THE EFFECT OF OCCUPATIONAL LICENSING ON CONSUMER WELFARE: EARLY MIDWIFERY LAWS AND MATERNAL MORTALITY*

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Abstract

Occupational licensing is intended to protect consumers. Whether it does so is an important, but essentially unanswered, question. Using annual state- and city-level U.S. vital statistics data from the period 1900-1940, we examine the effects of midwifery licensing on maternal and infant mortality. Requiring midwives to be licensed is associated with a 5 to 7 percent decrease in the maternal mortality rate. There is also evidence of a negative relationship between requiring midwives to be licensed and infant mortality, albeit weaker in terms of both magnitude and precision. These results provide the first econometric evidence that occupational licensing leads to an increase in the quality of services received by consumers.

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1. INTRODUCTION

Requirements that workers hold an occupational license as a condition of employment have become increasingly common in recent decades. Indeed, the fraction of licensed workers today is nearly three times larger than the roughly 11 percent of workers in labor unions (Gittleman and Kleiner 2016). Despite the rapid growth in the prevalence of licensure requirements, there has been relatively little empirical work assessing their effects, with the bulk of studies focusing on the outcomes of licensees as opposed to the outcomes of consumers served by these workers.[1]

Whether consumers are helped or hurt by occupational licensure is theoretically ambiguous. Licensure has historically been justified on the grounds that, by requiring that providers of services pass exams or receive formal training, it causes low quality providers to leave the market and raises the quality of those who remain, both of which should improve the health and safety of consumers (Shapiro 1986, Kleiner 2000, Gittleman and Kleiner 2016). However, licensure may put upward pressure on prices (Shepard 1978; Adams et al. 2003; Kleiner and Kudrle 2000; Kleiner et al. 2014), which could encourage substitution towards providers of alternative, and perhaps inferior, services. Moreover, because licensees are insulated from competitive pressure, their incentive to provide high-quality service may be diminished, and they may even engage in behavior that strictly lowers quality.[2]

This study examines how the introduction of state midwifery licensure requirements during the late 19th and early 20th centuries affected the likelihood of dying due to complications of

[1] Various papers have shown, across a variety of sectors, that persons holding occupational licenses have higher earnings (See, for example, Kleiner and Krueger (2010; 2013), Kleiner and Krueger (2010; 2013), Timmons and Thornten 2008; Kleiner and Kudrle 2000; Thornten and Timmons 2013; Kleiner et al. 2014). Some of the papers examining the connection between licensure and consumer outcomes include Carroll and Gaston (1981) and Kleiner and Kudrle (2000), which assess the effect of licensure on patient outcomes in dentistry, and Larsen (2015), who studied teacher licensure on student test scores.

[2] In the context of health care, for example, Carrol and Gaston (1979) suggested several mechanisms through which licensing could negatively impact quality in health care, including self-substitution towards inferior products or services, reduction in the time spent with each customer (e.g., briefer office visits), and locational choices more in line with provider preferences than consumer needs (e.g., doctor shortages in rural areas).

pregnancy and childbirth among American women. Our analysis uses data from the 1870-1940 period, when 31 states, the District of Columbia (and at least a dozen municipalities) adopted midwifery licensing requirements. Drawing on contemporary sources, we assemble information on all of these policy changes, including their dates of passage and key provisions, which varied dramatically across states. For instance, women in Texas who did not actually advertise themselves as midwives were not required to obtain a license. In contrast, anyone practicing midwifery in New Jersey, Washington and Wisconsin was required to be a graduate of a recognized school of midwifery and to pass an examination administered by the Board of Medical Examiners. By exploiting geographical and temporal variation in the adoption of requirements such as these, we are able to assess their impact on maternal mortality. In addition, we are able to explore their effects on infant mortality as well as mortality among children under the age of 2 due to diarrhea/enteritis.

Information on mortality is from two sources, both published by the U.S. Census Bureau. *Vital Statistics* contains data at the state level on deaths by cause for the decennial census years 1870-1940. *Mortality Statistics*, released on an annual basis, contains data at the state level on deaths by cause for the period 1900-1940. This latter publication also provides deaths by cause at the city level for the period 1900-1922, which allows us to supplement the state-level analysis with city-level results. Using these two data sources, we estimate a series of models that relate maternal mortality in a particular state and year to whether midwives were required to be licensed in order to practice. The models control flexibly for state and year effects. Because we have data on maternal mortality for several years preceding the introduction of the typical law, we are able to test whether pre-treatment trends are similar across states. In addition, we control for mortality rates from non-pulmonary tuberculosis and typhoid, which are meant to proxy for milk and water quality (Clay et al. 2014).

We find that the introduction of licensure requirement for midwives was associated with a 5-7 percent reduction in maternal mortality. This result is robust across a variety of specifications, including controlling for state-specific linear time trends. Because state and local initiatives to combat various infectious diseases could have been correlated with the adoption of midwifery laws and maternal mortality, we conduct a series of falsification tests. Specifically we examine the relationship between midwifery laws and mortality due to tuberculosis, influenza, malaria, and diabetes. The estimates provide no evidence of a relationship between the adoption of midwifery laws and these other dimensions of health that are unrelated to pregnancy and childbirth, suggesting that the estimated effects on maternal mortality are truly capturing the casual effect of licensing midwives. Finally, we also find evidence of a negative relationship between requiring midwives to be licensed and infant mortality, although we argue that this result should be viewed as more tentative than the results for maternal mortality.

Our analysis helps address the relative paucity of work on the consumer effects of licensure by focusing on an outcome of first-order importance. Because maternal mortality depends so crucially and immediately upon the actions taken by persons attending childbirth, our analysis links licensure among a group of workers (midwives) to a specific consumer outcome over which those workers have direct and profound impact. Beyond these contributions to the general literature on licensure, the results we present are directly relevant to ongoing policy debates.

One set of debates have to do with the modern practice of midwifery in the United States, where there are, broadly speaking, two types of midwives. Nurse midwives, who typically work in hospitals, are required to be licensed. In contrast, "lay" or "direct-entry" midwives typically attend births that occur outside of the hospital – most commonly at home. Licensure rules for lay midwives differ dramatically across states. In some states, lay midwives are required to meet specific conditions in order to obtain a license and practice, while in other states they are completely

unregulated (Pence 1997; Rausch 2008; Reaves 2010; Rini 2015). In recent decades, the number of women choosing to deliver outside of hospitals has risen sharply (Belluck 2015), raising the obvious questions as to whether the presence or stringency of licensing rules for lay midwives affect maternal health outcomes. Although our estimates are from an earlier period in U.S. history, we are aware of no other evidence on this issue.

Given the levels of health, medical technology and wealth that prevailed in the United States during the time period we study, our results may be even more relevant to ongoing policy debates about the merits of training and licensing midwives in developing countries today, where maternal mortality rates are often comparable to U.S. rates at the turn of the 20th century.[3] In many developing nations, the majority of births are attended by traditional birth attendants (TBAs), who have no formal education or training.[4] Experts have claimed that replacing TBAs with trained and licensed midwives would substantially reduce infant and maternal mortality (WHO 2005 pp. 68-72; Thompson et al 2011; UNFPA 2011 pp. 2-7). This claim is based, in large part, on historical studies showing that Sweden had a lower maternal mortality rate than a handful of other industrialized countries (including the U.S.) during a period lasting from roughly when its municipalities were first required to employ a trained midwife in the early 19th century until 1940 (De Brouwere et al. 1998; Adegoke and van den Broek 2009; Loudon 2000; UNFPA Report 2011). However, these studies do not isolate the effect of the Sweden's midwifery requirements from other potentially important influences.[5] Moreover, the credibility of the cross-country comparisons such as these papers make is severely limited by the fact that in the late 1800s (when the first midwife laws were introduced in the

[3]At the turn of the 20th century, the U.S. maternal mortality ratio (MMR, maternal deaths per 100 000 live births) was approximately 700 (Woodbury 1924; Loudon 2000a, 200b). In comparison, the MMR in Sub-Saharan Africa today is estimated to be between 380 and 730 (WHO 2014).

[4] See United Nations Population Fund Report (UNFPA 2011).

[5] Two such potential influences were the introduction of anti-septic technology and better nutrition (Högberg et al. 1986; Tomkins 2001).

United States) through the early 1900s, maternal morality was not coded in a uniform fashion across countries or across states (Loudon 1999). Our results and methods contribute credible evidence to this hugely important policy issue.

The remainder of the paper is organized as follows. We begin with a historical overview of the midwifery debate and laws in the U.S at the turn of the 20th century. In Section 3, we describe our empirical approach; in Sections 4 and 5 we report the principal maternal morality results (based on state- and city-level data). In Section 6, we explore the effect of midwifery laws on infant mortality, and in Section 7 we examine midwifery laws and the supply of midwives. Section 8 concludes.

2. HISTORICAL OVERVIEW

In the mid-1800s, the field of obstetrics was in its infancy and the vast majority of births in the United States were attended by midwives without formal training (Leavitt 1983; Drife 2002). As obstetrical knowledge and practices advanced, middle- and upper-class women increasingly relied on doctors to deliver their babies. By the turn of the 20th century, doctors attended roughly half of U.S. births (Jacobson 1956).[6]

This emerging preference for doctors as birth attendants can be attributed, at least in part, to the widespread perception that they were more competent than midwives (Rooks 1997, pp. 22-23). There is, however, reason to believe that women's trust in doctors was misplaced.

In general, midwives were loath to intervene in the birthing process (Leavitt 1983). In contrast, many doctors in the early 1900s routinely used forceps and anesthesia (ether or chloroform) during delivery. Being trained in the use of forceps was an important advantage if the

[6] According to Leavitt (1983, p. 295), "Most of these births took place in the woman's home". By 1933, approximately one-third of all births took place in the hospital (Leavitt 1983, p. 301).

labor was prolonged or the baby was in breech position, but the overuse of forceps came with significant risks to the mother and her baby. The leading cause of maternal mortality at the turn of the 20th century was "childbed" or puerperal fever (Loudon 2000).[7] According to Leavitt (1983, p. 292):

> Inappropriate forceps use and the careless administration of ether and chloroform introduced serious lacerations and breathing disorders that otherwise might not have developed. Most significant, physicians carried puerperal fever, which was potentially disastrous, to birthing women. Because their medical practices included attending patients with communicable diseases, doctors were more likely than midwives to bring with them on their hands and on their clothing the agents of infection.

In fact, contemporary studies provide strong evidence that mortality rates were higher among mothers attended by a doctor than among mothers attended by a trained midwife (Jacobi 1912; Mendenhall 1917; Levy 1918; Sobel 1918; Levy 1923). Despite this evidence, doctors and public health officials argued forcefully that midwives were to blame for puerperal fevers (Cody 1913; Plecker 1915; Edgar 1916; Frizzelle 1917; Terry 1917; Stedman 1920; Howe 1921; Rude 1922), and a variety of solutions to the so-called "midwife problem" were proposed. The abolition of midwifery was prominent among these solutions (Emmons and Huntington 1912; Williams 1912; Huntington 1913; De Lee 1915; Holmes 1920). However, some physicians conceded that abolition was impractical and, as an alternative, recommended the licensing and increased supervision of midwives coupled with teaching antiseptic technique and how to recognize pregnancy complications (Edgar 1916; Hardin 1925).

[7] Puerperal fever, an infection of the reproductive tract during labor or its aftermath, was typically caused by Group A streptococcus bacteria (Nathan and Leveno 1994; De Costa 2002). Described as "the classic example of iatrogenic disease—that is, a disease caused by medical treatment itself" (Wertz and Wertz 1977, p. 128), puerperal fever accounted for about half of all deaths related to childbirth; only tuberculosis killed more women childbearing age in the United States at the turn of the 20th century (Woodbury 1924; Loudon 2000a, 2000b).

Midwives, many of whom were black or foreign-born, lacked the political and social clout to effectively counter the physician-led campaign against them (Rooks 1997, p. 24), and the demand for midwifery services continued to fall.[8] By 1935, only 11 percent of births in the United States were attended by midwives; of these, 63 percent were to non-white mothers (Jacobson 1956, p. 254). By 1940, the last year of our analysis, 9 percent of births were attended by midwives; of these, 68 percent were to nonwhite mothers (Jacobson 1956, p. 254).

2.1. EARLY MIDWIFERY LAWS

In the United States, the practice of midwifery in the U.S. was wholly unregulated until 1877, when Illinois became the first state to license midwives (Rooks 1997, pp. 17-22; Sandvick 2009). Under the Illinois Medical Practice Act, licensure was required of any person "practicing medicine, in any of its departments". Licenses were issued by the newly created State Board of Health, which was empowered to give examinations to practitioners who had not graduated from a recognized medical institution.[9] Although midwifery was nowhere mentioned in the Act, the newly created State Board of Health contended that it made "the same requirement of midwives as of physicians" (Illinois State Board of Health 1879, p. 54).

[8] Information on the race and national origin of midwives is available from a variety of contemporary sources. Crowell (1907) surveyed 500 midwives practicing in New York City; 96 percent were foreign born and 30 percent were "unable to speak English." Koehler and Drake (1911, p. 25) estimated that, of the 485 midwives practicing in Chicago, "35 per cent are Slavic and 6 per cent are Italian." Jeidell and Fricke (1912) surveyed 119 midwives living in Anne Arundel County, Maryland. Of these, 95 were identified as "Negroes", 17 were identified as "Americans", and the remainder were identified as foreign born. Thirty-four had registered with the Board of Health and only 21 were licensed to practice midwifery. According to Williams (1915), 326 midwifery licenses were issued by the State of New York between November 16, 1914 and April 15, 1915. Eight of the licensed midwives were identified as "American", 1 was identified as "Colored" and the remaining midwives were identified as foreign born (Williams 1915). The Texas Bureau of Child Hygiene (1925) provided background information on 485 midwives practicing in 6 Texas counties. Of these, 76 percent were identified as "Colored", 18 percent were identified as "Mexican", and 6 percent were identified as either "White" or "American". Finally, according to Smith (2005, p. 62), by "the mid-1920s the state [of Washington] had licensed…at least 40 Japanese midwives out of a total of 60 midwives."

[9] One year after the Act came into effect, the State Board of Health estimated that no fewer than 1,400 "non-graduates" had been forced out of the state for practicing medicine without a license (Illinois State Board of Health 1879, p. 5).

The Illinois Medical Practice Act of 1877 served as a model for other state legislatures interested in regulating the practice of medicine (Sandvick 2009). By the turn of the 20th century, most states required physicians to be licensed (Hamowy 1979), and 8 states (Connecticut, Illinois, Indiana, Louisiana, Minnesota, New Jersey, Ohio and Wyoming) required midwives to be licensed (see Appendix Table 1). Licensing requirements for midwives varied considerably among these 8 states. For instance, examination was mandatory in some states (Connecticut, Louisiana, New Jersey, Ohio, and Wyoming), whereas no exams were required of graduates of recognized midwifery programs in other states (Illinois, Indiana and Minnesota). In addition to requiring a license to practice, New Jersey prohibited midwives from attending breech births and administering any type of medicine or drugs; Ohio not only prohibited midwives from attending breech births, but also forbad the use of instruments such as forceps.[10]

Under increasing pressure from public health officials and the medical profession (Kobrin 1966; Rooks 1997, p. 23), 16 states passed laws requiring the licensure of midwives between 1900 and 1920. Cities and even small towns also took up the cause. During this same period, at least 12 municipalities (including Los Angeles and New York City) adopted ordinances requiring practicing midwives to obtain a license, certificate or permit. North Carolina, which did not require licensure until 1935, nonetheless required midwives to wash their hands before touching a patient and banned women who were addicted to drugs or alcohol from the practice of midwifery (van Blarcom 1913).

As noted earlier, licensing requirements varied considerably, as did enforcement. For instance, Texas required that midwives be of "good moral character" and graduates of a "bon fide, reputable" medical school. However, the Texas law, passed in 1907, did "not apply to those who do not follow obstetrics as a profession, and who do not advertise themselves as obstetricians or

[10] Although the Louisiana law required examination, it exempted the "so-called midwife of the rural districts and plantation practice, who, in the sense of this act, are not considered as practicing midwifery as a profession." In 1896, midwives in the District of Columbia were required to pass an exam administered by the board of medical supervisors.

midwives".[11] According to a report issued in 1925 by the Texas Bureau of Child Hygiene, only 20 midwives had been licensed.[12]

By contrast, the New York law, which passed in 1913, was quite stringent. Midwives were forbidden to "use instruments, prescribe drugs, or take charge of any other than a normal case of labor" (New York Department of Health 1915, p. 323). As of January 1, 1915, applicants for licensure in New York were required to have graduated from a recognized midwifery program or provide a statement from a licensed physician attesting that the applicant had attended and received instruction in at least 15 deliveries (Williams 1915). Applicants also had to show evidence of "habits of cleanliness", be at least 21 years of age, be able to read and write, and be of "good moral character" (New York Department of Health 1915; Williams 1915). Six months after the New York midwifery law came into effect, the Department of Health had issued 326 licenses (Williams 1915).

3. EMPIRICAL FRAMEWORK

As described earlier, effect of midwifery laws on maternal mortality is, *a priori*, theoretically ambiguous. Licensing requirements could have stimulated the formation of human capital and prevented the least competent midwives from practicing (Shapiro 1986). However, by restricting supply and insulating midwives from competition, midwifery laws could have reduced the quality of services provided (Carroll and Gaston. 1979). For instance, if licensed midwives attended more births than their unlicensed counterparts (or intervened more often in an effort to hasten delivery), then their clients would have been at greater risk of puerperal fever.

[11] Likewise, women in Missouri who did not practice midwifery as a profession and did not charge for their services were not required to obtain a license. Utah required anyone practicing obstetrics to obtain a license, but permitted the practice of obstetrics "in case of emergency" and in communities "where there are no licensed practitioners" (Egan 1910).

[12] The authors of the report went on to describe Texas midwives as "usually dirty and in rags, gesticulating, often times not able to talk or understand the English language, superstitious and suspicious, often with the only knowledge of obstetrics and nursing as handed to them by their mothers..." (Texas Bureau of Child Hygiene 1925).

Our baseline regression for estimating how early midwifery laws affected maternal mortality is of the form:

$$(1)\quad \ln(\textit{Maternal Mortality}_{st}) = \beta_0 + \beta_1 \textit{License Required}_{st} + \boldsymbol{X}_{st}\beta_2 + v_s + w_t + \varepsilon_{st},$$

where s indexes states and t indexes years. The coefficient of interest, β_1, represents the effect of licensing requirements on maternal mortality, defined as deaths due to complications from pregnancy or childbirth in state s divided by the state's female population in year t. It should be noted that, during the period under study, many states included women in the "puerperal state" who died due to infectious diseases and other causes in their maternal mortality counts (Loudon 1999).

The controls, represented by the vector $\boldsymbol{X}_{st}$, are listed in Table 1, along with descriptive statistics and definitions. They include a women's suffrage indicator and Sheppard-Towner spending over the period 1922-1927. Miller (2008) showed that women's suffrage laws led to substantial increases in public health spending and an 8–15% reduction in child mortality. Moehling and Thomasson (2014) found a negative association between Sheppard-Towner spending and infant mortality. The vector $\boldsymbol{X}_{st}$, also includes educational requirements for physicians, a department of health indicator, and a department of child hygiene indicator.[13] The terms v_s and w_t represent state and year fixed effects, respectively.

Next, following Clay et al. (2014), we use non-pulmonary tuberculosis mortality to proxy for milk quality and typhoid mortality to proxy for water quality, both of which were important

[13] Educational requirements for physicians are at the state level and are from Hamowy (1978). They include an indicator for whether the state required a diploma in order to practice medicine and an indicator for whether the state empowered medical boards to set pre-professional education requirements. The department of hygiene indicator is equal to 1 if the state had a department of child hygiene. Other controls include percent of the population less than 18 years of age, percent 18-65 years of age, percent white, percent black, percent living in an urban area, percent female, and the percent foreign born. These controls are from the U.S. Census and are estimated using linear interpolation for non-census years.

determinants of infant and overall mortality (Wolf 2003; Cutler and Miller 2004; Alsan and Goldin 2015). Specifically, we estimate a modified version of the baseline equation:

$$(2)\ \ln(\textit{Maternal Mortality}_{st}) = \beta_0 + \beta_1 \textit{License Required}_{st} + \boldsymbol{X}_{st}\beta_2 + \beta_3 \textit{Non-Pulmonary TB}_{st} + \beta_4 \textit{Typhoid}_{st} + v_s + w_t + \varepsilon_{st},$$

where *Non-Pulmonary TB* is equal to mortality due to non-pulmonary tuberculosis per 100,000 population and *Typhoid* is equal to mortality due to typhoid per 100,000 population.

Finally, we include state-specific linear time trends ($\Theta_s \cdot t$) to account for the possibility that mortality rates evolved at different rates in states that adopted licensing requirements as compared to states that did not:

$$(3)\ \ln(\textit{Maternal Mortality}_{st}) = \beta_0 + \beta_1 \textit{License Required}_{st} + \boldsymbol{X}_{st}\beta_2 + \beta_3 \textit{Non-Pulmonary TB}_{st} + \beta_4 \textit{Typhoid}_{st} + v_s + w_t + \Theta_s \cdot t + \varepsilon_{st}.$$

The actual effect of midwifery laws on maternal mortality is an empirical question, to which we now turn our attention.

4. RESULTS BASED ON ANNUAL STATE-LEVEL DATA, 1900-1940

Estimates of β_1 based on annual data for the period 1900-1940 are presented in Table 2. During this period, 22 states adopted licensing restrictions for midwives. [We are currently collecting the decennial census data on maternal mortality for the years 1870-1940. Results based on the decennial data for these years will be reported in a separate table and will be ready before the NBER summer institute is underway. During the period 1870-1940, 31 states and the District of

Columbia adopted midwifery laws]. The regressions are weighted by the female population of state *s* in year *t*, and the standard errors are corrected for clustering at the state level (Bertrand et al. 2004).

The baseline estimate, in the first column of Table 2, suggests that the licensing of midwives leads to a 6.8 ($e^{-.070} - 1 = -.068$) percent reduction in maternal mortality, or roughly 1.9 fewer deaths per 100,000 women relative to a mean of 27.9. This estimate is not particularly sensitive to whether we include the controls in the vector $\boldsymbol{X}_{st}$ or whether we include mortality due to non-pulmonary tuberculosis and typhoid (our proxies for milk and water quality, respectively). When state-specific trends are included on the right-hand side, the estimated effect of requiring a midwifery license is slightly reduced in absolute magnitude, but remains statistically significant at the 5 percent level: the adoption of a midwifery law is associated with a 5.5 percent reduction in maternal mortality. In the final column of Table 2, we test the parallel trends assumption by adding a lead to the model, equal to 1 if a midwifery law was passed in year $t + 1$ or year $t + 2$, and equal to 0 otherwise. The estimated coefficient on the lead, although negative, is small and not statistically significant at conventional levels.

4.1. FALSIFICATION TESTS

Until the 1920s, public health officials focused their efforts on reducing infant, as opposed to maternal, mortality (Kotelchuck 2007, p. 108).[14] However, state and local initiatives to combat tuberculosis and other infectious diseases (such as the flue and malaria) could have been correlated with the adoption of midwifery laws, potentially biasing our estimates of their effects on maternal mortality.[15] Such initiatives included the application of insecticides (Kitron and Spielman 1989),

[14] Until the passage of the Sheppard-Towner Act in 1921, efforts to reduce maternal mortality mostly took the form of midwifery licensing laws were viewed as the maternal mortality..we control for s-T spending in all the regressions. Moreover, if we lop of the period 1920-1938 we still get significant results.

[15] As noted above, many states during the period under study used a broad definition of maternal mortality, which included women who died in pregnancy, during labor and up to 42 days after childbirth from any cause aside from

forming local and state anti-tuberculosis associations (Knoff 1922), and passing anti-spitting laws (O'Conner 2015).

We address this issue through conducting a series of falsification tests. Specifically, we examine the relationship between midwifery laws and mortality due to the following causes: tuberculosis, influenza, malaria, and diabetes.

The results of these falsification tests are reported in Table 3.[16] If we do not control for state-specific linear trends, requiring midwives is associated with an increase in mortality due to diabetes. When the state-specific trends are included on the right-hand side of the estimating equation, all of the estimated coefficients of the license required indicator are positive and statistically insignificant. This pattern of results suggests that, conditional on controlling for state-specific linear trends (and the controls included in the vector $\boldsymbol{X}_{s,t}$), the adoption of midwifery laws was not related to maternal health through public health initiatives aimed at tuberculosis and other infectious diseases.

4.2. HETEROGENEOUS EFFECTS

In this section, we test for heterogeneity in the relationship between licensure and maternal mortality. We begin by focusing on urban status--that is whether the mother lived in a city or town with a population greater than 10,000. Maternal mortality among mothers living in urban areas was substantially higher than among mothers living in rural areas during this period (17.1 per 100,000 versus 11.6), but enforcement of midwifery laws was, by many accounts, much stricter urban as compared to rural areas (Borst 1995, pp. 55-60; Molina 2006, p. 105;).

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accidents including infectious diseases such as influenza and tuberculosis (Loudon 1999). Almond (2006), in fact, used maternal mortality as to measure the intensity of the 1918 influenza epidemic.

[16] He sample size for the malaria regressions is smaller due to the fact that the mortality rate due to malaria in some state-years was zero. Taking the quartic root of malaria mortality, which mimics the natural log function for positive numbers, produced very similar results. This method of dealing with zeros is used by Tarozzi et al. (2014) and Ashraf et al. (2015), among others.

The results, reported in the first two columns of Table 4, suggest that the relationship between requiring midwives to be licensed and maternal morality was much stronger in urban areas as compared to rural areas. In fact, although negative, the estimated coefficient of *License Required* is not significant when the our attention is restricted to rural areas.

In the remaining columns of Table 4, we divide midwifery laws based on their specific provisions. Of the 22 states that adopted midwifery laws during the period 1900-1940, 11 required applicants to pass an examination at the state level or graduate from a recognized school of midwifery.[17] Nine states, which we label "Least Strict" did not include either of these requirements (DE, GA, KY, LA, MS, NC, SC, UT, and VA). The estimated effect of requiring a midwifery license appears to be larger when these least strict states are allowed to have their own effect, although the difference between these two types of law is not statically significant.

5. RESULTS BASED ON CITY-LEVEL DATA, 1900-1917

We turn now to an analysis of midwifery laws and maternal mortality at the city level. The data are annual, cover the period 1900-1917, and come from *Mortality Statistics*. Four additional years

[17] William R. Nicholson, a prominent advocate of providing midwives with more training surveyed of health officers across the country to determine "conditions surrounding childbirth" (Nicholson 1921, p. 517). Based on the results of this survey, Nicholson concluded that these were the only 4 states "at present attempting any real control of the midwife" (Nicholson 1921, p. 517). Two of these 4 states (New York and Pennsylvania) are included among the 11 we categorize as having had strict midwifery laws; the other two required midwives to be licensed prior to 1900. Nicholson (1921, p. 517) wrote:

> New York…New Jersey, Connecticut, and Pennsylvania are the only states at present attempting any real control of the midwife. It is true that a license to practice is necessary in twenty states, and if this requirement is accepted at its face value it would give one interested in this work a feeling of great satisfaction; but there is need of but slight examination of the facts to show how farcical this so-called licensing is in the great majority of instances. For example, the state of Missouri reports that 10 per cent of her population is delivered by the midwife, Wisconsin puts it at 20 per cent, Rhode Island at 12 per cent, and Illinois, while unable to hazard a definite percentage says that it is rather high, and yet all these states frankly admit that the law regarding the midwife is not enforceable. The state of Alabama replies that 60 per cent of her population is born in the care of her 1500 midwives, and that she has control of them, but said control is in the hands of various county officers (p. 518).

of maternal mortality statistics at the city level are available from *Mortality Statistics*, but we chose to focus on this period in order to avoid confounding the effect of midwifery laws with the 1918 influenza epidemic.

There are 548 cities in the sample. On average, each of these cities contributed 13.5 observations to the analysis. Estimates based on a balanced panel are very similar to those reported below.

There are three advantages to using the city-level data. First, 9 municipalities adopted midwifery licensing requirements during this period, representing an additional source of policy variation (see Appendix Table 2). Second, many cities and towns began reporting maternal mortality before this statistic was available at the state level. Third and lastly, these data allow us to focus on mothers living in urban areas, where we think the effect of midwifery laws should be most pronounced.

Our estimation strategy is similar to that used in the state-level analysis. We begin is a standard difference-in-difference model, and then augment it by controlling mortality due to non-pulmonary tuberculosis and mortality due to typhoid (our proxies for milk and water quality, respectively):

$$(4)\quad \textit{Maternal Mortality}_{ct} = \beta_0 + \beta_1 \textit{License Required}_{ct} + \boldsymbol{X}_{ct}\beta_2 + \beta_3 \textit{Non-Pulmonary TB}_{ct} + \beta_4 \textit{Typhoid}_{ct} + v_c + w_t + \Theta_c \cdot t + \varepsilon_{ct}.$$

Because morality by cause at the city level can be equal to zero, we take its quartic root, which mimics the logarithmic function for positive numbers (Duncan et al. 2006).[18] Marginal effects are

[18] This method of dealing with zeros is used by Tarozzi et al. (2014) and Ashraf et al. (2015), among others. We also estimated a version of equation (4) in which the dependent variable is equal to ln(.001 + *Mortality Rate*). These estimates are similar to those reported in the main body of the paper.

reported in brackets. Our independent variable of interest, *License Required*, is equal to one if midwives were in city *c* were required by either the state law or a municipal ordinance to be licensed.

The results provide additional evidence that requiring midwives to be licensed is associated with lower maternal mortality. The estimates of β_1 are, in fact, larger than those based on the state-level data. According to the baseline specification, requiring midwives to be licensed is associated with 3.23 fewer maternal deaths per year, or almost a 20 percent reduction relative to the mean of 16.2. When we add the city-specific linear trends, this estimate is reduced in magnitude and loses significant (p-value = .127). If taken at face value, this estimate suggests that requiring midwives to be licensed is associated with 0.92 fewer maternal deaths per year, or a 5.6 percent reduction

6. INFANT MORTALITY

Up until this point in the analysis, our focus has been on maternal mortality. However, there are at least two reasons why licensing and training midwives could have led to fewer infants dying. First, midwifery instruction and textbooks emphasized the importance of breastfeeding.[19] This was at a time when most American mothers did not exclusively breastfeed, but instead supplemented their breastmilk with cows' milk and typically weaned their infants within three months of birth (Wolf 2003).[20] Second, licensed midwives were trained in antiseptic technique and artificial respiration, and would have been able to recognize and handle common birth complications (Barnes 1883; Jewett and Jewett 1901; Johnstone 1913). A recent study conducted in Zambia found that teaching TBAs about newborn care (including training in cleanliness, resuscitation, and how to

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[19] For instance, one popular textbook for midwives (Johnstone's 1913, p. 407) unequivocally stated: "In all cases an infant should be suckled by its mother unless definite contra-indications exist." See also Jewett and Jewett (1901, pp. 188-189) and Smith (2005, p. 130).

[20] Most cities did not require cow's milk to be pasteurized until the 1920s (Brosco1999) and, as a consequence, it was often spoiled or contaminated with bovine tuberculosis (Wolfe 2003; Olmstead and Rhode 2004).

recognize and manage birth complications) led to dramatic reductions in 7-day neonatal mortality due to asphyxia and infection (Carlo et al. 2010).

Table 6 presents estimates of the relationship between midwifery laws and infant mortality. The estimate in the first column of Table 6 is mall , positive, and insignificant, suggesting that the licensing of midwives had little effect on the overall infant mortality rate. When we examine the relationship between midwifery laws and infant mortality by race (white versus non-white), this relationship appears to be strongest among blacks when the trends are included. Controlling for state-specific linear trends, requiring a license is associated with 11.8 fewer infant deaths relative to a mean of 255,4, although this estimate is not quite significant at the 10 percent level. When we turn to the city-level data, we find evidence that requiring midwives to be licensed was associated with a small reduction in mortality due to diarrhea/enteritis among children under the age of 2.

We view the results in Table 6 as less definitive than the maternal morality results reported in Tables 2-5. A wide variety of public health initiatives directed at reducing infant mortality were undertaken during the period 1900-1930 (Kotelchuck 2007). For instance, state and local educational campaigns encouraged breastfeeding (Wolf 2003); public health inspectors visited dairy farms to ensure that milk was processed under sanitary conditions and shipped in refrigerated railroad cars (Atkins 1992). If these initiatives were correlated with the adoption of midwifery laws, the results reported in Table 6 could easily be biased. As a falsification test, we examined the relationship between midwifery laws and mortality due to diarrhea/enteritis among individuals ages 2 and over. Although some (but by no means all) midwives made multiple visits to the mother and child during the first few weeks of the postpartum period (Baker 1913; Dart 1921, p. 29; Smith 2005, p. 130; Bartlett 2008, p. 21), mortality due to diarrhea/enteritis among this group should, in theory, have been unaffected by requiring their licensure. The estimated relationship between requiring midwifery licenses and this outcome is small and insignificant, suggesting that any bias is minimal.

7. MIDWIFERY LAWS AND THE SUPPLY OF MIDWIVES

In this section, we examine the relationship between midwifery laws and the supply of midwives using census data for the period 1880-1930. The results, which are preliminary, are reported in Table 7. They suggest that licensing increased the number of women in the census who reported their occupation as "midwife". At first blush, this result may seem counterintuitive—licensing laws are thought to restrict supply. However, in many states there were literally no women who reported midwifery as their occupation before the passage of a midwifery law. Only after the passage of the law, did any women report midwifery as their occupation, suggesting that these laws contributed to the professionalization of women who, prior to licensure, may have only attended a handful of births per year (Dart 1921; Borst 1995, pp. 55-60).

8. CONCLUSION

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Table 1. Descriptive Statistics for State-Level Maternal Mortality Analysis, 1900-1940

	Full sample	*Midwifery License Required* = 1	*Midwifery License Required* = 0	Description
Maternal Mortality	27.9 (11.1) N = 1,296	26.7 (10.1) N = 711	29.3 (12.0) N = 585	Maternal mortality per 100,000 female population
% Pop < 18	.351 (.045)	.352 (.046)	.350 (.043)	Percent of population less that was than 18 years of age
% Pop 18-65	.598 (.037)	.600 (.038)	.597 (.036)	Percent of population that was 18-65 years of age
% White	.899 (.134)	.882 (.141)	.919 (.121)	Percent of population that was white
% Black	.079 (.128)	.101 (.142)	.052 (.102)	Percent of population that was black
% Urban	.482 (.183)	.523 (.186)	.431 (.166)	Percent of population that lived in an urban area
% Female	.489 (.018)	.493 (.014)	.485 (.022)	Percent of population that was female
% Foreign	.116 (.091)	.107 (.090)	.126 (.091)	Percent of population that was foreign born
Physician Diploma	.962 (.191)	.982 (.134)	.938 (.241)	= 1 if state required physicians to have a diploma
Physician Education	.952 (.214)	.989 (.106)	.908 (.290)	= 1 if state medical boards could set preliminary education requirements
Dept. of Child Hygiene	.726 (.446)	.820 (.384)	.612 (.488)	= 1 if state had a division of child hygiene
Suffrage	.767 (.423)	.823 (.382)	.699 (.459)	= 1 if women were allowed to vote
ST Act	4.15 (10.2)	5.26 (12.2)	2.80 (6.84)	For 1930, sum of Sheppard-Towner spending for 1922-1929 ($1,000)
Typhoid	8.87 (9.30)	7.75 (8.29)	10.2 (10.2)	Typhoid mortality per 100,000 population
Non-pulmonary TB	11.1 (7.04)	10.1 (5.93)	12.4 (8.01)	Non-pulmonary tuberculosis mortality per 100,000 population

Notes: Unweighted means with standard deviations in parentheses.

Table 2. Maternal Mortality and Midwifery Laws: State-Level Analysis, 1900-1940

	(1)	(2)	(3)	(4)	(5)
Midwifery License Required, 1 to 2 Year Lead	…	…	…	…	-.025 (.029)
Midwifery License Required	-.070** (.027)	-.069** (.027)	-.067** (.026)	-.057** (.023)	-.069** (.027)
Mean	27.9	27.9	27.9	27.9	27.9
N	1,296	1,296	1,296	1,296	1,296
R^2	.952	.954	.955	.965	.965
Policy controls	no	yes	yes	yes	yes
Typhoid and non-pulmonary TB	no	no	yes	yes	yes
State-specific linear trends	no	no	no	yes	yes

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on data from the U.S. Census Bureau's annual *Mortality Statistics* reports, 1900-1940. Each column represents the results from a separate OLS regression. The dependent variable is equal to ln(*Maternal Mortality*) in state *s* and year *t*. Controls include % of population less than 18 years of age, % 18-65 years of age, % white, % black, % living in an urban area, % female, % foreign born, state fixed effects, and year fixed effects. Regressions are weighted by female population. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 3. Falsification Outcomes and Midwifery Laws: State-Level Analysis, 1900-1940

	Pulmonary Tuberculosis		*Malaria*		*Influenza*		*Diabetes*	
Midwifery License Required	.032	.022	.136	.165	-.002	.077	.055*	.004
	(.026)	(.017)	(.117)	(.128)	(.075)	(.051)	(.031)	(.018)
Mean	81.6	81.6	3.83	3.83	37.2	37.2	17.8	17.8
N	1,296	1,296	1,032	1,032	1,296	1,296	1,296	1,296
Typhoid and non-pulmonary TB	no	yes	no	yes	no	yes	no	yes
State-specific linear trends	no	yes	no	yes	no	yes	no	yes

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on data from the U.S. Census Bureau's annual *Mortality Statistics* reports, 1900-1940. Each cell represents the results from a separate OLS regression. The dependent variable is equal to the natural log of the specified mortality rate per 100,000 population in state *s* and year *t*. Controls include physician educational requirements, a department of child hygiene indicator, a women's suffrage indicator, Sheppard-Towner spending, % of population less than 18 years of age, % 18-65 years of age, % white, % black, % living in an urban area, % female, % foreign born, state fixed effects, and year fixed effects. Regressions are weighted by state population. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 4. Heterogeneous Effects and Midwifery Laws: State-Level Analysis, 1900-1940

	Urban Maternal Mortality	*Rural Maternal Mortality*	*Maternal Mortality*	*Maternal Mortality*
Midwifery License Required	-.098**	-.024	-.074**	-.071**
	(.039)	(.027)	(.036)	(.034)
*Midwifery License Required * Least Strict*				.042
				(.039)
Mean	17.7	11.6	27.9	27.9
N	1,296	1,296	1,296	1,296

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on data from the U.S. Census Bureau's annual *Mortality Statistics* reports, 1900-1940. Each cell represents the results from a separate OLS regression. The dependent variable is equal to the natural log of the specified mortality rate per 100,000 population in state *s* and year *t*. Controls include % of population less than 18 years of age, % 18-65 years of age, % white, % black, % living in an urban area, % female, % foreign born, physician educational requirements, a department of child hygiene indicator, a women's suffrage indicator, Sheppard-Towner spending, the typhoid mortality rate, the non-pulmonary tuberculosis mortality rate, state fixed effects, year fixed effects, and state-specific linear time trends. Regressions are weighted by the relevant state population. Standard errors, corrected for clustering at the state level, are in parentheses.

Table 5. Maternal Mortality and Midwifery Laws: City-Level Analysis, 1900-1917

	(1)	(2)	(3)
Midwifery License Required	-.100***	-.090***	-.028
	(.031)	(.027)	(.018)
	[-3.23]	[-2.91]	[-.917]
Mean	16.2	16.2	16.2
N	7,425	7,425	7,425
R^2	.344	.356	.451
Typhoid and non-pulmonary TB	no	yes	yes
City-specific linear trends	no	no	yes

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on data from the U.S. Census Bureau's annual *Mortality Statistics* reports, 1900-1917. Each column represents the results from a separate OLS regression. The dependent variable is equal to the quartic root of the maternal mortality rate per 100,000 population in city *c* and year *t*. Controls include physician educational requirements, a department of health indicator, a department of child hygiene indicator, a women's suffrage indicator, city fixed effects, and year fixed effects. Regressions are weighted by city population. Standard errors, corrected for clustering at the state level, are in parentheses and marginal effects are in brackets.

Table 6. Infant Mortality and Midwifery Laws

	State-level analysis, 1900-1938			City-level analysis, 1900-1917		
	Infant Mortality	*White Infant Mortality*	*Nonwhite Infant Mortality*	*Infant Mortality*	*Diarrhea, Under Age 2*	*Diarrhea, Ages 2+*
Midwifery License Required	.003	.004	-.046	-.004	-.051**	.013
	(.017)	(.020)	(.030)	(.024)	(.024)	(.033)
			[-11.8]		[-5.89]	[.470]
Mean	169.9	144.5	255.4	303.0	89.1	19.3
N	1,200	1,018	1,018	7,422	7,425	3,594
R^2	.989	.988	.937	.857	.851	.573

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on data from the U.S. Census Bureau's annual *Mortality Statistics* reports, 1900-1938. Each column represents the results from a separate OLS regression. For the state-level analysis, the dependent variable is equal to the natural log (or quartic root in the case of nonwhite infant mortality) of the specified mortality rate per 100,000 population in state *s* and year *t*. For the city-level analysis, the dependent variable is equal to the natural log (or quartic root in the case of diarrhea) of the specified mortality rate per 100,000 population in city *c* and year *t*. For the state-level analysis, controls include % of population less than 18 years of age, % 18-65 years of age, % white, % black, % living in an urban area, % female, % foreign born, physician educational requirements, a department of child hygiene indicator, a women's suffrage indicator, Sheppard-Towner spending, the typhoid mortality rate, the non-pulmonary tuberculosis mortality rate, state fixed effects, year fixed effects, and state-specific linear time trends. For the city-level analysis controls include, physician educational requirements, a department of health indicator, a department of child hygiene indicator, a women's suffrage indicator, they typhoid mortality rate, the non-pulmonary tuberculosis mortality rate, city fixed effects, year fixed effects, and city-specific linear time trends. Regressions are weighted by the relevant state population for the state-level analysis. Regressions are weighted by city population for the city-level analysis. Standard errors, corrected for clustering at the state level, are in parentheses and marginal effects are in brackets.

Table 7. Licensing and the Supply of Midwives: Evidence from Census Years 1870-1930

Quartic root of midwife rates	*Total Midwives*		*Black Midwives*		*Foreign-Born Midwives*	
Midwifery License Required	.569***	.677***	.526	.869	.453	.319
	(.206)	(.243)	(.506)	(.773)	(.340)	(.401)
	[19.0]	[45.0]	[14.6]	[23.2]	[51.2]	[37.1]
Mean	22.3	22.3	19.7	19.7	72.4	72.4
N	286	286	258	258	286	286
R^2	.605	.721	.564	.647	.644	.728
State-specific linear trends	no	yes	no	yes	no	yes

*Statistically significant at 10% level; ** at 5% level; *** at 1% level.

Notes: Based on U.S. Census data at the state level for the period 1870-1930. Each cell represents the results from a separate OLS regression. The dependent variable is equal to the specified midwife rate per 100,000 women from the relevant population (or its quartic root) in state *s* and year *t*. Controls include physician educational requirements, a department of health indicator, a department of child hygiene indicator, a women's suffrage indicator, Sheppard-Towner spending, % of population less than 18 years of age, % 18-65 years of age, % white, % black, % living in an urban area, % female, % foreign born, state fixed effects, and year fixed effects. Regressions are weighted by the relevant female population, ages 15-45. Standard errors, corrected for clustering at the state level, are in parentheses and marginal effects are in brackets.

Appendix 1. State Midwifery Laws, 1890-1940

State	Licensing Requirement	Year of Passage	Description and sources
Alabama	Yes	1918	Midwives were required to pass an examination and register with the Alabama State Board of Health. According to Tovino (2004, p. 72), "Although thousands of women practiced as lay midwives in Alabama, only a few completed the required training." In response to the passage of the law, the Tuskegee Institute developed a four-week course "of intensive training in midwifery" (Kennedy 1921).
Arizona	No		A 1903 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913).
Arkansas	No		A 1904 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913).
California	Yes	1917	The law came into effect on July 27, 1917. It required that midwives receive instruction in anatomy, hygiene and sanitation, obstetrics and physiology from a legally chartered school approved by the Board of Medical Examiners. Applicants also had to pass an examination in these subjects. Persons practicing midwifery without a license were subject to a fine of not more than $600 and/or imprisonment up to 180 days. The full text of the law is available in Henning and Hyatt (1921).
Colorado	Yes	1915	The law required that applicants be examined by the State Board of Medical Examiners. Persons practicing midwifery without a license were subject to a fine of not more than $300 or imprisonment for up to 30 days. See Colorado (1915) for the full text of the law. Also see Stone (1918).
Connecticut	Yes	1893	The law came into effect in October 1893. Applicants had to pass an exam administered by a committee appointed by the State Board of Health. Persons practicing midwifery without a license were subject to a fine of not more than $300 or imprisonment for up to 90 days. See Connecticut (1893) for the full text of the law.
Delaware	Yes	1920	License to be issued by the State Board of Health upon a signed statement from a licensed physician that the applicant is qualified. See the National Committee for the Prevention of Blindness (1920) for more details.
District of Columbia	Yes	1896	The law created a board of medical supervisors, which administered examinations. Persons practicing midwifery without a license were subject to a fine of not more than $500 and/or imprisonment for up to 90 days. See District of Columbia Health Department (1909) for the full text.
Florida	Yes	1931	The law required that applicants be at least 21 years of age, sponsored by two practicing physicians, be able to read "the Manual for Midwives intelligently", and show evidence "of habits of cleanliness". Applicants were required to have attended 15 deliveries under the supervision of a licensed physician or to have graduated from a school for midwives recognized by the State Health Officer. See Hanson (1931) for the full text of the law.
Georgia	Yes	1925	Midwives were required to receive basic instruction from public health nurses in order to be certified. Beginning in 1956, applicants

			had to be of "good character and sound mind." Under the new requirements, applicants who were not previously certified had to complete a course of instruction approved by the Georgia Department of Public Health and were required to pass an examination. Previously certified midwives were required to receive "periodic instruction made available to them each year in order to maintain eligibility for certification." See Georgia Department of Public Health (1928), Cadwallader (1957), Georgia (1957), Pennell and Stewert (1968), and Warsh (2010, pp. 108-109) for details.
Idaho	No		A 1908 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913).
Illinois	Yes	1877	The law came into effect on July 1, 1877. It created the State Board of Health, which was empowered to examine midwives (and physicians) who had not graduated from a medical institution "in good standing". Persons practicing midwifery without a license were subject to a fine of not more than $500 and/or imprisonment up to 365 days. See Illinois State Board of Health (1884), Egan (1910), and Sandvick (2009) for more details.
Indiana	Yes	1897	The law came into effect on April 14, 1897. It required applicants to have graduated from a recognized school of midwifery or pass an examination given by the Board of Medical Registration and Examination. Persons practicing midwifery without a license were subject to a fine of not less than $25 and not more than $500 (Egan 1910; van Blarcom 1913; Burns 1914, pp. 142-144; Pennell and Stewart 1968).
Iowa	No		The practice of midwifery was unregulated until 1978, when it was prohibited AG's opinion (Egan 1910; Pennell and Stewart 1968; Butter and Kay 1988).
Kansas	No		Under a 1911 law, midwives were required to register with the local registrar of vital statistics (van Blarcom 1913).
Kentucky	Yes	1919	Established in 1919, the Bureau of Child Hygiene was tasked with instructing, examining and licensing midwives "through county health officers". See Kentucky (1922) for the full text of the law.
Louisiana	Yes	1894	The law required examination by the Board of Medical Examiners, but exempted the "so-called midwife of the rural districts and plantation practice, who, in the sense of this act, are not considered as practicing midwifery as a profession." Persons practicing midwifery without a license were subject to a fine of up to $100 (Louisiana 1904; Duffy 1962, p. 409; Pennell and Stewart 1968).
Maine	No		A 1903 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913).
Maryland	Yes	1910	The law came into effect on July 1, 1910. It required examination by the State Board of Health. Applicants were also required to provide a "certificate from a legal practitioner of medicine…that he or she has attended at least 5 cases of childbirth", and had to provide certificates from three "reputable citizens" attesting that the applicant was of good moral character. See Maryland (1914) for the full text of the law.
Massachusetts	No		The practice of midwifery was prohibited by the Medical Practice Act

			of 1894 (Declercq 1994).
Michigan	No		The practice of midwifery was (and remains) unregulated (Egan 1910; Pennell and Stewart 1968; Butter and Kay 1988; Gray 2015).
Minnesota	Yes	1891	The law came into effect on April 20, 1891. It required applicants to have graduated from a recognized school of midwifery or pass an examination administered by the Board of Medical Examiners. Practicing midwifery without a license was subject to a fine of up to $50 or imprisonment of up to 30 days. See Minnesota (1891) for the full text of the law. Also see Egan (1910).
Mississippi	Yes	1921	Beginning in 1921, the Bureau of Child Welfare provided instruction to midwives and required them to be certified. Applicants were judged based on character, cleanliness, intelligence, and "reputation for calling a doctor in difficult or abnormal cases". See Mississippi Board of Health (1921) for more details.
Missouri	Yes	1901	Applicants had to pass an examination administered by the State Board of Health. Women who did not practice midwifery as a profession and did not charge for their services were not required to obtain a license. Persons practicing midwifery as a profession without a license were subject to a fine of up to $50 or imprisonment of up to two months. See Missouri (1909) for the full text of the law. Also see Perry (1983).
Montana	No		The practice of midwifery was unregulated until 1978, when it was prohibited AG's opinion (Egan 1910; Pennell and Stewart 1968; Butter and Kay 1988).
Nebraska	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Nevada	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
New Hampshire	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
New Jersey	Yes	1892	Under the law, applicants were required to have 6 months of training from a legally incorporated school of midwifery and pass an examination given by the Board of Medical Examiners. Practicing midwifery without a license was punishable by a fine of not more than $50 and/or imprisonment of up to 30 days (New Jersey State Board of Medical Examiners 1902). In 1910, the law was amended to require two years of training (van Blarcom 1913; Levy 1921).
New Mexico	Yes	1937	A 1901 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913). The 1937 law provided for licensure by examination and set penalties for practicing midwifery without a license (Pennell and Stewart 1968).
New York	Yes	1913	Applicants had to be at least 21 years of age, be able to read and write, and be of "good moral character". These requirements came into effect on November 16, 1914 except in New York City and Rochester (New York Department of Health 1915; Williams 1915). As of January 1, 1915, applicants were required to show evidence of "habits of cleanliness" and to have graduated from a recognized midwifery program or provide a statement from a licensed physician attesting that the applicant had attended and received instruction in at least 15

			deliveries (Williams 1915).
North Carolina	Yes	1935	The practice of midwifery was unregulated until a 1908 law required midwives to wash hands before touching a patient and banned women who were addicted to drugs or alcohol from the practice of midwifery (van Blarcom 1913). In 1917, midwives were required to register with the Board of Health (North Carolina 1920). In April of 1935, midwives were required to obtain a permit from the Board of Health, "under rules and regulations which it shall adopt with respect thereto…" Practicing midwifery without a permit was punishable by a fine of not more than $50 or imprisonment of up to 30 days. See North Carolina (1935) for the full text of the law.
North Dakota	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Ohio	Yes	1896	Applicants were required to pass an examination administered by the State Board of Medical Registration and Examination. Practicing midwifery without a license was punishable by a fine of not less than $25 and not more than $100. See Laning (1896), Ohio (1905) and Egan (1910).
Oklahoma	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Oregon	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Pennsylvania	Yes	1913	Beginning in 1914, applicants were required to pass an examination administered by the Bureau of Medical Education and Licensure and penalties for practicing midwifery without a license came into effect (van Blarcom 1913; Pennsylvania State Department of Health 1913, pp. 8-9; Stevens 1914, p. 404; Miller and Baker 1916, p. 1000).
Rhode Island	Yes	1918	The law came into effect on July 1, 1918. It required applicants to be examined by the State Board of Health and stipulated penalties for practicing midwifery without a license. Persons practicing midwifery without a license were subject to a fine of up to $100 and/or imprisonment of up to 6 months. See Rhode Island (1918) for the full text of the law.
South Carolina	Yes	1920	Midwives were required to receive basic instruction from public health nurses in order to obtain a permit. Beginning in the early 1940s, midwives were required to be able to read and write, "see well, have average intelligence, and be in good general health." New midwives were required to attend a two-week course of instruction "at an annual State or district midwife institute" before receiving a certificate "at the discretion" of the county health officer. Certified midwives were required to attend "a two weeks institute every four years." See Dodd (1920), South Carolina (1960), and Hill (2012) for details.
South Dakota	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Tennessee	No		The practice of midwifery was unregulated (Egan 1910; van Blarcom 1913; Pennell and Stewart 1968; Butter and Kay 1988).
Texas	Yes	1907	The Medical Practice Act required applicants to be 21 years of age, of good moral character, and to have graduated from a "bon fide,

			reputable" medical school. Applicants were examined by the Board of Medical Examiners in obstetrics, but the law did "not apply to those who do not follow obstetrics as a profession, and who do not advertise themselves as obstetricians or midwives". Persons practicing obstetrics without a license were subject to a fine of up to $500 and/or imprisonment of up to 6 months. See Daniel (1910), Egan (1910), and Texas (1916) for more details.
Utah	Yes	1907	The law required a license to practice obstetrics, but permitted the practice of obstetrics "in case of emergency" and in communities "where there are no licensed practitioners". Applicants were required to pass an examination administered by the Board of Medical Examiners. See Egan (1910) for more details.
Vermont	No		A 1906 law stipulated that the practice of midwifery be unrestricted (van Blarcom 1913).
Virginia	Yes	1919	The law required that midwives register with the local registrar and "obey the sanitary rules of the State Board of Health." Persons convicted of practicing the profession of midwife without a permit were subject to a fine in "a sum not less than ten dollars and not more than fifty dollars". See Virginia (1918) and Pennell and Stewart (1968).
Washington	Yes	1917	The law required that applicants receive 14 months of training from a "legally incorporated school on midwifery in good standing" and pass an examination administered by the Board of Medical Examiners. Any person practicing midwifery without a license "shall be deemed guilty of a misdemeanor". For details see Washington (1919), Smith (2005, pp. 55-56), and Varney and Thompson (2016, p. 143).
West Virginia	Yes	1925	The law into effect on January 11, 1926. Applicants for licensure had to be at least 21 years of age, able to read and write, show habits of cleanliness, and have good moral character. A diploma from a school of midwifery or a physician's statement verifying that the applicant had attended at least five births was required. Only licensed midwives could accept compensation, but "nothing contained in this article shall prevent a neighbor or friend from rendering assistance" in an emergency. See Bickley (1990) for more details.
Wisconsin	Yes	1909	The law came into effect in December, 1909. It required applicants to have graduated from a reputable midwifery school, pass an examination administered by the Medical Board of Examiners, and furnish evidence of "good moral and professional character". To be considered reputable, a school had to offer at least 12 months of instruction and practical experience in at least 20 "cases of confinement". See Wisconsin (1909) for the full text of the law.
Wyoming	Yes	1899	Examination and licensure by the State Board of Medical Examiner (van Blarcom 1913; Pennell and Stewart 1968). The law allowed the practice of obstetrics or midwifery without a license "in cases of emergency". See Wyoming (1899) for the full text of the law.

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Appendix Table 2. Midwifery Ordinances 1900-1925

City and State	Year Ordinance Adopted	Description
Alexandria Virginia	1912	Adopted on July 23, 1912. Applicants were examined by the health officer of the city. Persons found guilty of practicing midwifery without a license were subject to a fine of "not less than $5 nor more than $100".
Birmingham Alabama	1918	The ordinance came into effect on January 1, 1919. It required receipt of a permit from the Board of Health of Jefferson County Alabama in order to practice midwifery in the city of Birmingham. The Jefferson Board of Health was required to administer an examination to applicants, who had to provide proof that they were of good moral character and free of communicable diseases.
Jacksonville, Florida	1913	Effective April 1, 1914. Applicants had to pass an examination administered by the city board of health. The city board of health, in turn, was required to provide instruction free of charge. "No test of the literacy or the education of the applicants shall form part of the examination". Any person "to assist for a compensation of any kind a woman in normal childbirth" was subject to the ordinance. Violation of the ordinance was punishable by a fine of not more than $25 or imprisonment of up to 30 days.
Los Angeles, California	1910	Applicants were required to pass an examination administered by board of health. The board of health was also tasked with investigating the applicant and refusing permits to those with a criminal history and to those found to have committed immoral acts. Practicing midwifery without a permit was punishable by a fine of up to $500 and/or imprisonment of up to 6 months.
Marquette, Michigan	1915	Applicants had to be 21 years of age, able to read and write, and pass an examination administered by the city health officer. Based on the results of the examination, her qualifications and her "experience as a midwife", the city health officer was authorized to certify the applicant. Violation of the ordinance was punishable by a fine of up to $50 or imprisonment up to 90 days.
Memphis, Tennessee	1910	Effective August 9, 1910. Applicants were required to pass an examination administered by the superintendent of health. In addition, applications for a permit had to be signed by at least three "reputable citizens and taxpayers of the city of Memphis, who certify to the good character of the applicant". Practicing midwifery without a permit was punishable by a fine of not less than $5 but not more than $50. Anyone acting as a midwife for "hire or compensation" was subject to the ordinance.

New York, New York	1907	The law required midwives to obtain a permit issued by the New York City Board of Health. According to the rules adopted by the Board of Health in 1908, applicants were required to have attended at least 20 deliveries under the supervision of a physician. In addition, applicants had to be 21 years of age, of "moral character", able to read and write, and "show evidences…of habits of cleanliness". The homes and equipment of midwives had to be available for inspection "at all times". New rules took effect on April 1, 1914. Under the new rules, applicants were required to have graduated from a registered school of midwifery.
Norfolk, Virginia	1912	Adopted July 16, 1912. Applicants were required to receive a permit from the city health commissioner who was empowered to "refuse such permit in any case where in his judgement it is not advisable to grant the same". Violations of the ordinance were punishable by a fine of up to $20.
Raleigh North Carolina	1912	Adopted on July 19, 1912. Midwives were required to register in the office of the board of health and provide the name and location of the "college or school or other institution from which such person received a diploma, certificate or license". Neglecting to register was punishable with a fine of $10 per day.
Richmond Virginia	1921	Adopted on June 3, 1921. Applicants were required to pass an examination administered by the Midwife Examining Board. The first exams were administered on August 29, 1921. Beginning in August, the health officer of the city offered instruction in midwifery, which was "well attended" (Richmond Department of Health 1922). In addition to receiving instruction in midwifery and passing the exam, previous experience as a midwife was taken into account when issuing permits. A 1910 city ordinance required registration (van Blarcom 1913).
Syracuse New York	1913	Effective April 7, 1913. Midwives were examined and licensed by the Board of Examiners in Midwifery, appointed by the mayor. Applicants had to be 21 years of age. The board was empowered to exam applicants "as to their moral character and qualifications to practice midwifery". Violation of the law was punishable by a fine not less than $50 but not more than $100. According to the New York Department of Health (1915), the city of Syracuse "has not exercised any systematic supervision of the midwives licensed".
Winston-Salem NC	1919	Effective September 1, 1919. Applicants were required to pass an exam administered by the city health officer "or physicians designated by the city health officer for this purpose". The ordinance required that "all

		reasonable aspetic precautions" be employed and prohibited the application of "grease or any other lubricant to the private parts of the patient".

Sources for Appendix Table 2:

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Syracuse Midwifery Act, Chapter 227. Source: *Charter of the City of Syracuse Consisting of Second Class Cities Law and Special Statutes Together with General Ordinances, and Rules and Regulations of the Boards, Bureaus, Offices and Departments of the City of Syracuse* (1915).

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