Where Do Freestanding Emergency Departments Choose to Locate? A National Inventory and Geographic Analysis in Three States

Jeremiah D. Schuur, MD, MHS*; Olesya Baker, PhD; Jaclyn Freshman, BA; Michael Wilson, MD, PhD; David M. Cutler, PhD

*Corresponding Author. E-mail: jschuur@partners.org, Twitter: @JSchuurMD.

Study objective: We determine the number and location of freestanding emergency departments (EDs) across the United States and determine the population characteristics of areas where freestanding EDs are located.

Methods: We conducted a systematic inventory of US freestanding EDs. For the 3 states with the highest number of freestanding EDs, we linked demographic, insurance, and health services data, using the 5-digit ZIP code corresponding to the freestanding ED's location. To create a comparison nonfreestanding ED group, we matched 187 freestanding EDs to 1,048 nonfreestanding ED ZIP codes on land and population within state. We compared differences in demographic, insurance, and health services factors between matched ZIP codes with and without freestanding EDs, using univariate regressions with weights.

Results: We identified 360 freestanding EDs located in 30 states; 54.2% of freestanding EDs were hospital satellites, 36.6% were independent, and 9.2% were not classifiable. The 3 states with the highest number of freestanding EDs accounted for 66% of all freestanding EDs: Texas (181), Ohio (34), and Colorado (24). Across all 3 states, freestanding EDs were located in ZIP codes that had higher incomes and a lower proportion of the population with Medicaid. In Texas and Ohio, freestanding EDs were located in ZIP codes with a higher proportion of the population with private insurance. In Texas, freestanding EDs were located in ZIP codes that had fewer Hispanics, had a greater number of hospital-based EDs and physician offices, and had more physician visits and medical spending per year than ZIP codes without a freestanding ED. In Ohio, freestanding EDs were located in ZIP codes with fewer hospital-based EDs.

Conclusion: In Texas, Ohio, and Colorado, freestanding EDs were located in areas with a better payer mix. The location of freestanding EDs in relation to other health care facilities and use and spending on health care varied between states. [Ann Emerg Med. 2016;■:1-10.]

Please see page XX for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

Emergency departments (EDs) play a critical role in the United States health care system, delivering 11% of ambulatory visits and a quarter of acute care visits, and serving as the portal for half of hospital admissions.[1-3] Modern EDs in the United States developed from the "emergency room" of acute care hospitals, and until recently most EDs were hospital based.[4] Freestanding EDs were introduced in the 1970s to provide access to emergency care in communities that could not support a hospital-based ED. They deliver emergency care in a facility that is physically separate from an acute care hospital.[5] Although some freestanding EDs are owned or operated by hospitals ("satellite"), others are independently owned and operated by physician groups and other entrepreneurs.

Importance

Recently, there has been significant growth of freestanding EDs, with a concentration in several states, notably, Texas. In 2007, Sullivan et al[6] identified 80 freestanding EDs nationwide, whereas in 2009 the California HealthCare Foundation identified 222 freestanding EDs. Reports from the popular press reflect the rapid and accelerating growth of freestanding EDs.[7,8] As the number of freestanding EDs increases, policymakers, health professional organizations, and payers are discussing how to react, including by making changes to policy and reimbursement.[9,10] Yet current data on the number, geographic distribution, and analysis of the population and health services in areas in which freestanding EDs choose to locate have not been published, to our knowledge.

Editor's Capsule Summary

What is already known on this topic

Freestanding emergency departments (EDs) have been increasing in some regions of the country. There is debate about their role in the health care delivery system.

What question this study addressed

What is the distribution of freestanding EDs in relation to underserved populations and populations with fewer health services?

What this study adds to our knowledge

In the 3 states with the most freestanding EDs (Texas, Colorado, and Ohio), facilities were located in areas with higher income and lower rates of Medicaid. In Texas, freestanding EDs were located in areas with more health services, whereas in Ohio, they were located in areas with fewer health services.

Research we would like to see

How freestanding EDs are related to local health care needs, access to care, continuity of care, and health outcomes.

Goals of This Investigation

One question that recurs is whether freestanding EDs improve access to emergency care. In this article, we aim to describe the location and distribution of freestanding EDs and identify what populations are served by them. We test whether ZIP codes in which freestanding EDs locate differ from nonfreestanding ED ZIP codes along population growth, socioeconomic, and health services factors. Specifically, do freestanding EDs locate in areas with demographic features of underserved populations or fewer health services? Our findings can inform ongoing policy discussions of whether freestanding EDs help improve access to emergency care and for which patients.

MATERIALS AND METHODS

Study Design and Setting

We created a national inventory of freestanding EDs and then conducted ZIP code–level geographic analyses in the 3 states with the most freestanding EDs: Texas, Ohio, and Colorado.

Methods of Measurement

We identified operational freestanding EDs by conducting a systematic national inventory. First, we gathered lists of licensed freestanding EDs from state departments of health and other state agencies. Second, we conducted Internet searches for each state, using Google to search for "freestanding" or "satellite" and "Emergency Department" or "ED" by state. The list of freestanding EDs in the inventory is current as of March 31, 2015. We collected data on facility characteristics (name and address), hospital ownership (satellite versus independent), and for-profit status (versus nonprofit). We used the inventory to calculate the number of freestanding EDs in each state.

We linked the freestanding ED inventory with ZIP code–level demographic, insurance, and health services data, using the 5-digit ZIP code corresponding to the freestanding ED's location. We obtained demographic data, including population counts, annual growth rate, sex, age, race, education, and employment data from the 2013 ESRI Demographics files compiled by the Center for Geographic Analysis at Harvard University.[11,12] Use of health services and medical facility data were also compiled by the Center for Geographic Analysis, using 2013 North American Industry Classification System (NAICS) business counts data.[13] We used the 2013 American Hospital Association data to calculate the number of hospital EDs per ZIP code. We obtained ZIP code–level percentages of uninsured, privately insured, and Medicare and Medicaid patients from the 2013 American Community Survey.

Primary Data Analysis

We focused our geographic analysis on the 3 states with the highest number of freestanding EDs: Texas, Ohio, and Colorado. In each state, we flagged ZIP codes that contained at least 1 freestanding ED and ZIP codes that contained none. We found that ZIP codes with freestanding EDs had significantly higher total population and smaller land area compared with ZIP codes without freestanding EDs. To control for possible confounding because of differences in land area and population, in the 3 states we matched 187 freestanding EDs to 1,048 nonfreestanding ED ZIP codes on land area and population. We used a one-to-many coarsened exact matching algorithm that uses cut points to temporarily coarsen each variable, creates strata of land and population values, and matches observations within each stratum.[14] The cut points were defined manually according to examination of the joint distributions of land and population in freestanding and nonfreestanding ED groups. Each freestanding ED ZIP code was allowed to be matched to more than 1 nonfreestanding ED ZIP code within the same population-land stratum. This one-to-many match produced different sample sizes, and we used coarsened exact matching weights to correct for sample size

difference when computing confidence intervals. We used the cem function in Stata MP 13.1 to perform this analysis (StataCorp, College Station, TX). Matching produced groups that were similar with respect to the matching variables (Table E1, available online at http://www.annemergmed.com). As a robustness check, we also performed a one-to-one match on land area and population, as well as a one-to-many match on population and 2010 to 2013 annual compound growth rate. Results of the one-to-one land area and population match were similar to the one-to-many match. Population and growth rates in freestanding ED and nonfreestanding ED samples were similar after we matched on these variables (Tables E2 and E3, available online at http://www.annemergmed.com).

Using matched ZIP code–level data, we computed group-level means of demographic, health insurance, and use and availability of health services variables. To compare characteristics of ZIP codes with and without freestanding EDs, we calculated differences in means across matched groups. We computed confidence intervals for these differences by using univariate regression with freestanding ED group dummy and cem weights to correct for sample size differences. We also performed a multivariable logistic regression analysis to assess the joint contribution of state, demographic, and health services variables to freestanding ED location (Table E4, available online at http://www.annemergmed.com). Links to the datasets and the coarsened exact matching code are available online (Figure E1, available online at http://www.annemergmed.com). All analyses were performed in Stata 13.1.

RESULTS

We identified 360 freestanding EDs in the continental United States and a total of 310 freestanding ED–containing ZIP codes as of March 31, 2015. Figure 1 shows the geographic distribution of freestanding EDs across the United States. Freestanding EDs are heavily concentrated in a handful of states. The 3 states with the largest number of freestanding EDs were Texas (n=181), Ohio (n=34), and Colorado (n=24); they had 137, 32, and 22 freestanding ED–containing ZIP codes, respectively. In Texas, freestanding EDs were highly concentrated around several metropolitan areas, as illustrated in Figure 2. Nationwide 54.2% of freestanding EDs were hospital satellites, 36.6% were independent, and 9.2% were not classifiable; 45.3% of freestanding EDs were for profit, 43.9% nonprofit, and 10.8% not classifiable. In Texas, 22.1% of freestanding EDs were hospital satellites

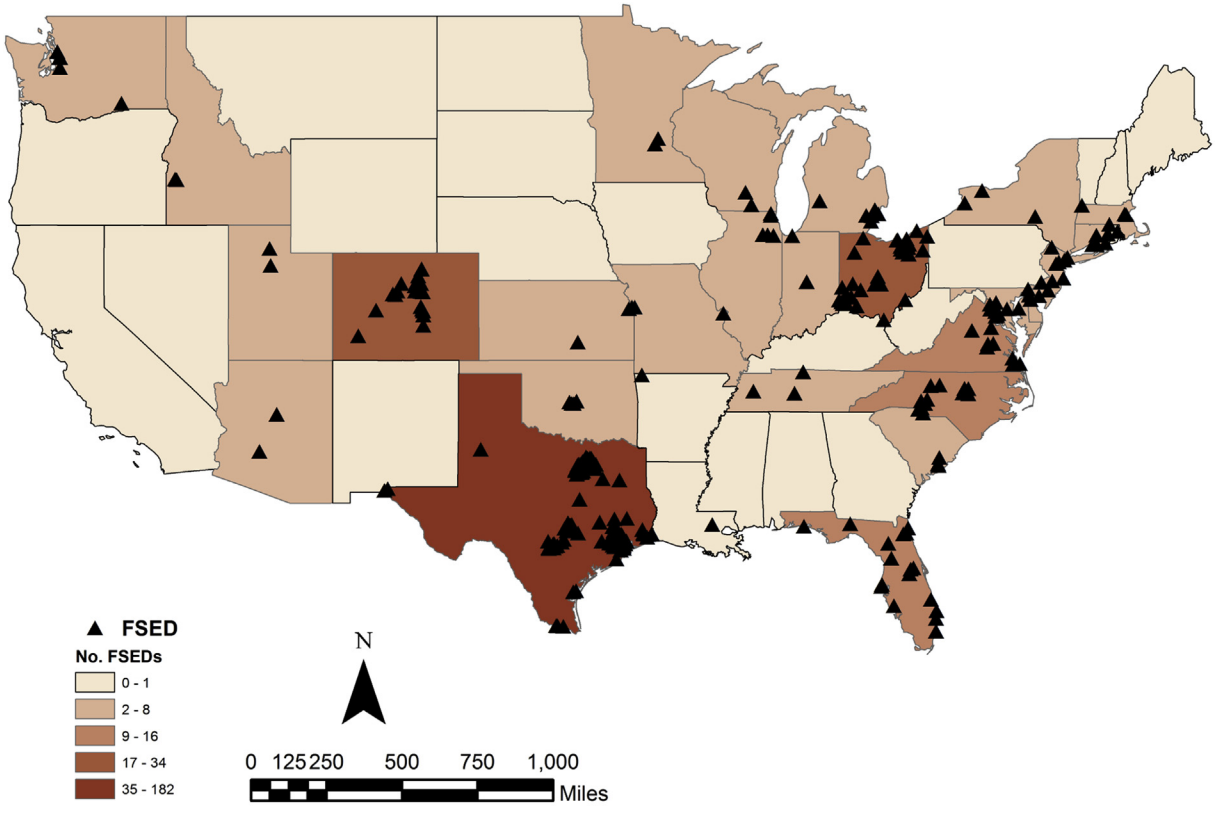

Figure 1. Number of freestanding EDs by state. *FSED*, Freestanding emergency department.

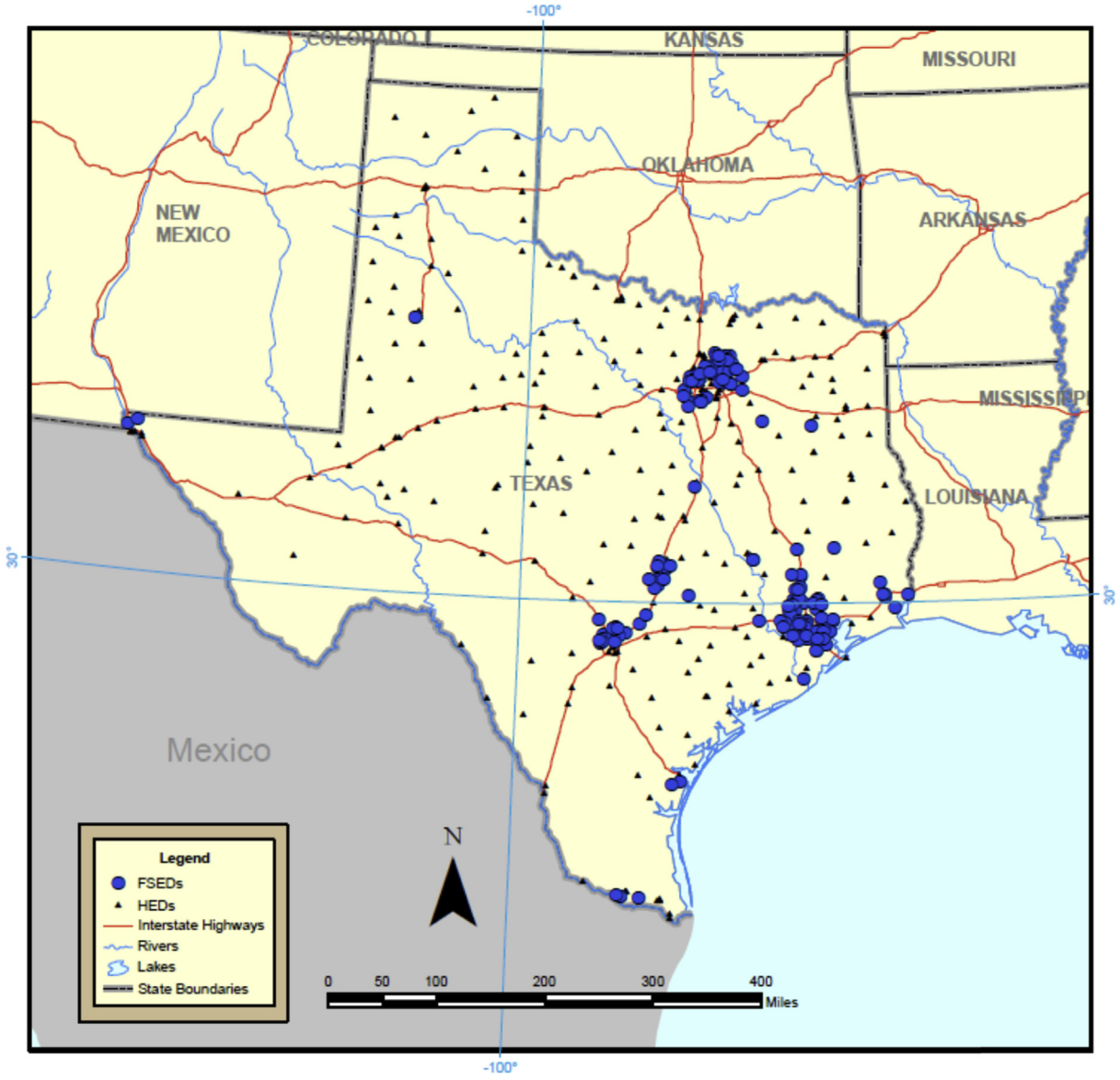

Figure 2. Hospital and freestanding ED locations in Texas.

and 71.3% were for profit; in Colorado, 45.8% were hospital satellites and 61.9% were for profit; in Ohio, all but 1 freestanding ED were hospital satellites and 5.8% were for profit.

Demographic, insurance, and health services characteristics differed between matched ZIP codes with and without freestanding EDs (Table 1). Compared with nonfreestanding ED ZIP codes, those ZIP codes with freestanding EDs had higher population growth, fewer racial and ethnic minorities, higher incomes, higher rates of private health insurance, and a lower proportion of the population with Medicaid. In Ohio and Colorado, the direction of the differences was similar to that of Texas, but magnitudes were smaller. In both Colorado and Ohio, household income was higher and percentage Medicaid lower in freestanding ED ZIP codes. In Ohio, freestanding ED ZIP codes had higher rates of private insurance. In Colorado, freestanding ED ZIP codes had a lower proportion of Medicare population.

Additionally, Table 1 describes differences in health services use and facilities in matched ZIP codes with and without freestanding EDs. In Texas, freestanding EDs were located in ZIP codes that had more physician visits, medical spending per year, hospital-based EDs, physician offices, and medical laboratories than nonfreestanding ED ZIP codes. In Ohio and Colorado, there were no large differences in physician visits or medical spending between freestanding and nonfreestanding ED ZIP codes. In Ohio, there were fewer hospital-based EDs in freestanding ED ZIP codes. In Ohio and Colorado, there were fewer of

Table 1. Demographic, insurance, and health services factors in matched ZIP codes with and without freestanding EDs.

	Texas			Ohio			Colorado		
Variable	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**
Matched 5-digit ZIP codes	134	441		32	344		21	263	
Demographics									
Population growth rate	1.7	1.3	0.4 (0.2 to 0.6)	0.3	0.1	0.2 (−0 to 0.4)	1.4	0.8	0.6 (0.4 to 0.9)
Female patients, %	50.8	50.8	0 (−0.4 to 0.4)	51.3	51.0	0.3 (−0.4 to 0.9)	49.1	49.5	−0.4 (−1.4 to 0.7)
Median age, y	35.8	32.7	3.1 (2.2 to 3.8)	40.2	40.0	0.2 (−1.6 to 2.0)	36.3	38.0	−1.7 (−4.6 to 1.1)
Hispanic, %	25.8	50.2	−24.4 (−29.4 to −19.5)	2.4	3.6	−1.2 (−2.5 to 0.1)	18.1	19.4	−1.3 (−8.5 to 6.0)
Black, %	10.2	12.8	−2.6 (−5.3 to 0.2)	6.6	10.5	−3.9 (−9.7 to 1.9)	2.4	3.0	−0.6 (−2.8 to 1.5)
Median income, $	73,003	49,267	23,736 (19,360 to 28,113)	58,482	49,646	8,836 (2,083 to 15,589)	70,604	59,831	10,773 (1,639 to 19,908)
Unemployment rate	5.5	7.4	−1.9 (−2.4 to −1.4)	6.4	8.0	−1.6 (−3.0 to −0.4)	6.4	7.3	−0.9 (−2.3 to 0.5)
Insurance, %									
Private	71.9	53.9	18.0 (14.6 to 21.6)	76.9	70.5	6.4 (1.9 to 11.0)	75.7	70.9	4.8 (−1.6 to 11.3)
Medicaid	9.8	19.3	−9.5 (−11.3 to −7.8)	11.7	16.0	−4.3 (−7.6 to −1.1)	9.0	13.2	−4.2 (−8.2 to −0.3)
Medicare	10.4	10.8	−0.4 (−1.2 to 0.4)	15.8	16.5	−0.7 (−2.2 to 0.7)	10.4	13.7	−3.3 (−6.5 to −0.2)
Uninsured	16.4	25.1	−8.7 (−10.5 to −6.8)	9.1	11.3	−2.2 (−3.8 to −0.6)	13.5	14.0	−0.5 (−3.6 to 2.6)
Health services use and spending									
Physician visits/y	23,330	19,973	3,356 (1,694 to 5,020)	17,774	16,608	1,165 (−2,476 to 4,807)	14,444	14,507	−63 (−4,199 to 4,073)
Medical care, $ spent/y, in millions	37.6	22.9	14.7 (12.1 to 17.4)	24.5	20.6	3.9 (−1.0 to 8.9)	23.0	19.8	3.2 (−2.8 to 9.2)
Health facilities									
Hospital-based EDs	0.6	0.3	0.3 (0.1 to 0.4)	0.1	0.4	−0.3 (−0.5 to −0.1)	0.1	0.2	−0.1 (−0.4 to 0.1)
General medical and surgical hospitals	1.6	1.3	0.3 (−0.1 to 0.7)	1.6	1.4	0.2 (−0.3 to 0.7)	0.7	1.2	−0.5 (−1.2 to 0.3)
Offices of physicians*	54.3	31.2	23.1 (14.7 to 31.4)	25.8	30.1	−4.3 (−13.2 to 4.6)	17.3	23.3	−6.0 (−15.4 to 3.3)
Other outpatient care centers	4.1	3.7	0.4 (−0.3 to 1.2)	2.1	2.4	−0.3 (−1.2 to 0.6)	2.6	3.9	−1.3 (−2.9 to 0.4)
Medical laboratories	2.0	1.5	0.5 (0.1 to 0.9)	1.3	1.3	0 (−0.6 to 0.5)	1.2	0.9	0.3 (−0.2 to 0.8)
Diagnostic imaging centers	0.3	0.2	0.1 (0 to 0.2)	0.1	0.2	−0.1 (−0.3 to 0.1)	0.1	0.1	0 (−0.2 to 0.1)

*Excluding mental health specialists.

several types of health services in freestanding ED ZIP codes compared with nonfreestanding ED ZIP codes. The results of sensitivity analyses matching on population and growth rate were not materially different; some absolute differences between freestanding and nonfreestanding ED ZIP codes were reduced in Texas and Ohio, and confidence intervals for differences in income and percentage Medicaid became wider in Colorado.

Figure 3*A* and *B* shows scatter plots of matched Texas ZIP codes with or without freestanding EDs, comparing population density against the proportion of the population with Medicaid or private insurance. Freestanding EDs are generally located in ZIP codes with lower proportions of Medicaid and higher proportions of privately insured residents irrespective of the population density of the area.

Tables 2 and 3 show results stratified by freestanding EDs' hospital affiliation and for-profit status and compare ZIP codes in which these freestanding EDs locate in Texas and Colorado. We excluded Ohio because we found only 1 nonaffiliated and 2 for-profit freestanding EDs. In Texas, location of hospital-affiliated freestanding EDs differed little from nonaffiliated freestanding EDs. For-profit freestanding EDs tended to locate in areas that had a larger Hispanic population than nonprofit freestanding EDs.

We modeled the relationship between presence of a freestanding ED in a ZIP code and several demographic and health services variables, as well as differences across states, using multiple variable logistic regression (Table E4, available online at http://www.annemergmed.com). The strongest association was found between freestanding ED presence in a ZIP code and both higher population growth rate and higher percentage of private insurance. The model also shows a strong negative association between same–ZIP code hospital EDs and freestanding EDs for Ohio relative to Texas. Even after controlling for multiple demographic and health services factors, results remained similar to the univariate regression results shown in Table 1.

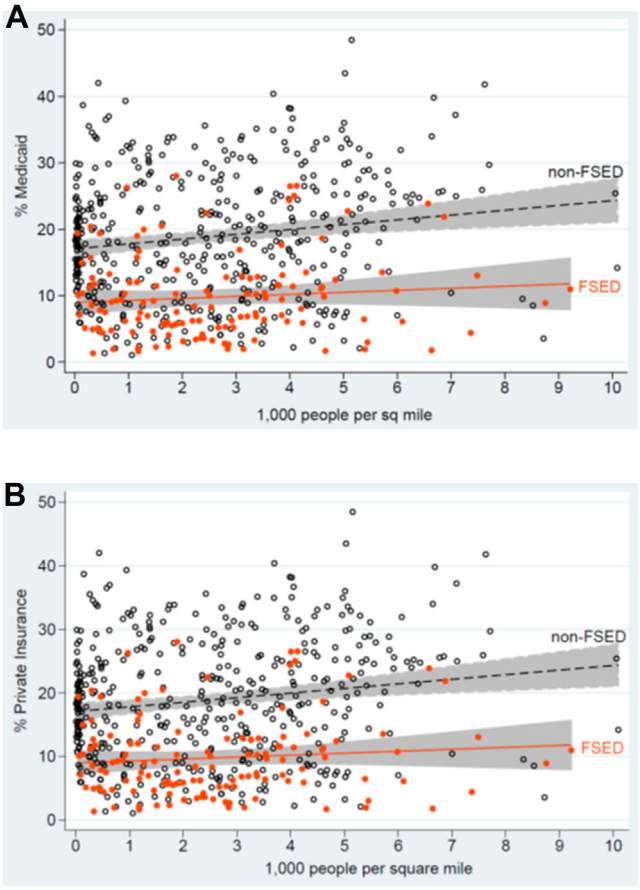

Figure 3. Texas ZIP codes with and without freestanding EDs by percentage of population with private insurance and Medicaid.

LIMITATIONS

Our study has limitations. We did not conduct a patient-level analysis of freestanding ED use. Therefore, our analysis does not address whether patients visiting freestanding EDs required emergency care or the quality of care they received. Previous studies have suggested that retail and urgent care clinics could potentially deal with between one sixth and one quarter of ED visits.[15] An area-level analysis can capture current and prospective freestanding ED patients but can also include or exclude relevant groups. Furthermore, ZIP codes, which were created for mail delivery, may not be the best representation of freestanding ED market areas, especially in small or large ZIP codes. We balanced data on land and population to avoid confounding, but matching removed only confounding related to land and population differences. Additionally, there could be small changes to ZIP codes between the dates of our demographic data (2013) and geographic data (2015). There could be other unmeasured factors that, if included in the match, could have increased the strength of the comparison, such as transportation or availability and proximity of other acute care sites. Additionally, the matching approach was not perfect. We successfully matched 187 of 192 ZIP codes with freestanding EDs, meaning that we excluded 5 ZIP codes with a freestanding ED. It is possible that visits are higher in some ZIP codes because that is where the providers are located, not because the people living there access care more. Our analysis presents differences between areas with and without freestanding EDs at a single point. It is likely that these differences will change as the number of freestanding EDs continues to increase.

DISCUSSION

Freestanding EDs are a rapidly increasing source of acute unscheduled care in the United States. We created a current inventory of freestanding EDs in the United States and found that the number of freestanding EDs has increased rapidly, from 222 in 2009 to 360 in 2015.[5] Freestanding EDs are concentrated in a handful of states, with only 6 states having more than 10, Texas being home to half of them. We found that in Texas, Colorado, and Ohio, freestanding EDs preferentially locate in ZIP codes with higher rates of population growth, higher median income, and a better payer mix (more likely to have private insurance, less likely to have Medicaid) than ZIP codes without freestanding EDs. In Texas, freestanding EDs locate in ZIP codes that are more likely to have existing health services, including hospital EDs, whereas in Ohio they are more likely to locate in ZIP codes without a hospital ED. States and payers should review these patterns as they consider changing freestanding ED regulations.

Freestanding EDs are concentrated in a handful of states. This is likely due to several factors, including state regulation of freestanding EDs and economics. State legislation about freestanding EDs varies, ranging from a minimal burden to a functional ban on their development. In Texas and Colorado, the regulatory requirements to open a freestanding ED are relatively limited. In Texas, they include a license application form, patient transfer documents such as a hospital agreement, fire safety report, approval for occupancy, and a fee of $14,820.[16] In Colorado, the regulatory requirements to open a freestanding ED include a license application form, a fee of $3,100, and standard requirements for opening any health care facility. The Ohio Department of Health does not license or regulate freestanding EDs; all freestanding EDs are hospital-affiliated, requiring accreditation by a Centers for Medicare & Medicaid Services–approved accrediting organization. In some other states, one must obtain a certificate of need, a formal regulatory process

Table 2. Demographic, insurance, and health services factors, by hospital affiliation status.

	Texas			Colorado		
Variable	**Hospital Affiliated**	**Not Hospital Affiliated**	**Difference (95% CI)**	**Hospital Affiliated**	**Not Hospital Affiliated**	**Difference (95% CI)**
FSEDs	40	120		11	8	
Demographics						
Population growth rate	2.0	1.8	0.2 (−0.2 to 0.7)	1.3	1.5	−0.2 (−1.43 to 1.0)
Female patients, %	50.8	50.8	0.0 (−0.5 to 0.4)	48.6	50.2	−1.6 (−4.5 to 1.2)
Median age, y	36.5	35.3	1.2 (−0.2 to 2.7)	37.2	36.0	1.2 (−1.7 to 4.2)
Hispanic, %	22.4	26.1	−3.7 (−9.5 to 2.0)	16.0	14.2	1.8 (−5.0 to 8.5)
Black, %	9.0	10.7	−1.7 (−4.8 to 1.3)	1.4	3.4	−2.0 (−4.3 to 0.4)
Median income, $	77,887	76,202	1,685 (−7,683 to 11,054)	68,342	76,669	−8,327 (−27,766 to 11,111)
Unemployment rate	5.3	5.4	−0.1 (−0.7 to 0.5)	6.0	6.0	0.0 (−1.2 to 1.3)
Insurance, %						
Private	75.5	72.8	2.7 (−2.2 to 7.6)	75.5	81.2	−5.7 (−14.3 to 2.8)
Medicaid	8.4	9.4	−1.0 (−3.2 to 1.1)	8.4	7.2	1.2 (−3.3 to 5.6)
Medicare	10.8	9.5	1.3 (−0.1 to 2.8)	11.0	9.8	1.2 (−1.6 to 3.8)
Uninsured	14.3	16.1	−1.8 (−4.6 to 1.0)	14.0	10.5	3.5 (−3.4 to 10.3)
Health services use and spending						
Physician visits/y	23,108	26,050	−2,942 (−6,773 to 887)	16,410	14,490	1,920 (−8,217 to 12,058)
Medical care, $/y, in millions	38.4	43.3	−4.9 (−12.4 to 2.7)	25.6	23.1	2.5 (−14.2 to 19.2)
Health facilities						
Hospital-based EDs	0.3	0.6	−0.3 (−0.6 to 0)	0.1	0	0.1 (−0.1 to 0.3)
General medical and surgical hospitals	1.4	1.7	−0.3 (−0.9 to 0.4)	0.5	0.8	−0.3 (−1.3 to 0.7)
Offices of physicians*	47.6	57.1	−9.5 (−26.6 to 7.5)	20.2	15.8	4.4 (−12.4 to 21.3)
Other outpatient care centers	4.2	4.0	0.2 (−1.0 to 1.3)	1.9	3.3	−1.4 (−3.7 to 1.0)
Medical laboratories	1.6	2.1	−0.5 (−1.3 to 0.3)	1	1.1	−0.1 (−1.5 to 1.3)
Diagnostic imaging centers	0.3	0.3	0 (−0.1 to 0.2)	0.1	0	0.1 (−0.1 to 0.3)

*Excluding mental health specialists.

demonstrating that there is need in the market for the health care services, before opening a freestanding ED.[17] Some states, including California, effectively ban freestanding EDs by requiring that any facility using the term "emergency" must provide intensive care, laboratory, radiology, surgical, post-anesthesia, and blood bank services. Any facility that provides all of these services is essentially an acute care hospital, not a freestanding ED.[5]

Economics also contribute to clustering of freestanding EDs because there are economies of scale. It is less expensive and easier to build and open the second and subsequent facilities because decisions on site location, real estate, construction, licensing, and staffing all have economies of scale. In particular, staffing presents economies of scale because most freestanding EDs are small, so extending both nursing and physician coverage over multiple facilities creates efficiency and flexibility. The Texas market illustrates this well because most freestanding EDs are clustered around Houston, Dallas, Austin, and San Antonio (Figure 2). In these markets, several networks of freestanding EDs are operated or staffed by a single emergency physician group practice.

Do freestanding EDs improve access to emergency care? Access is a multidimensional construct. Penchansky and Thomas[18] defined access as reflecting the fit between characteristics and expectations of the providers and the clients, and described 5 dimensions of access to care: affordability, availability, accessibility, accommodation, and acceptability.[19] Our analysis can address the concepts of availability and accessibility, but not the others. Expanding availability and accessibility can be viewed in several ways: in regions with population growth, currently crowded EDs, or in underserved areas and populations. We found that freestanding EDs in the top 3 states tended to locate in ZIP codes with higher population growth, a predictor of increasing demand for ED services. As many EDs nationwide experience crowding, especially those in urban areas,[20,21] it is likely that freestanding EDs do address the increased demand for ED services in areas in which existing hospital-based EDs cannot keep up. Even without population growth, freestanding EDs may increase access to emergency care if local hospital EDs are crowded and waiting is endemic because they provide an alternate venue. For example, if patients leave hospitals without being seen, then additional ED capacity could increase access. Our analysis cannot fully answer this question because we do not have data on ED waiting times or patients who left without being seen.

Freestanding EDs' effect on availability and accessibility of emergency care for disadvantaged populations and

Table 3. Demographic, insurance, and health services factors, by for-profit status.

	Texas			Colorado		
Variable	**Not for Profit**	**For Profit**	**Difference (95% CI)**	**Not for Profit**	**For Profit**	**Difference (95% CI)**
FSEDs	25	129		9	13	
Demographics						
Population growth rate	1.9	1.9	0 (−0.6 to 0.6)	0.9	1.8	−0.9 (−1.9 to 0.1)
Female patients, %	50.6	50.8	−0.2 (−0.8 to 0.3)	47.4	50.6	−3.2 (−5.4 to −1.2)
Median age, y	36.6	35.3	1.3 (−0.4 to 3.0)	37.4	35.3	2.1 (−0.6 to 4.8)
Hispanic, %	19.0	26.4	−7.4 (−14.2 to −0.6)	16.0	21.7	−5.8 (−18.7 to 7.1)
Black, %	8.3	10.5	−2.2 (−5.8 to 1.4)	1.0	3.1	−2.2 (−4.1 to −0.2)
Median household income, $	81,909	76,672	5,237 (−5,947 to 16,421)	60,589	76,833	−16,243 (−34,695 to 2,207)
Unemployment rate	5.1	5.3	−0.2 (−1.0 to 0.5)	6.2	6.8	−0.6 (−2.8 to 1.6)
Insurance, %						
Private	77.2	73.2	4.0 (−1.9 to 9.8)	71.4	78.0	−6.6 (−18.9 to 5.7)
Medicaid	7.6	9.2	−1.6 (−4.2 to 0.8)	9.2	9.7	−0.5 (−7.2 to 6.2)
Medicare	10.7	9.4	1.3 (−0.4 to 2.9)	10.7	10.4	0.3 (−2.3 to 3.0)
Uninsured	13.3	16.0	−2.6 (−5.9 to 0.7)	17.0	11.0	6.0 (−0.9 to 13.0)
Health services use and spending						
Physician visits/y	23,680	26,003	−2,323 (−6,961 to 2,315)	12,649	17,097	−4,448 (−13,395 to 4,498)
Medical care, $ spent/y, in millions	41.7	43.0	−1.3 (−10.4 to 7.7)	17.2	28.0	−10.8 (−24.9 to 3.3)
Health facilities						
Hospital-based EDs	0.2	0.6	−0.4 (−0.7 to 0)	0.1	0	0.1 (−0.1 to 0.3)
General medical and surgical hospitals	1.5	1.7	−0.2 (−1.0 to 0.6)	0.4	0.5	−0.1 (−0.9 to 0.8)
Offices of physicians*	50.2	54.7	−4.5 (−25.2 to 16.1)	18.2	14.6	3.6 (−11.8 to 18.9)
Other outpatient care centers	3.9	4.1	−0.2 (−1.6 to 1.2)	1.4	3.2	−1.8 (−3.7 to 0.1)
Medical laboratories	1.6	2.0	−0.4 (−1.3 to 0.5)	1.0	0.9	0.1 (−1.1 to 1.4)
Diagnostic imaging counts	0.2	0.3	−0.1 (−0.3 to 0.2)	0.1	0	0.1 (−0.1 to 0.3)

*Excluding mental health specialists.

medically underserved areas is more complex. In the 3 states studied, freestanding EDs were more likely to locate in more advantaged neighborhoods: ZIP codes with higher income, higher percentages of the population with private health insurance, and lower proportions receiving Medicaid. This is similar to what has been found about retail clinics[10] and urgent care clinics.[22] Additionally, it has been reported that freestanding EDs are expensive and may not accept government insurance at the same rate as hospital EDs.[23,24] It is therefore unlikely that they increase access to care for disadvantaged populations.

With regard to medically underserved areas, Texas and Ohio have different patterns of where freestanding EDs locate. In Texas, ZIP codes with freestanding EDs have more medical services availability, including more hospital EDs, more physician visits, and higher medical spending, than ZIP codes without freestanding EDs. In Ohio, however, freestanding EDs tend to locate in areas with fewer hospital-based EDs. Because all but 1 freestanding EDs in Ohio are satellite EDs of acute care hospitals, their business model may be to locate in communities with limited health services access, increasing the hospital's total ED volume and creating a source for referrals. Satellite freestanding EDs may locate farther away from a hospital ED to avoid cannibalizing the parent hospital's volume or creating political tension with a competing hospital. Market saturation may also affect freestanding ED location choice. Texas has a relatively mature market, with many freestanding EDs around major metropolitan areas, and thus newer facilities may be more likely to open near a hospital ED because the empty areas already have a freestanding ED. In Colorado, the market is relatively young, so there are many potential markets without a hospital ED. Location choice of freestanding EDs deserves further study because the results diverge in states with different freestanding ED ownership structures for freestanding EDs.

It is not surprising that in all 3 states, freestanding EDs locate in areas with a better payer mix because the decision to open a freestanding ED is a business decision. Freestanding EDs' profitability is determined by visit volume and profit margin per visit. A freestanding ED can be profitable either by treating a higher volume of patients with a lower profit margin or a lower volume with a higher margin. Locating in a site with a better payer mix may be the critical decision for the financial success of a freestanding ED. Because freestanding EDs are able to collect both a provider fee and a separate facility fee, the breakeven for a small freestanding ED can be as low as 12 patients per day.[25] Therefore, the presence of other sources of acute care, such as a hospital ED, does not preclude

opening a freestanding ED as long as the payer mix is favorable, as we found in Texas. In Ohio, however, freestanding EDs are more likely to choose locations more distant from a hospital-based ED, even if payer mix is not as favorable. Because almost all freestanding EDs in Ohio are hospital satellites, they may be willing to run the ED as a "loss leader" to direct patients to the acute care hospital for more lucrative services, such as operations and admissions. For-profit status was not associated with a material difference in the location of freestanding EDs in Texas or Colorado. Although the operating group may be a hospital, physician group, or investment group, they are all dealing with the same economic constraints of market-based fee-for-service medicine. This is not surprising because the literature on for-profit status of acute care hospitals shows varied results. For example, nonprofit hospitals, compared with for-profit hospitals, were found to be located in counties with lower poverty rates, lower rates of uninsurance, or both.[26] But for-profit hospitals are less likely to offer services that have a lower profit margin than nonprofit hospitals.[27] All freestanding EDs are seeking markets in which they will be profitable.

In summary, freestanding EDs are an innovative model of acute care delivery with the potential to reshape the market for emergency care. There has been rapid and accelerating growth of freestanding EDs, concentrated in a small number of states, notably, Texas, in which half of freestanding EDs are located. Although freestanding EDs may address increasing demand for ED services in areas with high population growth, in Texas they are unlikely to improve access to emergency care in underserved areas because they tend to locate in areas with well-insured populations who already have access to health services. Further research is needed to determine how the growth of freestanding EDs will affect access, quality, and cost of emergency care.

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Author affiliations: From the Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA (Schuur, Baker, Freshman, Wilson); the Department of Emergency Medicine, Harvard Medical School, Boston, MA (Schuur, Wilson); and the Department of Economics, Harvard University, Cambridge, MA (Cutler).

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Table E1. One-to-many matching of freestanding and nonfreestanding ED ZIP codes on land area and population.

	Texas			Ohio			Colorado		
	FSED	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**
Full sample									
5-digit ZIP codes	138	1,693		32	1,086		22	465	
Avg land, square miles	37.4	132.2	−94.8 (−130.8 to −58.7)	44.6	36.6	8.04 (6.2 to 22.2)	69.3	218.6	−149.4 (−270.8 to −27.9)
Avg population	41,576	12,095	29,480 (26,787 to 32,173)	30,056	9,794	20,262 (15,903 to 24,622)	26,509	9,893	16,616 (10,799 to 22,431)
Matched sample									
5-digit ZIP codes	134	441		32	344		21	263	
Avg land, square miles	37.8	39.4	−1.7 (−17.3 to 13.9)	44.6	44.7	−0.06 (−12.4 to 12.3)	70.8	78.0	−7.2 (−57.1 to 42.6)
Avg population	41,257	40,275	982 (−2,451 to 4,414)	30,056	27,938	2,118 (−4,046 to 8,283)	25,204	25,222	18 (−7,241 to 7,278)

Avg, Average.

Table E2. Demographic, insurance, and health services factors in freestanding and nonfreestanding ED ZIP codes, one-to-one match on land area and population.

	Texas			Ohio			Colorado		
Variable	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**
Matched 5-digit ZIP codes	120	120		31	31		21	21	
Demographics									
Land area	37.9	37.1	0.8 (−17.5 to 19.0)	44.1	42.7	1.4 (−15.2 to 17.9)	70.8	62.9	−7.8 (−30.2 to 45.9)
Population	39,054	38,291	763 (−3,576 to 5,104)	25,203	24,468	1,505 (−6,868 to 9,880)	25,203	24,828	735 (−9,316 to 10,786)
Population growth rate	1.7	1.3	0.4 (0.1 to 0.7)	0.3	0.1	0.2 (−0.1 to 0.5)	1.4	0.7	0.6 (0.1 to 1.2)
Female patients, %	50.8	50.2	0.5 (0 to 1.1)	51.3	50.5	0.8 (−0.3 to 1.9)	49.1	49.7	−0.6 (−2.0 to 0.6)
Median age, y	35.8	33.0	2.8 (1.7 to 3.9)	40.9	40.4	0.6 (−1.5 to 2.8)	36.3	39.7	−3.4 (−7.1 to 0.2)
Hispanic, %	25.8	48.1	−22.2 (−28.1 to 16.5)	2.2	3.0	−0.8 (−1.8 to 0.1)	18.3	16.5	1.6 (−7.9 to 11.2)
Black, %	10.0	12.9	−2.8 (−6.1 to 0.3)	6.5	8.1	−1.6 (−7.4 to 4.2)	2.4	2.2	0.2 (−1.6 to 2.0)
Median income, $	72,659	50,180	22,478 (15,985 to 28,972)	58,505	55,527	2,977 (−6,495 to 12,451)	70,604	58,022	12,582 (4.4 to 25,160)
Unemployment rate	5.5	7.6	−2.1 (−2.7 to −1.5)	6.3	7.8	−1.5 (−3.0 to 0)	6.4	7.4	−1.0 (−2.7 to 0.7)
Insurance, %									
Private	72.1	54.5	17.5 (13.1 to 21.9)	77.1	72.1	5.0 (−1.0 to 10.9)	75.7	72.5	3.2 (−5.2 to 11.6)
Medicaid	9.6	18.9	−9.3 (−11.4 to −7.2)	11.6	15.0	−3.3 (−7.8 to 1.1)	8.9	12.6	−3.6 (−8.2 to 0.9)
Medicare	10.5	10.7	−0.2 (−1.2 to 0.8)	16.0	16.5	−0.5 (−2.5 to 1.4)	10.4	15.8	−5.4 (−8.4 to −2.4)
Uninsured	16.4	24.6	−8.2 (−10.5 to −5.8)	8.9	10.7	−1.8 (−3.8 to 0.1)	13.5	13.2	0.3 (−4.3 to 4.8)
Health services use and spending									
Physician visits/y	22,186	19,115	3,071 (844 to 5,297)	17,083	16,326	757 (−4,122 to 5,636)	14,444	14,434	10.4 (−5,825 to 5,846)
Medical care, $ spent/y, in millions	35.7	23.0	12.8 (8.9 to 16.6)	23.8	21.4	2.3 (−4.5 to 9.3)	23.0	19.7	3.3 (−5.9 to 12.5)
Health facilities									
Hospital-based EDs	0.5	0.3	0.2 (0.1 to 0.5)	0.1	0.4	−0.3 (−0.5 to −0.1)	0.1	0.1	0 (−0.1 to 0.1)
General medical and surgical hospitals	1.6	1.4	0.2 (−0.3 to 0.7)	1.5	1.1	0.4 (−0.3 to 1.17)	0.7	0.9	−0.2 (−1.0 to 0.6)
Offices of physicians*	53.7	32.9	20.7 (9.2 to 32.2)	25.5	31.2	−5.6 (−17.5 to 6.3)	17.3	22.0	−4.8 (−16.0 to 6.5)
Other outpatient care centers	4.1	3.2	0.4 (0 to 1.6)	2.1	1.8	0.3 (−0.7 to 1.3)	2.6	4.1	−1.5 (−3.6 to 0.6)
Medical laboratories	2.0	1.4	0.6 (0.1 to 1.1)	1.3	1.5	−0.2 (−1.0 to 0.5)	1.1	0.9	0.2 (−0.7 to 1.1)
Diagnostic imaging centers	0.2	0.3	−0.1 (−0.2 to 0.1)	0	0.2	−0.1 (−0.3 to 0.1)	0	0.1	−0.1 (−0.3 to 0.1)

*Excluding mental health specialists.

Table E3. Demographic, insurance, and health services factors in freestanding and nonfreestanding ED ZIP codes, one-to-many match on population and growth rate.

	Texas			Ohio			Colorado		
Variable	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**	**FSED**	**No FSED**	**Difference (95% CI)**
Matched 5-digit ZIP codes	136	470		31	326		20	196	
Demographics									
Total population	41,270	39,526	1,743 (−1,498 to 4,984)	30,056	29,187	869 (−5,124 to 6,863)	25,383	25,688	−304 (−8,686 to 8,078)
Population growth rate	1.7	1.7	0 (−0.2 to 0.3)	0.3	0.3	0 (−0.2 to 0.2)	1.2	1.2	0 (−0.4 to 0.4)
Female patients, %	50.8	50.4	0.4 (−0.1 to 0.8)	51.3	51.2	0.1 (−0.6 to 0.9)	49.0	49.7	−0.7 (−1.6 to 0.1)
Median age, y	35.7	33.2	2.5 (1.6 to 3.4)	40.2	39.0	1.2 (−0.6 to 2.9)	36.4	37.9	−1.5 (−4.3 to 1.2)
Hispanic, %	26.1	45.9	−19.8 (−24.7 to −14.9)	2.4	3.8	−1.4 (−2.9 to 0.1)	18.8	19.5	−0.7 (−8.4 to 6.8)
Black, %	10.2	12.1	−1.9 (−4.4 to 0.6)	6.6	11.7	−5.1 (−11.2 to 1.0)	2.2	4.1	−1.9 (−4.8 to 1.1)
Median income, $	72,924	51,475	21,449 (17,312 to 25,586)	58,482	49,625	8,857 (2,650 to 15,064)	67,028	65,938	1,090 (−10,141 to 12,322)
Unemployment rate	5.5	7.1	−1.6 (−2.1 to −1.1)	6.4	7.8	−1.5 (−2.9 to −0.1)	6.6	7.0	−0.4 (−1.6 to 0.8)
Insurance, %									
Private insurance	71.5	54.9	16.6 (12.1 to 18.7)	76.9	70.7	6.2 (1.1 to 11.3)	74.2	70.9	3.2 (−4.4 to 10.8)
Medicaid	9.9	17.9	−8.0 (−9.6 to −6.3)	11.7	15.8	−4.1 (−7.6 to −0.6)	9.7	12.6	−2.9 (−7.2 to 1.5)
Medicare	10.4	10.8	−0.4 (−1.4 to 0.6)	15.8	15.5	0.3 (−1.3 to 1.8)	10.8	12.5	−1.7 (−5.1 to 1.7)
Uninsured	16.7	24.2	−7.5 (−9.3 to −5.7)	9.1	11.4	−2.3 (−4.2 to −0.3)	14.3	14.3	0 (−3.9 to 3.9)
Health services use and spending									
Physician visits/y	23,261	19,852	3,409 (1,817 to 5,001)	17,774	17,233	541 (−2,958 to 4,040)	14,618	14,463	−154 (−4,504 to 4,813)
Medical care, $ spent/y, in millions	37.4	23.7	13.7 (11.1 to 16.4)	24.5	21.6	2.9 (−2.1 to 7.9)	22.0	20.6	1.4 (−5.6 to 8.4)
Health facilities									
Hospital-based EDs	0.6	0.4	0.2 (0 to 0.3)	0.1	0.3	−0.2 (−0.4 to −0.1)	0	0.1	−0.1 (−0.3 to 0.1)
General medical and surgical hospitals	1.3	1.6	0.3 (0 to 0.7)	1.6	1.6	0 (−0.6 to 0.7)	0.8	0.8	0 (−0.7 to 0.7)
Offices of physicians*	54.1	28.6	25.5 (18.1 to 32.9)	26.6	31.9	−5.3 (−15.9 to 5.2)	19.4	17.3	2.05 (−7.8 to 11.9)
Other outpatient care centers	4.1	3.2	0.9 (0.3 to 1.6)	2.2	2.4	−0.2 (−1.0 to 0.6)	2.8	3.1	−0.3 (−1.8 to 1.1)
Medical laboratories	2.0	1.2	0.8 (0.4 to 1.1)	1.3	1.3	0 (−0.6 to 0.5)	1.4	0.9	0.5 (0 to 1.1)
Diagnostic imaging centers	0.3	0.2	0.1 (0 to 0.2)	0.1	0.2	−0.1 (−0.4 to 0)	0.1	0.1	0 (−0.1 to 0.1)

*Excluding mental health specialists.

Table E4. Multivariable regression model: effect of ZIP code–level demographic and health services factors on freestanding ED presence.

Outcome	Effect	95% CI
Presence of FSED in a ZIP code		
TX	[Reference]	NA
OH	−0.48	−6.10 to 5.14
CO	2.89	−2.98 to 8.75
Land, sq. miles	−0.01	−0.01 to 0
Land * OH	0.01	0 to 0.02
Land * CO	0	0 to 0.01
Total ZIP code population	0	0 to 0
Population * OH	0	0 to 0
Population * CO	0	0 to 0
Population growth rate	0.13	−0.03 to 0.29
Population Growth Rate * OH	−0.05	−0.75 to 0.65
Population Growth Rate * CO	−0.09	−0.33 to 0.16
% Hispanic	−0.02	−0.03 to 0
% Hispanic * OH	−0.20	−0.51 to 0.11
% Hispanic * CO	0.03	−0.01 to 0.08
Median age, y	0.01	−0.03 to 0.06
Median Age * OH	−0.01	−0.12 to 0.09
Median Age * CO	−0.06	−0.15 to 0.02
% Private insurance	0.06	0.03 to 0.07
% Private Insurance * OH	0	−0.05 to 0.04
% Private Insurance * CO	−0.01	−0.06 to 0.04
hEDs per ZIP code	0.25	0.01 to 0.48
hEDs per ZIP Code * OH	−2.41	−3.98 to −0.83
hEDs per ZIP Code * CO	−1.70	−3.72 to 0.31

TX, Texas; *OH*, Ohio; *CO*, Colorado; *hED*, hospital-based EDs; *NA*, not applicable.

Links to databases

Center for Geographic Analysis at Harvard University: http://www.gis.harvard.edu/

ESRI Demographic Files—GIS mapping software: http://www.esri.com/

NAICS business counts: http://www.naics.com/

American Hospital Association data: http://www.aha.org/

American Community Survey: http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

Coarsened Exact Matching Stata Code and Documentation

Matching code: cem land_sq_mi (0 4 9 16 25 36 49 80 160) totpop_cy (0 5000 10000 15000 20000 25000 30000 35000 40000 50000 80000), k2k tr(fED)

Detailed information on coarsened exact matching in Stata can be found on: http://gking.harvard.edu/files/cem-stata.pdf.

Figure E1. Links to data sets and code.