trend; Table 1). In contrast, we found that an increase from less than 0.12 clinics per 100 square miles to greater than 0.46 clinics per 100 square miles was associated with a 35% decrease in ED use by uninsured adults in that county from 2005–2012 (p<0.01, Table 1). In additional analyses, we found that geographic FQHC density was independently associated with increases in the percentage of uninsured patients using FQHCs in the following year (p<0.01) but not with the percentage of Medicaid-insured patients using FQHCs in the following year (p=0.88; Table S1).

When using FQHC delivery sites per county resident as a measure of FQHC access, we found no statistically significant association between increasing numbers of FQHCs per 100,000 county residents and ED visit rates among Medicaid-insured or uninsured adults (p=0.10 and p=0.37 for overall trend, respectively, Table 2). In our additional analyses, we found that FQHC delivery sites per 100,000 county residents were not statistically significantly associated with changes in the proportion of Medicaid-insured or uninsured adults seen at FQHCs the following year (p=0.18; p=0.07, Table S1.)

Increases in our third measure of access – percentages of Medicaid-insured or uninsured adults served at a FQHC – were not associated with a significant change in ED use by Medicaid-insured or uninsured patients between 2008 and 2013 (p=0.30; p=0.26 for overall linear trend; Table 3).

DISCUSSION

We could not identify a significant association between increasing access to and utilization of FQHCs and ED use among underinsured adults in California counties between 2005–2013 in five of our six analyses. The lack of consistent statistically significant associations with reduced ED use across all access measures challenges the assumption that expansion of FQHCs will necessarily reduce ED use by uninsured and Medicaid-insured patients. While these findings do not address other potential benefits of increased access to primary care and

social services via FQHCs, which increasingly provide an important source of care to racial and ethnic minorities, low-income, and uninsured or Medicaid-insured individuals,[26] they serve as a sobering reminder that reduced ED use may not necessarily be among them.

However, our findings do suggest that improved geographic access to FQHCs is associated with lower rates of ED use among uninsured adults. We found that increasing from the lowest quartile (<0.12 clinics per 100 square miles) to either of the top two quartiles of geographic access to FQHCs (>0.46 clinics per 100 square miles) was associated with a 35% decrease in rates of ED use by uninsured adults in those counties. These findings concur with previous cross-sectional work showing that the presence of a FQHC in a geographic area was related to lower rates of preventable hospitalizations or ED use among vulnerable populations.[14,15]

Our additional analysis on determining whether or not this association is mediated through additional uninsured patients seen at these newly opened clinics showed that the proportion of uninsured adults seen at FQHCs increased the year following an increase in FQHC delivery sites per 100 square miles, but the proportion of Medicaid-insured adults seen at FQHCs did not. This supports the theory that utilization by uninsured adults is the mechanism by which geographic FQHC density impacts ED utilization rates. However, our later analysis was unable to detect any correlation between increasing proportions of uninsured adults seen at FQHCs and ED use, which does not support this proposed mechanism. This disconnect could be secondary to our relatively small sample size of 58 counties, which limits our ability to detect such a relationship if the effect size is small. However, the mechanism by which geographic FQHC density reduced ED use by the uninsured could also be through other measures not captured in our analysis. For instance, more FQHCs could increase focus on and services for community health and reduce ED use as uninsured patients receive these additional public health benefits rather than more direct services at FQHCs.

The rest of our analyses were unable to detect a significant association between FQHC access and ED visit rates in uninsured and Medicaid-insured adults. When measuring access by geography, we found that ED visit rates among Medicaid-insured adults did not respond to increases in the number of clinics per 100 square miles. Previous evidence has shown that in addition to distance, factors such as lack of transportation, up-front costs, limited clinic hours, limited services, long wait times, difficulty getting timely appointments, patient education, and health literacy drive patients to use the ED instead of local FQHC clinics for non-emergent concerns.[1,27] These additional factors likely contributed to the lack of impact of increased geographic access to FQHCs on eventual ED use among Medicaid patients and may be less pronounced among uninsured patients who are more likely to seek alternative, less expensive sources of care when available, because they are not as shielded from medical costs as Medicaid enrollees.[28]

However, we were also unable to detect an association between the proportion of Medicaid-insured adults seen at FQHCs and their rate of ED visits. This measure of access captures patients who overcame non-geographic barriers and received some care from an FQHC, yet we still could not find an association with ED use. We also did not find an association

between FQHC sites per 100,000 county residents and ED use among Medicaid-insured adults. This points to alternative factors beyond FQHC access that drive Medicaid-insured patients to the ED.

For example, Medicaid-insured adults have significantly worse health than either uninsured or privately insured adults.[28–30] Healthcare use, including ED use, in medically complex populations is less elastic and subsequently, would likely be less affected by changes in access to primary care.[31] Our previous work with pediatric populations,[32] which found decreased ED use with increased geographic access for both uninsured and Medicaid-insured children, provides some support for this possibility, as children in general (whether Medicaid or uninsured) are healthier than adults. Health status or other Medicaid-specific concerns are unlikely to be the primary explanation behind our findings, however, as we also did not find an association between the proportion of uninsured adults or clinics per 100,000 uninsured residents and ED use among uninsured adults.

Numerous other factors beyond primary care use could be contributing to the lack of overall association between FQHC access and ED use among vulnerable populations. For example, we were unable to account for clinic and care-specific factors that influence the likelihood of patients using the ED, including physician attitudes, referral practices, continuity of care, quality of care, and patient-centeredness.[5,33–35] The specific interventions individual clinics can implement to reduce ED use is an important area for continued research. In addition, previously cited factors in qualitative studies that drive patients to visit the ED for potentially preventable or non-urgent concerns such as time constraints, flexibility, provider referrals, perception of severity of illness, and perception of quality of care could be further investigated as potential intervention points to reduce preventable ED use.[5,27,36]

While our findings contradict previous cross-sectional studies that show Medicaid-insured patients seen at FQHCs having fewer ED visits,[18,19] other earlier works have similarly suggested that increased access to health services may not reduce ED use. In the 2008 Oregon Medicaid expansion, subjects randomized to receive Medicaid coverage actually had increased rates of ED use compared to those not given insurance.[37] In addition, projections have shown that expanding healthcare access alone is likely to increase ED use.[38] While these studies focus on expanding access to health insurance and our analysis attempted to capture expanded access to primary care, they do point out that expanded healthcare access can lead to increased use of *all* healthcare services.

Recent policy shifts may impact the results we found over our study period. In California, extensive Medicaid insurance expansion following the first Affordable Care Act enrollment period in 2013 reduced the uninsured population by 68%, half of which gained insurance through Medicaid.[39] The California FQHC Program, which receives the majority of its funding from enhanced Medicaid reimbursements,[40] is poised to benefit from this shift. Furthermore, California FQHCs were already growing at a rate that outpaced the national average before 2013[41] and have taken the initiative to begin comprehensive payment and delivery reform to help reduce spending, raise the quality of care, and improve access to primary and preventive care.[42] Because these changes in the environment of FQHC care in California have primarily occurred after our study period, it is unclear how they will affect

the relationships we find between FQHC access and ED use. However, if increasing geographic FQHC density reduces ED visits for uninsured, but not for Medicaid-insured adults, as our findings suggest, then a growing Medicaid population and dwindling uninsured population may reduce any net benefit realized by increasing FQHC density in a given county. Further research could help elucidate the impact of these policy changes.

LIMITATIONS

While our fixed effects model allowed us to remove all between-county omitted variable bias, there is still the possibility of confounding in the relationship between FQHC access and ED use by factors that changed within a county over time. We attempted to control for this by using potentially time variant county characteristics, which did not meaningfully change the results. However, we could not control for all factors, such as measures of health status of the population over time, which could have shifted within counties over our study period and affected ED visits and FQHC utilization. Our analysis is also subject to the limitations of an ecological study; we cannot determine if the patients served at a FQHC were the same people making fewer visits to the ED, which would require longitudinal patient data that are not available, particularly for uninsured patients.

While counties as proxies for market areas approximate geographical access, the measures are imperfect. Boundary bias may exist if a clinic in a neighboring county is actually closer for some residents than clinics in their own county. However, no other geographic boundary allows us to combine the necessary sources of data for this analysis, and county boundaries serve as a common measure used in studies evaluating access to care.

Finally, our measures of access to FQHCs are imperfect. Geographic access, as we defined it, does not take into account transportation time to the nearest clinic, and thus is only a proxy for geographic access to care. In addition, the number of FQHC delivery sites per county resident is measured uniformly across each county, rather than within specific population centers, and may not capture the meaningful number of clinics per person. Further, while our measures of the proportion of Medicaid-insured or uninsured adults seen at an FQHC attempt to capture the penetrance of FQHC access into the target patient population, it does not account for a number of competing factors, such as the large number of Medicaid-insured patients that receive primary care at non-FQHC clinics. While we attempted to control for the underlying supply of primary care in a given county using our covariates of primary care doctors per population, as well as hospital access using hospital beds per population, we did not have data on alternative care sources used by Medicaid-insured and uninsured patients in that county. Therefore, we do not know whether changes in the proportion of patients served at a FQHC represent true penetrance of services into an area of unmet need (i.e. a true increase in access) or the transferring of patients between alternative care sources.

CONCLUSIONS

Our analysis could not detect a consistent association between multiple measures of FQHC access and ED use among uninsured and Medicaid-insured adults in California counties

between 2005 and 2013. These results suggest the need for the investigation of intervention points beyond non-specific primary care access in the effort to reduce ED overuse among vulnerable populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding Sources/Disclosures: This study was supported by the National Heart, Lung, and Blood Institute of the National Institutes of Health (NIH) under Grant Award No. R01HL114822. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

We would like to thank the California Office of Statewide Health Planning and Development for their assistance in preparing the datasets used in this project; and Sarah Sabbagh, MPH, and Joanna Guo, BA for their administrative and editorial support.

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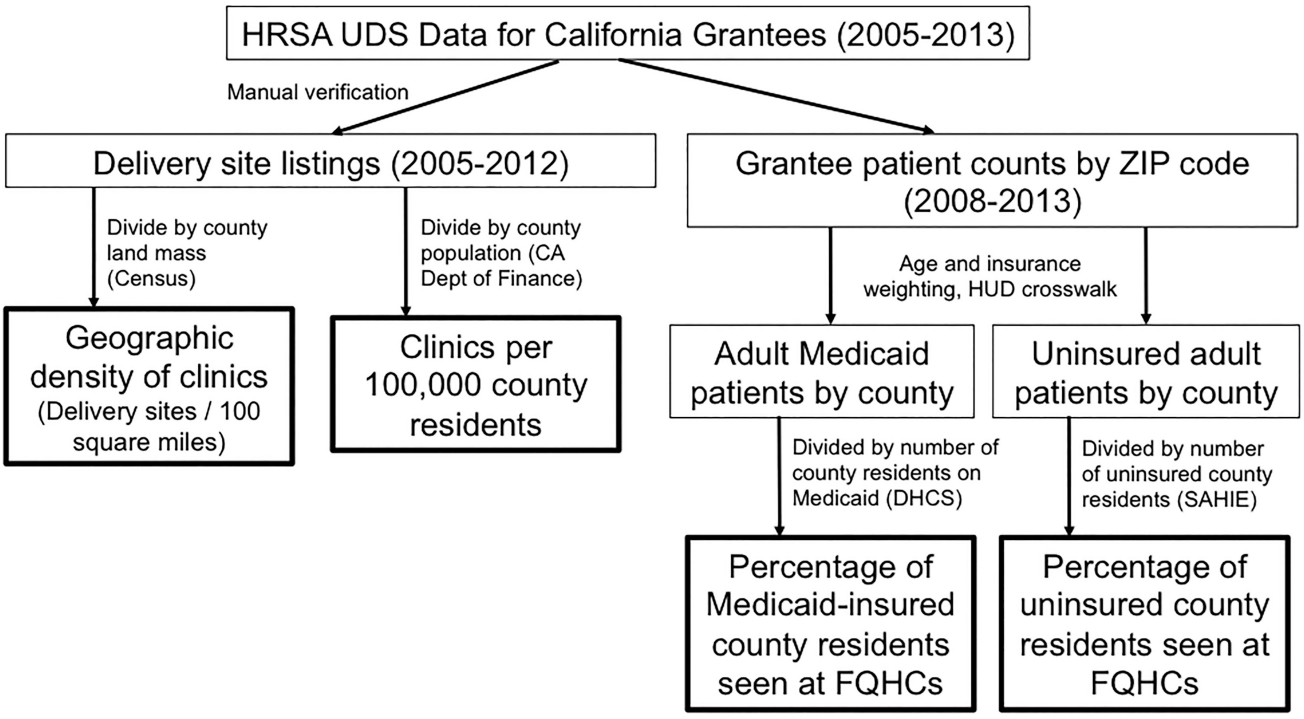

Figure 1. Derivation of FQHC Access Measures

Abbreviations: HRSA – Health Resources and Services Administration; UDS – Uniform Data System; CA – California; DHCS – California Department of Health Care Services; SAHIE – Small Area Health Insurance Estimates (US Census Bureau); ZIP – Zone Improvement Plan; US – United States; FQHC – Federally Qualified Health Center; HUD – Housing and Urban Development; FIPS – Federal Information Processing Standard Publication

Notes: Census refers to the US Census Bureau 2010 land mass estimates. The HUD crosswalk refers to the US Department of Housing and Urban Development ZIP code to FIPS county code crosswalk files (used to collapse patient counts by county). Manual verification: using online documentation or phone calls to the clinics or grantees directly we manually verified the years of operation of different clinics listed in the UDS data given frequent inconsistencies in the raw data. Age and insurance weighting: we multiplied each grantee's ZIP code patient counts by the proportion of their patients between ages 19-64, and by the proportion of Medicaid-insured or uninsured adult patients.

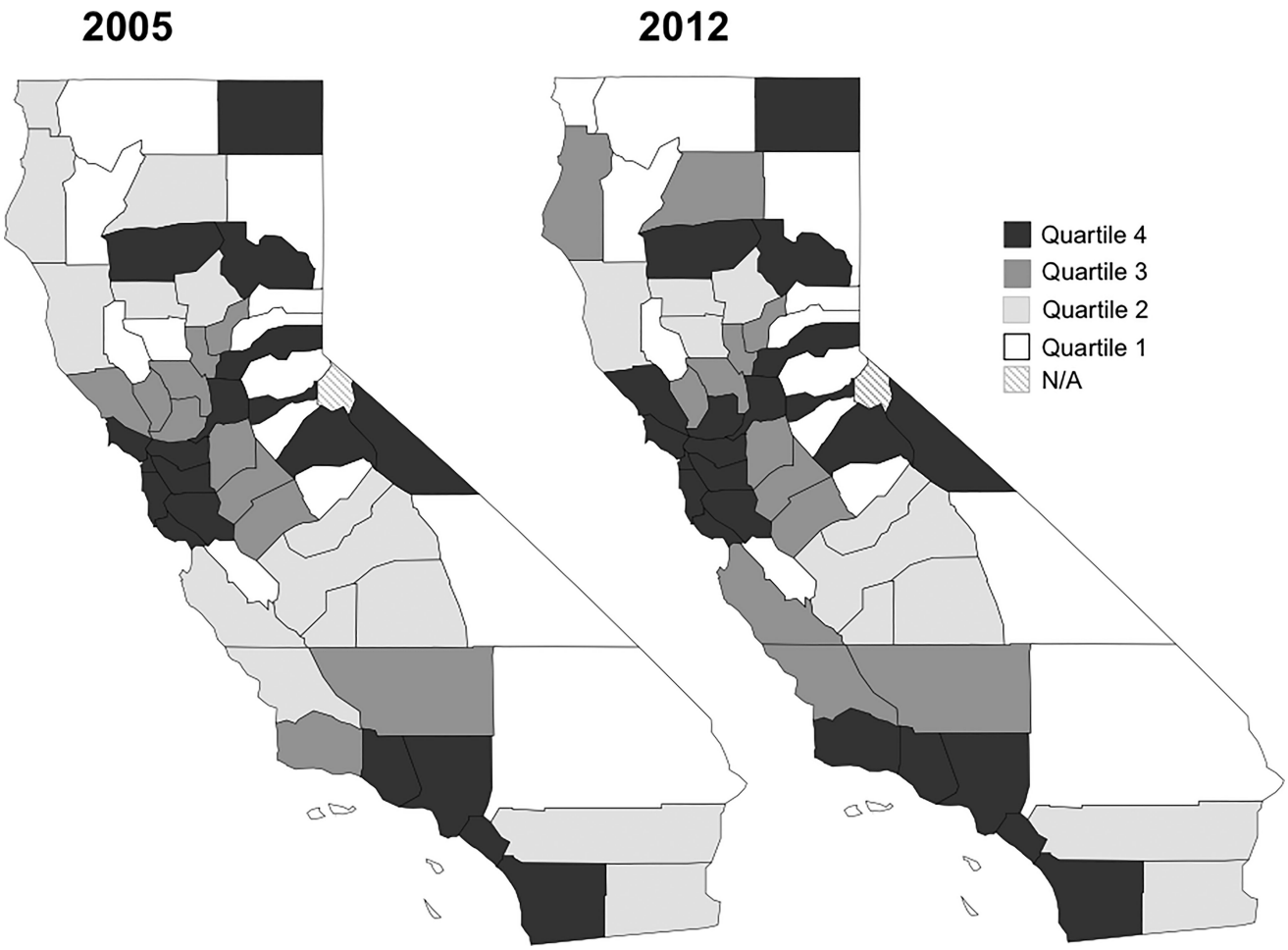

Figure 2. Quartile of clinics per 100 square miles, by county

Quartile 1: <0.12 sites/100 square miles. Quartile 2: 0.12–0.45 sites/100 square miles. Quartile 3: 0.46–1.38 sites/100 square miles. Quartile 4: >1.38 sites/100 square miles. N/A refers to the one county with insufficient data to calculate this metric.

Table 1

The association of geographic FQHC delivery site density with ED visit rates among adults ages 19–64 without insurance or insured by Medicaid, 2005–2012

Density of FQHC sites (Quartile – sites/100 square miles)	Medicaid			Uninsured		
	IRR	95% CI	*p*-value	IRR	95% CI	*p*-value
<0.12	Ref	Ref	0.45^	Ref	Ref	<0.01^
0.12–0.45	1.04	0.96–1.13	0.30	0.74	0.63–0.87	<0.01
0.46–1.38	0.89	0.76–1.05	0.17	0.65	0.54–0.78	<0.01
>1.38	0.97	0.82–1.15	0.73	0.65	0.52–0.81	<0.01

Abbreviations: FQHC – Federally Qualified Health Center; ED – Emergency Department; IRR – Incidence Rate Ratio; CI – Confidence Interval

Notes: The table demonstrates the results of a negative binomial model regressing ED visits on geographic density of FQHC delivery sites in each county each year. Estimates adjusted for year and county as fixed effects as well as time-varying county-level covariates including percent of population living in poverty, median household income, unemployment rate, primary care doctors per population, short term hospital beds per population, percent of the population with a college degree, and health professional shortage area status. IRR's are interpreted as the incidence of ED visits in quartile listed/incidence of ED visits in reference quartile, similarly to an odds ratio or hazard ratio for their respective outcomes. Additional Results are available as supplemental material accompanying the online article.

^ *p*-value for trend across 4 quartiles

Table 2

The association of FQHC delivery sites per 100,000 county residents with ED visit rates among adults ages 19–64 without insurance or insured by Medicaid, 2005–2012

FQHCs per 100,000 population (Quartile)	Medicaid			Uninsured		
	IRR	95% CI	*p*-value	IRR	95% CI	*p*-value
< 2.12	Ref	Ref	0.10^	Ref	Ref	0.37^
>2.12–4.59	1.02	0.96–1.08	0.62	0.97	0.91–1.04	0.46
>4.59–7.27	0.93	0.85–1.01	0.09	0.98	0.89–1.08	0.74
>7.27	0.92	0.82–1.04	0.20	1.08	0.87–1.45	0.37

Abbreviations: FQHC – Federally Qualified Health Center; ED – Emergency Department; IRR – Incidence Rate Ratio; CI – Confidence Interval

Notes: The table demonstrates the results of a negative binomial model regressing ED visits on FQHC delivery sites per 100,000 county residents in each county each year. Estimates adjusted for year and county as fixed effects as well as time-varying county-level covariates including percent of population living in poverty, median household income, unemployment rate, primary care doctors per population, short term hospital beds per population, percent of the population with a college degree, and health professional shortage area status. IRR's are interpreted as the incidence of ED visits in quartile listed/ incidence of ED visits in reference quartile, similarly to an odds ratio or hazard ratio for their respective outcomes. Additional Results are available as supplemental material accompanying the online article.

^ *p*-value for linear trend across 4 quartiles

Table 3

The impact of percentage of Medicaid-insured and uninsured adults ages 19–64 seen at FQHCs on ED visit rates, 2008–2013

Percent of Medicaid-insured adults seen at FQHCs (Quartile)	ED visits by adults with Medicaid			Percent of uninsured adults seen at FQHCs (Quartile)	ED visits by uninsured adults		
	IRR	95% CI	*p*-value		IRR	95% CI	*p*-value
0–10.8%	Ref	Ref	0.30^	0–7.2%	Ref	Ref	0.26^
>10.8–20.8%	1.04	1.00–1.08	0.04	>7.2–17.9%	1.01	0.91–1.12	0.83
>20.8–39.3%	1.07	1.02–1.12	0.01	>17.9–32.8%	1.08	0.94–1.25	0.29
>39.3–95.4%	1.03	0.96–1.10	0.41	>33.1–71.8%	1.08	0.93–1.26	0.31

Abbreviations: FQHC – Federally Qualified Health Center; ED – Emergency Department; IRR – Incidence Rate Ratio; CI – Confidence Interval

Notes: The table demonstrates the results of a negative binomial model regressing ED visit rate among adults ages 19–64 covered by Medicaid or uninsured adults by county on percentage of Medicaid-insured adults or percentage of uninsured adults ages 19–64 who are FQHC patients. Estimates adjusted for year and county as fixed effects as well as time-varying county-level covariates including percent of population living in poverty, median household income, unemployment rate, primary care doctors per population, short term hospital beds per population, percent of the population with a college degree, and health professional shortage area status. IRR's are interpreted as the incidence of ED visits in quartile listed/incidence of ED visits in reference quartile, similarly to an odds ratio or hazard ratio for their respective outcomes. Additional Results are available as supplemental material accompanying the online article.

^ *p*-value for trend across 4 quartiles