Where Do Doctors Work?

Medical School Access and the Rural Physician Shortage

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Abstract

The Flexner Report permanently changed medical education in the United States. Standards rose as the number of schools in the U.S. fell by almost half. Using comprehensive listings on physician locations and specialties from 1909 through 2011, I investigate some of the myriad effects of these reforms. A differences-in-differences approach finds that the geographic distribution of physicians relates significantly to the geographic distribution of medical schools. Further analysis indicates that doctors' practice locations depend not only on their birthplace but also characteristics of the medical school attended. This work has significant policy implications for construction and placement of medical schools going forward.

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1 Introduction

A long tradition in economics states that work restrictions can be harmful to trade (Smith, 1776, Friedman and Friedman, 1980). Barriers to entry, for example, restrict employment and raise prices. Yet around a quarter of workers in the US today hold positions restricted by certification or license requirements (Kleiner and Krueger, 2009), up from only 5% in the early 1950s. Certainly licensing does not always unambiguously hurt the consumer; quality of the good generally rises, while search cost may go down for certain consumers, as a minimum level of quality is now assured. I give insight into these questions through the study of one of the earliest licensed occupations: the medical profession.

How did the licensure of the medical profession (as described in section 2.1 below) and the associated restrictions on medical school entry affect consumers? Few would argue that large benefits arose as fraudulent and low-quality schools stopped handing out diplomas; the quality of the average medical school graduate could only have risen during this era. However, the reforms brought with them certain costs, including extensive restrictions making the opening of a new school of medicine a long, arduous process. With the closure of many medical schools at the time, aspiring doctors increasingly attended large city schools.

I document persistent, geographically differentiated costs of the reforms to medical education. Past research has shown that whether through the change in supply of doctors that occurred as standards rose or through the change in availability of schooling, doctors became significantly less likely to practice in rural areas during the reform era (the time in which the occupation became licensed, effectively; Moehling et al., 2020). Using a county panel regression, I show that school location does affect the geographic distribution of doctors throughout the last century (doctors live near schools). Additionally, evidence from analysis at the individual level shows that the urbanization of the school community matters as well; doctors who attend schools in smaller cities are more likely to work in small towns upon graduation.

The results are relevant to policy that seeks to alleviate the rural physician shortage. With an ever-increasing proportion of the US population living in urban areas, it can be argued that rural access to medicine is becoming ever less important. However, almost one in five Americans still live in rural areas, and rural hospitals have closed at increasing rates in recent years. 136 rural hospitals have closed in the US since 2010, including a record 20 rural hospital closures in 2020, in part due to the strain caused by the COVID-19 pandemic. Rural access to healthcare is a clear and pressing issue.

I describe the changes to the profession that occurred in the early 1900s in section 2.1. Section 2.2 documents the state of current research and this paper's contribution. Section 3 describes the data I use: comprehensive physician listings from selected editions of the *American Medical Directory*, supplemented by data from the US Census and a hand-constructed panel of medical school openings and closures in the last century. Section 4 provides the models, discussion of identification, and analysis. Section 5 concludes.

2 Background and Literature

Many prominent changes in the medical education happened in the early 1900s; much of this paper's identifying variation (in terms of medical school openings and closures) comes from this era. Section 2.1 provides relevant historical background information to aid understanding of the nature and effects of the reforms. Section 2.2 reviews the contributions of this paper to the wider literature on the rural physician shortage and the effects of licensure on an occupation.

2.1 Historical Background

The first doctors in America were doctors by necessity, not by choice. Over time, apprenticeship became the traditional method for training doctors. While Europe was reforming its medical training throughout the 1700s and early 1800s, with an increasing focus on the university, the first medical school in North America was not founded until 1765. The College of Philadelphia medical school had high standards, imitating the example of the University of Edinburgh, from which its two founders had graduated. Other medical schools followed.

Surprisingly, the reforms this paper studies were not the first of their kind; states and cities began regulating the practice of medicine beginning in 1760 and continuing up to the Jacksonian era. Jackson's presidency and the associated wave of anti-regulatory sentiment eliminated almost all the progress of the previous 50 years, and any regulations that remained on the books had their teeth removed at the very least.

Although attempts to regulate the profession began soon after Jackson's presidency, these attempts were just that; attemps, nothing more. It was very difficult for schools to voluntarily raise standards in the face of tremendous competition for paying students, and though the AMA (started in 1847) continued to convene through the 19$^{\text{th}}$ century, very little of significance occurred until the end of the century, when schools finally agreed to eliminate the two-year course in medicine. At the same time, states began to pass licensing laws that actually had teeth.

Abraham Flexner came to the scene as an educator, not a physician. Hired by the Carnegie Foundation to study the status of medical education in America, Flexner visited all 155 schools of the time, culminating in the publication in 1910 of his scathing report. Among other things, Flexner recommended that the number of schools be vastly reduced (to 31), that schools associate with hospitals, and that teaching be based in science. By and large, Flexner's recommendations were adopted. Figure 1 shows the number of medical schools in the US throughout the 20$^{\text{th}}$ century, with a sharp dip at the time of Flexner's report.

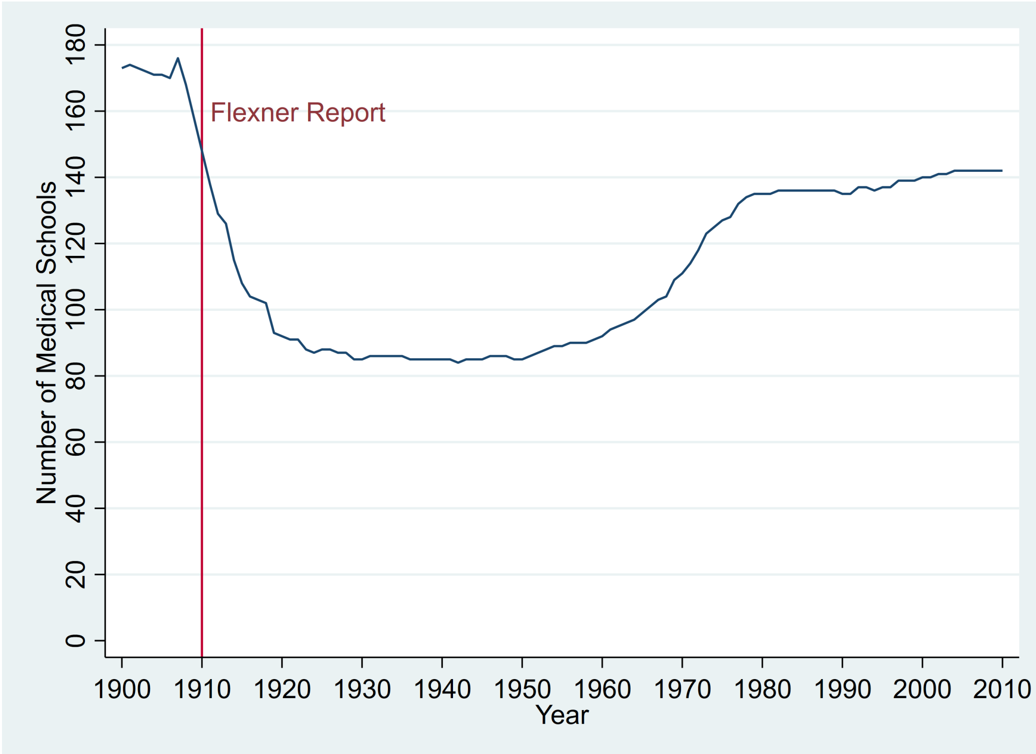

Figure 1: Medical Schools in the United States by Year

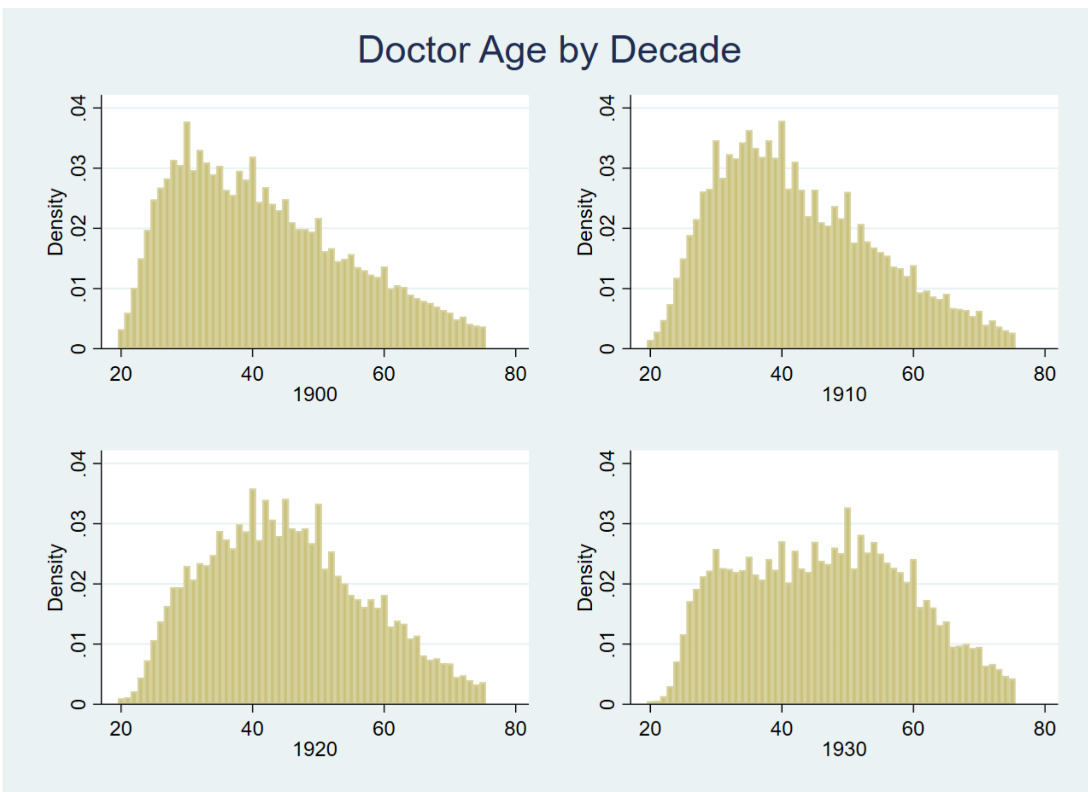

Figure 2: Doctor Age by Decade

Not all schools that shut down were entirely lost; many merged their facilities and resources with schools that survived the reforms. How did the number of medical graduates change during this time? One way to answer this question is to look at the age distribution of doctors over the time period; *ceteris parabus*, the age distribution of doctors should shift to the right if there is a restriction on supply. Figure 2 documents exactly such a change, with the distribution shifting substantially upward in age until 1930, when a small peak around age 30 is once again visible (see also Table 4.

This restriction in supply played a role in the origins of the rural physician shortage, with minorities, women, and individuals from rural areas less likely to attend medical school than before. In addition to this effect, binding restrictions on the organization of new schools took root. As can be seen in Figure 1, almost no new schools were built until five decades after Flexner's report. I argue that these restrictions also affected the rural physician shortage, due to the finding that more doctors live near schools. Counties far away from medical schools in 1920, therefore, were less likely to have doctors work there than counties near schools after the reforms.

2.2 Current Viewpoints and Contribution

I build on Moehling et al.'s (2020) excellent work on the origins of the rural physician shortage. The authors document a 40% decrease in the likelihood of physicians to practice in rural areas from 1905 to 1925. Additionally, they show that graduates of high-quality schools were less likely to practice rurally overall and were also attracted to places with more hospitals. I extend these results through 1990, and additionally find that the urbanization of the location where students attend medical school (as measured by county population) is a significant predictor of rural practice. I also use a national sample for this analysis, further affirming their results based on a small sample of states.

In addition to analysis at the individual level, I study the geographical ramifications of the reforms by examining how areas far from medical schools were hurt (if at all) by lack of medical care. Using county-level panel data spanning the century, I find that, conditional on population in a county, distance to the nearest medical school affects outcomes. Thus, areas far from medical schools in 1920 (after the reforms and four decades before most new schools would be built) were disproportionately hurt by the reforms, while areas close to schools were less affected.

This novel documentation of geographically differentiated costs to the licensure of an occupation provides additional insight into the economics of occupational licensing. Traditionally, economics has stated that benefits of licensing come through quality and costs come through higher prices, leading some transactions to not occur that otherwise would (Kleiner, 2000). Past work has shown that licensing can hurt both low-skilled workers (Federman et al., 2006) and high-skilled workers such as doctors (Kugler and Sauer, 2005). I show that licensing costs disproportionately affect rural populations in a very important labor market, the market for health care.

Finally, my results add to the literature on the rural physician shortage and policies that target it. Hancock et al. (2009) find one student in 22 that claims that a rural school experience was the primary reason for his decision to practice in a rural area, whereas Chan et al. (2005) find that education in rural medicine during medical training was an important factor in students from urban areas choosing to practice rurally. I build on these results by comparing school experiences and controlling for place of residence at a young age in a large sample. Gemelas (2021) uses the Index of Relative Rurality (IRR) to correlate rurality with physician density, and claims that even after significant policies in the Affordable Care Act designed to address the geographic maldistribution of doctors, urgent work is needed still. Finally, the Association of American Medical Colleges (AAMC) reports physician retention rates in the state of residence (of Medical Colleges, n.d.) in recent years, finding rates ranging from 27.2% in Wyoming through 77.7% in California; this indicates residency control could be a policy lever to change the distribution of doctors. My results bring the issue of school location, which has rarely been seen as the most salient factor in the discussion, to the forefront, and find that the doctor distribution responds (albeit in a modest way) to the distribution of medical schools.

3 Data

3.1 American Medical Directories

My primary data source is the *American Medical Directory*. The *Directory* was published in 41 different editions from the first edition in 1906 to the 41st (and final print-and-ink) edition in 2011; it is a comprehensive listing of all (registered) physicians practicing in the United States, compiled by the American Medical Association. I use select editions intended to span this period fairly evenly, with an emphasis on earlier years (1909, 1921, 1927, 1936, 1969, 1990, and 2011). Each edition was scanned and converted to text using ABBYY's optical character recognition (OCR) program. The data include name, location (city, county, state, and sometimes mailing address), medical education (school attended and year of graduation), and medical specialties. More details on the digitization process, as well as a picture from the 1927 directory showing the format of entries, are given in Appendix I.

Table 1 presents summary statistics for the AMD data, with the first three rows of the table demonstrated in Figure 3. The number of doctors identified after digitization is fairly close to the number of total doctors

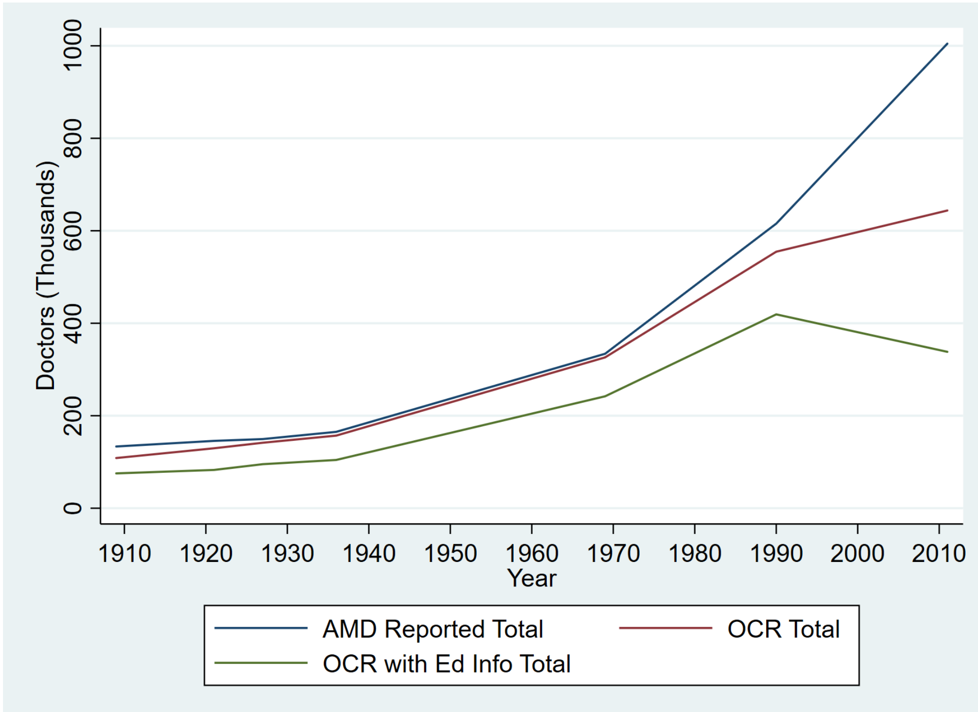

Figure 3: Capture Rates of Digitized Data

in the directories for most years, with a falling-off in 2011. Only a subset of these doctors have valid *domestic* education information. As my analysis only considers the set of US medical schools, I omit foreign-educated doctors from the analysis, so only domestically-educated doctors are counted among those with education information. Very few report a specialty in the early years, but a significant number report in 1969 and later years. The correlation between the doctor counts and total population is very high in the Census data and notably lower in early years of the digitized data. This is due to location misidentification in the digitized data carrying over to subsequent observations, so one misread location can result in many incorrectly placed doctors.

3.1.1 Accuracy of the data

Two primary concerns with the data source are correct identification of city and accuracy of the digitization process. Errors in identification of the city are problematic, as the format of the directories makes location assignments to the last-identified city in the data. Thus, a failure to correctly identify the city of New York would wrongly assign all New York City doctors to New Windsor (the previous city alphabetically) instead. To alleviate such misclassification, I will manually check the 200 largest cities in the US (as of 1950) in each directory to ensure correct identification in the most populous locations.

In order to check the accuracy of the digitization process, I compare my 1909 data to a hand-entered version of the same data, graciously loaned me by Gregory Niemesh and co-authors (Table 2; Moehling et al., 2020). The Niemesh data includes 11 states. One weakness of my data is failure to capture all observations (the digitized data have only 33,733 observations, whereas the hand-entered data have 45,298). While the accuracy of numeric variables is encouraging (from 86% to 97%), the capture rates for most of these variables are somewhat low. Additionally, accuracy of string variables (city and county) is fairly low prior to manual correction of cities. Since my analysis works at the county level, accuracy of cities is irrelevant to my results.

How much are data errors due to the 1909 sample? To answer this question, I compare data from the latest sample Niemesh et al. shared. This sample is from 1927 and includes the states California, Mississippi, New York, and North Carolina. Omitting unmatchable observations from Niemesh's data (observations identical in name, birth year, and location), the digitized data sample performs much better than its 1909 counterpart, with a 92.5% capture rate overall, and near-perfect accuracy for numeric variables. Notably, the county field improves about 10% from its 1909 version.

The data that are successfully digitized can be viewed as a subsample of the entire data set; it is natural to ask whether the sample is random or not. Thanks to the Niemesh data, I can provide evidence on this front (Table 3). For the 1909 data, regression output indicates that age is not strongly correlated with matching outcomes, while matched observations do appear correlated with city population. Interestingly, name length is not strongly related to match outcomes, perhaps because the matching process accounts for small errors in reading names. For the 1927 data, none of the variables are significant at the $\alpha = 0.05$ level in predicting occurrence of a match.

3.2 United States Census

Data from the Census of the United States corroborate and supplement the AMD data. These Census data include full-count records (including name, city, county, and state) for the 1940 Census and earlier, and publicly-available random samples of Census data for later years. Table 4 provides a comparison of the number and age of doctors in the early Census and AMD data. Interestingly, the Census included more doctors than the medical directories in the early and late years of the sample (1910 and 1940), while the directory had more doctors listed in 1920 and 1930. Both data sources show an increase in the mean age of doctors from 1910 through 1930, with age falling slightly in 1940.

Table 5 provides more detailed summary statistics on doctors throughout the 20$^{\text{th}}$ century. Interesting trends include the increasing number of doctors relative to increases in total population, as well as the steadily high share of doctors practicing in urban areas. The share of doctors that are females steadily increases throughout the century, while the share of black doctors rises moderately to 5% in 2018.

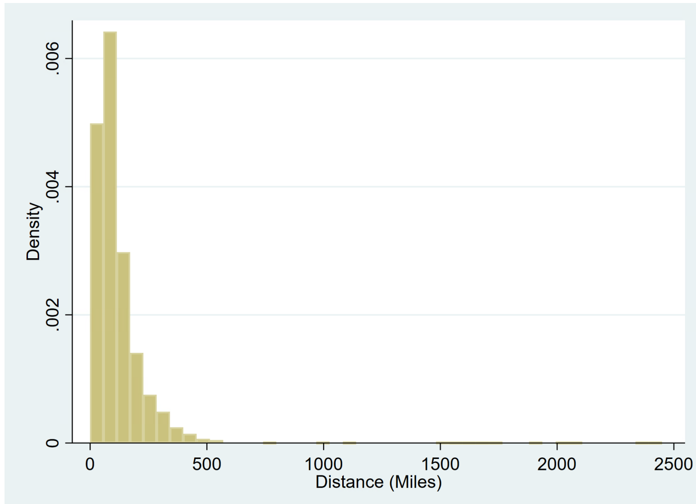

Figure 4: Distance from County to Nearest Medical School, All US

3.3 Matching Process

Matching the AMD and Census data is primarily done using last name, first name, birth year, and location. The multi-step process first sets very stringent requirements for matches, and any matches are removed from the pool of unmatched observations. Subsequent steps gradually allow for more imprecise matching, using the Levenshtein string distance (divided by the string length) as a measure of string-to-string matching, and allowing for one or two years of difference in birth year. Appendix II lays out the specific steps followed in matching similar-year data sets.

A similar process is used for different-year matching, but I retain only male physicians in the Census sample. For example, when matching 1940 Census records to 1990 *Directory* listings to see where doctors practicing in 1990 lived in 1940, I only keep males in the age range of interest (say, 0-10 years old) in the Census data. This ensures that last name is unchanged across time periods, but also implies that results are not representative of the doctor population as a whole; females have become an increasingly large share of the doctor work force throughout the last century.

3.4 Medical School Panel Data

Information on medical school openings, closures, and quality is primarily derived from introductory material of the *Directory*. This source is supplemented where necessary by historical material available on schools' websites. My panel also includes latitude and longitude of each city in order to calculate distances. Since my analysis is at the county level, I calculate population-weighted centroids for each county (in latitude and longitude), and then find the nearest medical school to this location in each year. Centroids are created using

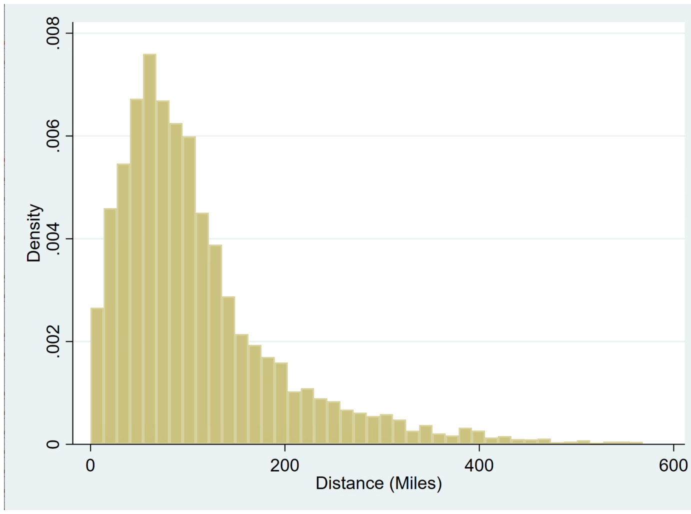

Figure 5: Distance from County to Nearest Medical School, Continental US

current city populations, accessed at https://simplemaps.com/data/us-cities on 5 January 2021. Figures 4 and 5 show the distances across all decades in my panel for all counties and the continental US, respectively.

4 Empirical Analysis

The empirical analysis takes a two-pronged approach driven by the data available. The first branch of analysis provides suggestive evidence on individual-level decisions to practice in rural areas, employing matched AMD-Census data to account for where individuals lived at a young age as well as where they attended medical school. These individual-level analyses provide important insight as to the type of individual that chooses to practice in rural areas.

The second branch of analysis identifies the causal effect, in number of doctors, on an area of a change in distance to the nearest medical school (via an opening or closure of a school). This branch of analysis shows how the geographic distribution of doctors corresponds to the geography of medical schools. It provides evidence as to the power of medical school openings and locations as a policy lever to alleviate the rural physician shortage.

4.1 Models, Identification, and Causality

4.1.1 Individual Analysis

The first branch of analysis estimates a proxy for the model

$$rural_i = \beta_0 + \beta_1 urban\ birth_i + \beta_2 log\ sch\ cty\ pop_i + \beta_3 age_i + \beta_4 \Sigma_{k=1}^{K} spec_{ki} + \beta_5 \Sigma_{k=1}^{K} sample_{ki} + \epsilon_i, \quad (1)$$

where $rural_i$ is a dummy for rural-practicing doctors, $urban\ birth_i$ is a dummy for birthplace in an urban area, $log\ sch\ cty\ pop_i$ is the log of the county population in the county and decade that the doctor attended school[1], age_i is the doctor's age, $spec_{ki}$ is a vector of dummies identifying various specialties, and $sample_i$ holds sample fixed effects.

As has been noted in prior literature, birthplace is an important factor in doctors' work locations, with medical students from rural areas more likely to practice in such areas. I augment these findings by including a measure of the rurality of the place and time when students attended school: the population of the county containing the school. This variable reflects both opportunities for rural training during the education years as well as any other effects that could lead to a student staying in the area of the school after graduation (such as marrying a local). Controls for age allow for differences for new and older doctors, while specialty dummies account for the varied demand for certain medical services by area (rural areas have little to no demand for plastic surgery, e.g.).

The estimated proxy model is given by

$$low\ pop\ cty_i = \beta_0 + \beta_1 urban\ res_i\ + \beta_2 log\ sch\ cty\ pop_i + \beta_3 age_i + \beta_4 \Sigma_{k=1}^{K} spec_{ki} + \beta_5 \Sigma_{k=1}^{K} sample_{ki} + \epsilon_i \quad (2)$$

There are two changes from the original model. First, the measure of rurality is given at the county level, rather than the city level. Counties with populations less than or equal to 50,000 are taken to be rural counties, and the remainder are taken as urban. Alternative specifications vary the outcome variable, as detailed in the results section. Second, urban birthplace is replaced by residence in an urban area between the ages of 0 and 10.

The model is estimated by matching doctors in the 1969 and 1990 cohorts of physicians to Census records from 5 decades previous. I use a simple, but restrictive, approach: eliminate all doctors with duplicate names, as location cannot be used to match, and eliminate doctors outside of a reasonable age range (which accounts for doctors being licensed between age 20 and age 35) in order to keep doctors about ages 50-60. On the Census side, I keep only boys ages 0-10, again eliminating duplicates in first and last name.

Table 6 provides estimates for the base model, as well as variations on the outcome variable. The sample is very small relative to the databases I draw from, due to the restrictive matching process. The outcome variable in the first column is whether or not a doctor practices in a county with population under 5,000; only 31 of the 15,025 doctors in the sample practiced in such a county, making estimates fairly noisy. Columns 2 and 3 increment the population cap to 10,000 and 20,000 people, respectively. Column 4 is the preferred specification for county outcome variables, as about 10% of doctors are shown to practice in

[1]No truly rural medical school exists; Vermillion, South Dakota, home to the University of South Dakota's Sanford School of Medicine, has a population of over 10,000, well over the 2,500-person limit set by the Census.

counties with population under 50,000, a similar proportion to the share of doctors that practice rurally nationwide (Gudbranson et al., 2017).

The coefficient on urban residence takes the expected sign and a fairly significant magnitude, with urban students 5.7% less likely to be practicing in rural areas between the ages of 50 and 60 in the preferred specification. Interestingly, medical school characteristics, as measured by the population of the county where the school is resident, has an effect beyond that of birthplace. In the preferred specification, a student who attends a school in a county of 100,000 people is about 1% more likely to live in a rural area than a student who attends a school in a county of 200,000 people. Age is not significant in the preferred specification, but a control for the 1969 cohort shows that these individuals were significantly more likely to be practicing in a rural area than were the 1990 cohort of doctors. Finally, specialties like general practice and family practice are very strong predictors of rural practice, with a 19.5% increase in likelihood of working rurally in the preferred specification.

Columns 5 through 7 use an alternative city-based outcome variable. Using the city-county-state locations from the directory listings, I count all cities and towns with five or fewer doctors in column 5. Columns 6 and 7 raise this cap to 10 and 20, respectively. The “correct” definition of rural lies somewhere in between 10- and 20-doctor locations. While the magnitude of the effects of both urban residence and school county population are lower, the significance and signs remain.

How much do the effects shown in Table 6 reflect causal relationships rather than correlations? The use of birthplace as a control certainly helps to alleviate concerns about innate preferences for rural areas as an omitted variable in the regression. Some portion of these preferences likely come from living in a rural area at a young age, which this model accounts for. Selection at the admissions step comes into play as well; many schools reserve seats for students from nearby areas, who are more likely to work in those areas after graduation (but again, controlling for rural residence at a young age should alleviate concerns here). I take the results to show that in some way, rural school experiences matter for outcomes, above and beyond the selection effects captured by urban residence at a young age.

4.1.2 County Analysis

The second branch of analysis estimates the model

$$ln\ doc_{ct} = \beta_0 + \beta_1 ln\ county\ pop_{ct} + \beta_2 ln\ dist\ med\ school_{ct} + \alpha_c + \gamma_t + \mu_{ct}, \quad (3)$$

where $ln\ doc_{ct}$ is the log number of doctors in a county-year, $ln\ county\ pop_{ct}$ is the log county population, $ln\ dist\ med\ school_{ct}$ is the log distance from the nearest medical school, α_{ct} are county fixed effects, and γ_t

are year fixed effects.

Equation 3 is consistent with medical schools having "aura" effects on their surrounding areas. This geographic effect is important inasmuch as schools admit local students preferentially (and these locals are more likely to practice locally), residencies are filled in local areas, word-of-mouth is an important part of joining a medical practice or hospital, medical students establish ties in the area by marriage or other means, and so on. It can also reflect other positive externalities that doctors may enjoy, such as an involved academic community or opportunities for research. Geography may be less important as means of communication improve, cost of search for residencies is lowered (for example, by the introduction of AMA's computerized FREIDA system to match students to residencies in the late 1980s (Rowley 1988)), and schools admit more non-local students.

One threat to identification of β_2 is endogeneity of the outcome variable. There are substantial costs to opening a medical school in the post-reforms era (Texas Higher Education Coordinating Board 2008), and these costs include salaries of doctors who must move to the area if they are not there already. It may be more attractive to open schools in areas with a good supply of physicians already in the hopes of finding teachers and staff more easily. Potential sites would certainly invest significant effort in analyzing demand for medical education (related to demand for health care) in the area.

While doctor counts can influence medical school openings and closures, it is difficult to imagine them being heavily influential. As might be inferred from Figure 1, opening medical schools became significantly more difficult in the post-Flexner era. Not only does opening a school require significant input of capital and medical skill, it also requires AMA approval throughout the multi-step process. Opening a medical school is an endeavor that takes up to 10 years and is not undertaken lightly, in contrast to the ease with which schools could be organized in pre-Flexner times. Over such a time period, there is no guarantee that demand for medical care will remain at its current level or not be filled by the time the first class graduates (four years after the school finally receives approval).

One omitted variable that could bias estimates of β_2 upward is demand for medical services in an area. Higher demand could lead to a new school, as well as increased doctors. The health care setting makes population a desirable control for demand, inasmuch as medical care is assumed to be a necessity good and affordable. It is an imperfect control - doctor urbanization rates might indicate higher demand for their services in urban areas - but nevertheless helps.

Finally, county wage levels are omitted from the regression. Higher wages in an area may entice both schools and doctors. I control for any such time-invariant differences across counties, as well as other amenities like weather, with the inclusion of county fixed effects. Year fixed effects play a similar role in controlling for time trends that could be correlated with trends in the regression variables.

Table 7 displays estimates for Equation 3. The first column uses counties from all states in the US, including Alaska and Hawaii. The 95% confidence interval on the coefficient for log county population excludes 1, showing that doctors overproportionately practice in more populated areas. The coefficient on log distance to the nearest medical school is negative and significant, with a moderately large magnitude. Column 2 shows that results are nearly unchanged when using only the continental US, while column 3 shows that identification does not hinge on the reform years alone.

The results indicate a modest relationship between the geography of medical schools and the geography of physicians. For example, if the distance to the nearest medical school is halved in an area, doctor numbers in that area would increase by about 5%. Conversely, a closure doubling the distance to the nearest school would decrease physician counts by about 5%.

5 Conclusion

Using data from the *American Medical Directory* and the Census, I find that the geography of medical schools has moderate implications for the geographic distribution of doctors. Halving the distance to the nearest medical school in an area is associated with a 5% increase in the number of doctors practicing in that area. Additional evidence from linked records suggests that not only place of origin, but also medical school experience affects doctors' likelihood to practice rurally. Both medical school admissions and medical school openings and closures appear to be viable policy levers to address the rural physician shortage.

6 Tables

	Year						
VARIABLES	1909	1921	1927	1936	1969	1990	2011
Number of Doctors (AMD Total)	133,487	145,608	149,521	165,163	334,028	615,421	1,004,635
Number of Doctors Identified (first, last name)	108,489	129,656	141,626	157,011	326,191	554,761	643,830
Number of Identified Doctors with Medical Education Info	75,342	82,768	95,272	104,349	242,039	419,236	338,229
Number of Identified Doctors Reporting Specialty	2,312	2,296	2,592	3,325	208,041	334,168	137,064
Correlation, Doctor Populations and Total Populations	0.70	0.75	0.56	0.58	0.92	0.92	0.75
Correlation, Doctor Populations and Total Populations (Census)	0.97	0.97	0.96	0.94	0.91	0.82	0.88

Notes: the 1969 doctor total is from 1970. Census correlations from 1969 on include only identified counties and publicly-available random sample data. Only doctors that attended domestic medical schools count towards the identified doctors with medical school info.

Table 1: Summary Statistics, AMD Data

VARIABLE	Capture Rate	Accuracy of Captured Data
1909 Directory		
N=45,298	74.5%	-
City	-	46.2%
City Population	-	43.2%
County	-	60.1%
Birth Year	84.5%	85.5%
Graduation Year	47.2%	92.9%
Licensure Year	25.5%	90.6%
Membership in AMA	74.5%	96.5%
1927 Directory		
N = 30,667	92.5%	-
City	-	45.3%
County	-	69.9%
Birth Year	92.1%	98.6%
Graduation Year	70.2%	98.1%
Membership in AMA	92.5%	99.4%

Notes: The 1909 sample uses 11 states, while the 1927 uses only four states. All capture rates use the total number of doctors in the states for which these variables are not missing in the Niemesh data. Accuracy denotes perfect matches for numeric variables and close matches for string variables.

Table 2: Accuracy Check, AMD Data

	YEAR=1909			YEAR=1927		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Matched	Matched	Matched	Matched	Matched	Matched
Age	1.86e-04			-2.44e-04		
	(1.91e-04)			(1.30e-04)		
Log County Population		-0.0115***			2.58e-04	
		(7.58e-04)			(5.30e-04)	
Name Length			1.41e-03			-5.19e-04
			(8.58e-04)			(7.48e-04)
Constant	0.837***	0.906***	0.729***	0.918***	0.904***	0.913***
	(8.67e-03)	(7.35e-03)	(9.80e-03)	(6.22e-03)	(6.44e-03)	(9.30e-03)
Observations	24,981	30,623	45,298	28,779	28,578	31,259

Standard errors in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Variable Dependency on Match Outcome

YEAR	VARIABLE	Census	AMD Records	AMD Digitized
1900	N	119,061	-	-
	Mean Age	42.3	-	-
1910	N	154,865	133,487	108,489
	Mean Age	42.9	-	43.9
1920	N	116,889	145,608	129,656
	Mean Age	45.5	-	47.2
1930	N	128,825	149,521	141,626
	Mean Age	47.0	-	48.5
1940	N	189,601	165,163	157,011
	Mean Age	45.4	-	48.4

Notes: Only doctors from ages 17-99 are included. AMD records do not match Census year perfectly (1909 for 1910 Census; 1921 for the 1920 Census; 1927 for the 1930 Census; and 1936 for the 1940 Census). Mean age is calculated only for observations with non-missing birth year in the digitized data.

Table 4: Number and Age of Doctors by Year and Data Source

	Year											
VARIABLES	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2018
Number of Doctors	1.6×10^5	1.2×10^5	1.3×10^5	1.9×10^5	2.0×10^5	2.4×10^5	3.1×10^5	4.6×10^5	6.3×10^5	7.9×10^5	9.0×10^5	1.0×10^6
Share Female	0.049	0.043	0.042	0.064	0.059	0.068	0.10	0.14	0.21	0.27	0.33	0.36
Share Black	0.012	0.016	0.026	0.022	0.021	0.020	0.025	0.031	0.035	0.047	0.050	0.051
Share Urban	0.64	0.69	0.76	0.76	-	0.87	0.89	0.87	0.87			
Population												
Share Urban	0.46	0.51			-	0.70	0.74	0.74	0.76			

Notes: Urban is defined according to the Census definition.

Table 5: Detailed Summary Statistics, Census Data

	(1) Pop ≤ 5,000	(2) Pop ≤ 10,000	(3) Pop ≤ 20,000	(4) Pop ≤ 50,000	(5) Docs ≤5	(6) Docs ≤10	(7) Docs ≤20
Urban Residence under Age 10	-.0013	-.0073***	-.0219***	-.0568***	-.0246***	-.0341***	-.0438***
	(8.8e-04)	(.002)	(.0035)	(.0054)	(.004)	(.0049)	(.0057)
Log School County Pop.	-8.3e-04*	-.004***	-.0115***	-.0296***	-.0036*	-.0074***	-.0089***
	(3.9e-04)	(7.7e-04)	(.0013)	(.0021)	(.0015)	(.0018)	(.0021)
Age	6.5e-05	-5.4e-04	-.0011*	-7.3e-04	-3.6e-04	-.0014	-9.1e-04
	(1.2e-04)	(2.8e-04)	(4.9e-04)	(7.8e-04)	(5.8e-04)	(7.1e-04)	(8.5e-04)
1969 Cohort	-2.5e-04	-.0014	.0048	.0249***	.0119***	.0192***	.0377***
	(7.6e-04)	(.0017)	(.003)	(.0047)	(.0035)	(.0043)	(.0052)
General Practitioner	.0089***	.0417***	.105***	.1947***	.1673***	.2404***	.2889***
	(.002)	(.0045)	(.0077)	(.0116)	(.0098)	(.0114)	(.0132)
Constant	.0092	.0858***	.2327***	.5196***	.1057**	.2233***	.2624***
	(.0074)	(.0181)	(.0298)	(.0465)	(.0339)	(.0412)	(.0494)
Observations	15,025	15,025	15,025	15,025	15,025	15,025	15,025

Notes: Standard errors in parentheses (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Data are a pooled cross-section of doctors in 1970 and 1990 that matched to males aged 0-10 from the Census from 50 years earlier. Outcome variable in first four columns reflects county population. Outcome variable in last three columns reflects total number of doctors in a city or town.

Table 6: Individual-Level Analysis

	(1) Log Doctors All Counties	(2) Log Doctors Continental US	(3) Log Doctors Post-Reform Era
Log County Pop	1.17**	1.17**	1.10**
	(0.012)	(0.012)	(0.023)
Log Distance to	-0.090**	-0.087**	-0.11**
Nearest School	(0.017)	(0.017)	(0.037)
N	19,963	19,930	10,984

Specification (3) includes 1940 and later years.
Robust standard errors in parentheses
** $p<0.05$, * $p<0.10$

Table 7: County-Level Regression, Basic Specification

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7 Appendices

7.1 Appendix I: Digitization of the *American Medical Directory*

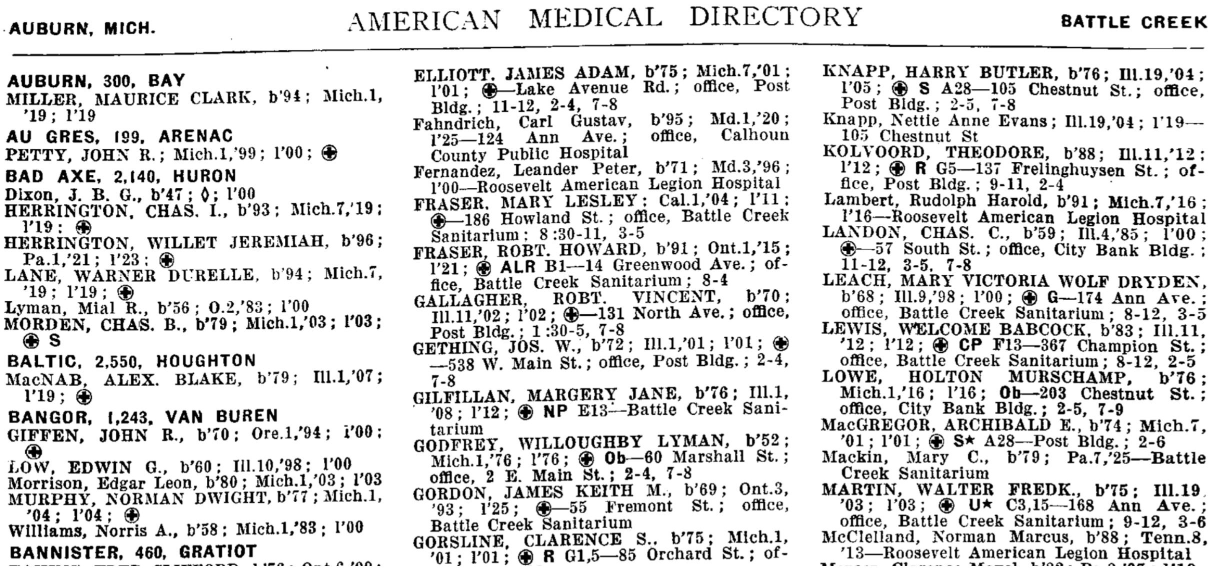
Figure 6 shows a page taken from the 1927 *American Medical Directory.* Data are given in columns, with an index at the top of each page showing the cities covered by that page. Last names are given, followed by first names and additional given names. Other information, by order of its appearance in entries, includes

- Membership in the American Medical Association: members have names listed in all-capital letters
- Birth year
- Medical education (school and year of graduation)
- Fellowship in the AMA ($\bigoplus$ symbol)
- Specialties claimed (bold font)
- Address and hours

Several of the challenges with digitization are reflected in the page shown. The column format of the data can be troublesome; failure to recognize columns can, in some cases, lead to omissions of all entries in that column in the digitized data. ABBYY handles column identification, and does a good job in most cases.

In addition to the columns present in the data, most entries span multiple lines. Without a way to identify first lines of entries (indentation and spacing are not very salient post-digitization), all identification of entry beginnings and endings must be completed after the digitization process. Additionally, location entries (which note the city, city population, and county; see the line for "BAD AXE" in Fig 6) must be distinguished from normal entries in the directory. Indeed, location entries are the single most important lines to identify, as they apply to many listings rather than just one.

Finally, some characters are quite hard to tell apart (compare the letters "i" and "l" and the number "1" in the entry for Alex MacNab under Baltic, MI, e.g.). Blemishes in the data (see the "l" that looks like an "i" in John Giffen's Bangor, MI entry, e.g.) only add to the errors. However, common mistakes can be accounted for when cleaning the digitized text (any string of three of "I," "l," and "1" in a row can be correctly interpreted as "Ill," an abbreviation for Illinois).


AUBURN, MICH. AMERICAN MEDICAL DIRECTORY BATTLE CREEK

AUBURN, 300, BAY
MILLER, MAURICE CLARK, b'94; Mich.1, '19; l'19
AU GRES, 199, ARENAC
PETTY, JOHN R.; Mich.1,'99; l'00; ⊕
BAD AXE, 2,140, HURON
Dixon, J. B. G., b'47; ◊; l'00
HERRINGTON, CHAS. I., b'93; Mich.7,'19; l'19: ⊕
HERRINGTON, WILLET JEREMIAH, b'96; Pa.1,'21; l'23; ⊕
LANE, WARNER DURELLE, b'94; Mich.7, '19; l'19; ⊕
Lyman, Mial R., b'56; O.2,'83; l'00
MORDEN, CHAS. B., b'79; Mich.1,'03; l'03; ⊕ S
BALTIC, 2,550, HOUGHTON
MacNAB, ALEX. BLAKE, b'79; Ill.1,'07; l'19; ⊕
BANGOR, 1,243, VAN BUREN
GIFFEN, JOHN R., b'70; Ore.1,'94; l'00; ⊕
LOW, EDWIN G., b'60; Ill.10,'98; l'00
Morrison, Edgar Leon, b'80; Mich.1,'03; l'03
MURPHY, NORMAN DWIGHT, b'77; Mich.1, '04; l'04; ⊕
Williams, Norris A., b'58; Mich.1,'83; l'00
BANNISTER, 460, GRATIOT

ELLIOTT, JAMES ADAM, b'75; Mich.7,'01; l'01; ⊕—Lake Avenue Rd.; office, Post Bldg.; 11-12, 2-4, 7-8
Fahndrich, Carl Gustav, b'95; Md.1,'20; l'25—124 Ann Ave.; office, Calhoun County Public Hospital
Fernandez, Leander Peter, b'71; Md.3,'96; l'00—Roosevelt American Legion Hospital
FRASER, MARY LESLEY; Cal.1,'04; l'11; ⊕—186 Howland St.; office, Battle Creek Sanitarium; 8:30-11, 3-5
FRASER, ROBT. HOWARD, b'91; Ont.1,'15; l'21; ⊕ ALR B1—14 Greenwood Ave.; office, Battle Creek Sanitarium; 8-4
GALLAGHER, ROBT. VINCENT, b'70; Ill.11,'02; l'02; ⊕—131 North Ave.; office, Post Bldg.; 1:30-5, 7-8
GETHING, JOS. W., b'72; Ill.1,'01; l'01; ⊕—538 W. Main St.; office, Post Bldg.; 2-4, 7-8
GILFILLAN, MARGERY JANE, b'76; Ill.1, '08; l'12; ⊕ NP E13—Battle Creek Sanitarium
GODFREY, WILLOUGHBY LYMAN, b'52; Mich.1,'76; l'76; ⊕ Ob—60 Marshall St.; office, 2 E. Main St.; 2-4, 7-8
GORDON, JAMES KEITH M., b'69; Ont.3, '93; l'25; ⊕—55 Fremont St.; office, Battle Creek Sanitarium
GORSLINE, CLARENCE S., b'75; Mich.1, '01; l'01; ⊕ R G1,5—85 Orchard St.; of-

KNAPP, HARRY BUTLER, b'76; Ill.19,'04; l'05; ⊕ S A28—105 Chestnut St.; office, Post Bldg.; 2-5, 7-8
Knapp, Nettie Anne Evans; Ill.19,'04; l'19—105 Chestnut St
KOLVOORD, THEODORE, b'88; Ill.11,'12; l'12; ⊕ R G5—137 Frelinghuysen St.; office, Post Bldg.; 9-11, 2-4
Lambert, Rudolph Harold, b'91; Mich.7,'16; l'16—Roosevelt American Legion Hospital
LANDON, CHAS. C., b'59; Ill.4,'85; l'00; ⊕—57 South St.; office, City Bank Bldg.; 11-12, 3-5, 7-8
LEACH, MARY VICTORIA WOLF DRYDEN, b'68; Ill.9,'98; l'00; ⊕ G—174 Ann Ave.; office, Battle Creek Sanitarium; 8-12, 3-5
LEWIS, WELCOME BABCOCK, b'83; Ill.11, '12; l'12; ⊕ CP F13—367 Champion St.; office, Battle Creek Sanitarium; 8-12, 2-5
LOWE, HOLTON MURSCHAMP, b'76; Mich.1,'16; l'16; Ob—203 Chestnut St.; office, City Bank Bldg.; 2-5, 7-9
MacGREGOR, ARCHIBALD E., b'74; Mich.7, '01; l'01; ⊕ S★ A28—Post Bldg.; 2-6
Mackin, Mary C., b'79; Pa.7,'25—Battle Creek Sanitarium
MARTIN, WALTER FREDK., b'75; Ill.19, '03; l'03; ⊕ U★ C3,15—168 Ann Ave.; office, Battle Creek Sanitarium; 9-12, 3-6
McClelland, Norman Marcus, b'88; Tenn.8, '13—Roosevelt American Legion Hospital

Figure 6: Sample from 1927 *American Medical Directory*

7.2 Appendix II: Matching Details

The matching problem is fairly simple; the AMD data has first and last names, as well as birth year and location (city, county, and state), while the Census data has first and last name, age, county, state, and sometimes city. Age can't generally be matched perfectly, as only the birth year is known in the AMD data. Steps are detailed below. Note that these steps apply only to similar-year matching, so location should be identical for most doctors in the two data sets.

1. A clear first step is to take all unique first-last name combinations from each data set, and take any perfect matches on name and age as correct. Notably, location can be used to provide suggestive evidence on the quality of the matches when matching observations from the same or nearby years.

2. Using the remaining observations from the Step 1, "tremble" the age variable by two years in either direction. This yields many more matches by accounting for the fact that (1) age is estimated based on birth year for one data set, and (2) age was often reported incorrectly/not tracked as closely in the early 1900s and before.

3. Replace the first name with the first initial. Match unique observations on first initial, last name, and age.

4. Repeat (3), trembling age by two years in either direction.

5. Take all names in both data sets that have not yet matched and are unique. Sort by state and last name, then search for fuzzy matches within X number of lines (I use 20) above or below each observation.

Quality of the match is measured by a weighted sum of penalty variables: variables penalizing the Levenshtein distance between the names (first and last, with last weighted more heavily) and a variable penalizing the distance in age between the two observations. Matches must meet a certain threshold for the weighted penalty variable and be unique to each observation in order to be counted.

6. Repeat (1), but replace the age variable with the state variable.

7. Repeat (2), replacing the age variable with the state variable.

8. Repeat (5), replacing age with state.

While some match rates seem low, this is fairly common for historical data. Additionally, many doctors that appear in one data source simply do not show up in the other. This can easily be seen by the large discrepancies in number of total doctors listed in the Census and the *Directory*, with the Census listing 20,000-25,000 more doctors in 1910 and 1940, while the *Directory* lists about 30,000 more doctors than the Census in both 1920 and 1930 (Table 4).

7.3 Appendix III: Historical Details, Flexner Era

7.3.1 Early Colonization

One of the first acts regulating the medical profession on the American continent was passed by the then-Province of Massachusetts in 1649, and stated in part, that "Chirurgeons, Midwives, [and] Physitians" were not to practice "without the advice and consent of such as are skillful in the same Art . . . or at least some of the wisest and gravest then present" (Packard 1931, ctd. in Shyrock 1967). This act and others like it anticipated difficulties which were to confront American medicine over the next three centuries. How could one protect both the public and the professionals concerned?

There were no medical institutions in the United States for nearly 150 years after the first settlements appeared. Women as well as men who had the ability to inspire confidence served as general practitioners for their neighbors. Gradually apprenticeship became the traditional method of training for doctors, and women fell out of the picture. Mixed reviews of early physicians indicate both that some were well-trusted by those they ministered to, while others were untrained quacks with few qualifying characteristics. Meanwhile, Europe in the late 1700s and early 1800s was gradually reforming its medical practices, with universities exercising increasing authority over medical education and the practice of medicine.

7.3.2 First Schools

In 1765, the first medical school on the American continent was formed in Philadelphia, PA by two young American graduates of Edinburgh. The College of Philadelphia medical school had high standards derived from the Edinburgh example, including preparation in Latin, Greek, mathematics, and philosophy. Medical schools at King's College in New York City and Harvard College in Boston were soon to follow.

Around the same time, states and cities began passing laws regulating the practice of medicine. The first such law, passed in New York City in 1760, required that every student undergo an examination by members of His Majesty's Council as well as other qualified physicians. New Jersey passed a similar law in 1772, and other states followed suit. By the 1830s, all but three states had passed such laws, which in most cases established state medical societies and gave them authority to interview applicants for licenses to practice medicine.

While medical schools in America had a promising start, things took a turn for the worse in the first half of the 19th century. The European model was not perfectly suited for America, with its frontiers and high costs of travel. Proprietary colleges began to pop up across the country. Such colleges were typically founded by a small handful of physicians, often in small villages that had no access to clinical facilities or hospitals. Catering to frontier students, for whom attendance bore a very real opportunity cost, these schools lowered standards across the board, from preliminary education requirements to attendance requirements - yet they still granted degrees. Over this same time period, in fact, bachelor's degrees were replaced by doctorates, even while candidates completed less work than previous bachelor's degree recipients had! The reduction in standards occurred at all medical schools to some extent, as returns to actual education received were relatively small; competition for students and their tuition fees was fierce.

As medical schools lowered standards, so too did the reputation and status of the physician fall. Bloodletting and calomel (mercurous chloride) were widely prescribed, often to grievous effect. Imposters further weakened medicine's reputation. To add insult to injury, the Jacksonian democracy of the 1820s to the 1850s pushed back strongly against the laws providing for state medical societies and licensure of physicians, arguing that the common man was able enough to choose his own physician. The rise of a branch of alternative medicine, based on herbs and botany (Thomsonian medicine), further weakened scientific-based medicine's hold on medical practice. Jacksonian democracy and the Thomsonians ultimately proved triumphant in repealing almost all the medical license laws; by 1849, only three states still regulated the practice of medicine.

7.3.3 Attempts at Regulation

Naturally, properly-trained physicians did not take all this punishment lying down. In 1846, 119 physicians from sixteen states (representing about one-third of medical colleges at the time) came together in the first national medical convention. The convention resolved that a set of uniform standards for medical education and for preliminary requirements to medical education be established, and committees were assigned to construct appropriate standards over the following year.

In 1847, what would become known as the American Medical Association (AMA) reconvened. The association adopted ten recommendations by the committee on medical education standards. These included each medical college having seven professors to provide instruction in seven different branches of medicine; requiring evidence of a completed apprenticeship; and that colleges require hospital practice; and extending the length of terms to six months (from four), among others. The association similarly adopted the proposal addressing entrants to medical schools, which suggested that preceptors vouch for incoming medical students publicly (presumably, preceptors would not vouch for incompetent students lest they embarrass the preceptor later on).

Sadly, the AMA's recommendations were all bark and no bite. Even though cognizant of the problems in medical education, colleges had little incentive to do better when anyone could practice medicine without attending college at all and competition for students was fierce. Two schools that did make changes to conform to the AMA's recommended standards were harshly punished for it; the University of Pennsylvania's six-month courses led enrollment at its competitor, the Jefferson Medical College, to far outstrip it within a matter of years. Real reforms would wait until after the Civil War when medical education could once again capture physicians' undivided attention.

The AMA continued to meet throughout the late 1800s, but did not yet enjoy the power to make its adoptions binding. Representation was low, with only about one-third of schools sending delegates. To make matters worse, these delegates' decisions were not even binding on their own schools; they were powerless representatives. However, deliberation continued, with general consensus that perhaps the best type of reforms would be state-driven. Under state boards and certification standards, the AMA reasoned, schools could no longer fail to provide quality education, as graduates would fail to obtain licenses to practice. Indeed, some states began to pass medical license laws during this time period. While a step in the right direction, these laws were fairly restricted in their reach; most did not penalize practicing without a license, as well as allowing graduates of any medical school to practice without examination.

Inferior medical schools continued to proliferate with the increased expansion and settlement in the west; the number of colleges rose from 90 in 1880, to 116 in 1890, to 151 by 1900! Increased competition for students lowered the attractiveness and feasibility of reforms. Several schools known as "diploma mills" forfeited almost all pretence of giving education when they discovered many thousands of people willing to pay for a degree. Nor was their deceit identifiable by naming the university alone; the operator of the Trinity University of Medicine of Surgery in Vermont also sold diplomas from the University of Cincinnati, Montreal Medical College, New York State Medical College, Trenton Medical College, and the University of New Hampshire. The effect of these mills was disastrous (for one example, almost 10% of practitioners in Illinois from 1877 to 1879 had purchased their diplomas).

7.3.4 Signs of Change

This is not to say that nothing good happened in the late 1800s. Several bright stars began to enforce higher standards of education, starting with the Chicago Medical College and continuing at Harvard, the University of Pennsylvania, Syracuse, and Michigan. In 1877, Illinois established a state board of health and gave it authority to enforce the medical practice law. Physicians could receive a license from the board by having practiced for more than 10 years in Illinois or by presenting an acceptable diploma; otherwise, they must pass the board's examination to receive a license. An 1878 report indicates that 1,400 practitioners (almost one-fourth) left Illinois upon passage of the law. Less than half of the 371 doctors who were examined passed and received a license that way. Illinois further sought out and shut down diploma mills and established minimum standards (albeit somewhat low standards) for colleges to meet.

Illinois was a harbinger of impetus for state-level reforms that began in the 1870s. A renewed interest in state licensing boards arose for the first time since the first set of such laws had been repealed almost half a century earlier. New York passed a hallmark law creating a licensing board with bite that failed (encouragingly) about one-third of doctors in 1894. Just a year earlier, the Johns Hopkins Medical School was created. As a school with a sufficient endowment to preclude any concern on professors' part about student fees, Johns Hopkins was uniquely situated to provide very high-quality medical education. Johns Hopkins was pioneering (for this continent) in its emphasis on scientific research, intimate connection with hospitals for real-time training, and reliance on laboratories for student learning. For the first time, a medical school exemplary in all aspects had finally appeared.

Johns Hopkins' influence on medical education in the United States can hardly be overstated. Within two decades, more than 60 American colleges had at least three professors with Hopkins degrees on their staff. Scientific research and hospital training came to be widely recognized as an integral part of medical education.

7.3.5 Elimination of the Two-Year Course

Reforms on the national front soon picked up steam as well. Delegates from just over half of the 90 orthodox medical colleges met in 1890 and established what would later become the Association of American Medical Colleges (AAMC). For once, there was a great deal of agreement on policies. In order to gain membership status in the AAMC, schools had to require three years of medical study with terms no shorter than six months. Laboratory work and entrance requirements were also required for membership. One year later, the National Confederation of State Medical Examining and Licensing Boards itself voted to require a minimum of three years of medical training.

The two reforms together proved successful at the national level for the first time. By 1893, less than 10 percent of schools continued to have two-year courses. In Illinois, 96.3 percent of schools required three of more years of study, a tremendous change from 1880, when only 26.8 percent of colleges held such a requirement. In 1894, the AAMC again met and voted to extend the course to four years for members, a move that was not unprecedented (Harvard and several other colleges had already extended). Although the delegates knew and anticipated that some of the sixty-five schools would leave due to the raised standards, it was encouraging that a large majority - fifty-four schools - chose to remain. In 1900, the AMA passed the same requirement for its members. A great change was taking place in medical education.

7.3.6 Abraham Flexner and the Report

As of the turn of the century, progress was encouraging but insufficient. Not all schools enforced entry requirements in practice as they should, and others operated with little to no equipment for laboratory research. In 1902, John Wyeth, president of the AMA, appointed a five-person committee on education. This committee would become the Council on Medical Education (CME) in 1905. The CME published a review of a thorough study of American colleges in 1907, stating that of the 160 extant schools, "only about 50 percent are sufficiently equipped to teach modern medicine," 30 percent "are doing poor work," and 20 percent "are unworthy of recognition." The CME heavily implied at the time of the report's release that future reports would mention schools by name. Notably, students who failed to pass examinations in states that required them moved in large numbers to states that did not require examination.

While physician reformers had achieved greater steps of progress than had been seen in the country to date, the public had yet to be fully convinced of the need for reforms. Only an impartial outside observer with no ties to physicians or state licensing boards could truly win the trust of the same public whose Jacksonian impulses half a century before had led to great steps backward in medical education. In 1907, AMA leaders asked Henry Pritchett, the head of the Carnegie Foundation, to inspect their aforementioned report. Pritchett, who became president of the Massachusetts Institute of Technology in 1900, had led to the Foundation's creation in the first place when he saw the need for a foundation to improve teaching. Pritchett must have found the AMA report convincing; in 1908 he recommended that the Carnegie Foundation undertake extensive examinations of medical and other types of education. He asked Abraham Flexner to direct this study.

Although Flexner's brother Simon was a physician, Flexner himself was an educator. He had written a criticism of the elective and lecture system, *The American College*, earlier that same year. Because Pritchett saw the problem with medical education as largely educational and less medical, Flexner was the perfect man for the job. Flexner undertook extensive preparations, familiarizing himself with medical practices and spending a large amount of time at Johns Hopkins, which he would come to idealize in his famous report. Then he visited every single medical school in the country over the next two years, interviewing administrators and students and analyzing every aspect of the school.

When published in 1910, the Flexner Report had some shocking findings. When Flexner asked to see the laboratory at one school, for example, the dean went upstairs to get it, returning with an instrument for measuring the pulse. Importantly, the report provided a detailed description of each school by name, fulfilling the promise of the CME several years earlier. Students now had access to an outside, ostensibly unbiased rating of each school's quality.

7.3.7 Aftermath

In addition to his detailed analyses of school quality, Flexner provided detailed recommendations for changes going forward. It is a remarkable sign of how much had changed over the last few decades that his recommendations were largely adopted. More than half of medical schools closed or merged with other schools in the next decade (Flexner recommended that the number of colleges be reduced from 155 to 31). Medical schools developed associations with hospitals and universities where they did not yet exist, and scientific and laboratory-based research became the basis of instruction.

While the main effects of the Flexner Report were higher-quality education and a drastic reduction in the number of medical schools, there were some adverse effects as well. Not all schools had large endowments that granted them independence from student fees; these schools still struggled with finances even after standards began to rise across the board. Schools that served primarily rural or minority students were more likely to close, and there was a shortage of physicians after the population explosion post-World War II. Nevertheless, it is hard to dispute that Flexner's report and the associated reforms did not make things much better than they were.