London School of Economics and Political Science

Delivering Disparity:
Black Maternal and Infant Health Policies and Practices in the Jim Crow South

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Abstract

This thesis investigates the persistence of racial disparities in maternal and infant health outcomes in the 20th-century American South by looking at three different contexts: a state-level public health program, a federal investment in hospital infrastructure, and case-level records from a leading Black hospital. These contexts provide a multi-lens analysis of the policies and practices shaping Black maternal and infant health within the racially discriminatory social environment of the Jim Crow South.

The first paper analyses Florida's Midwife Program (1933–1960) using a social capital framework to assess how knowledge transfers and peer networks influenced maternal health. While the program succeeded in spreading hygienic practices among midwives through strategies such as philanthropic support and racial matching, it struggled to foster collaboration with physicians, limiting its long-term impact and contributing to widening racial disparities in maternal mortality as physicians monopolised control over new life-saving technologies. The second paper evaluates the Hill-Burton Act's effect on racial health outcomes using a difference-in-difference approach across six Southern states. It finds that federal funding for hospital infrastructure significantly increased hospital births—especially among Black mothers—and reduced stillbirth rates but had minimal impact on infant mortality and Black-white health disparities. The third paper focuses on Lincoln Hospital, a leading Black hospital in Durham, North Carolina, to examine why stillbirth disparities across race persisted despite medical advances. Drawing on delivery room records from the prestigious, Black-led hospital, the study finds that limited access to surgical training among Black physicians constrained the adoption of life-saving interventions like caesarean sections.

Across all three studies, the thesis highlights that improvements in medical technology and access alone were insufficient to eliminate disparities. Instead, social structure, institutional design, and unequal access to professional opportunities critically shaped the reach and equity of healthcare delivery in the South.

Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work.

Acknowledgments

Two years before beginning my PhD in Economic History, I was in Cowpen, Belize serving as a Rural Health Educator in the Peace Corps. A focus of my work there was in maternal and infant health. Working in a satellite clinic with Nurses Rosa and Moreira impressed upon me the importance of quality healthcare during pregnancy and early life. It was also during this time that I emailed Eric Schneider about his work on historical childhood stunting rates. His quantitative historical approach to health issues inspired my pursuit of an MSc in Economic History at the LSE. Soon, the MSc would carry over into a PhD, and Eric would become my trusted PhD supervisor.

I have received substantial support from Eric. He has been my intellectual sounding board, diligent editor, honest critic, and sincere friend throughout this entire process. I have learnt so much about the craft of research from Eric. The researcher I am today is greatly indebted to his generous dispensations. His supervision was complemented perfectly by Sara Horrell. Aside from being generous with her time and advice, Sara offered excellent feminist and English perspectives on maternal health and women's history. This thesis is dedicated to them.

I would also like to thank several academics who have inspired, assisted, and guided me through this research: Jane Humphries, Neil Cummins, Patrick Wallis, Heidi Williams, Martin Gaynor, and Karen Thomas. My PhD cohort — the best social and intellectual support group — deserves credit for their unwavering support, especially Nick Fitzhenry, my fellow economic historian of health. I have appreciated the opportunity to share this work and receive feedback at academic conferences and seminars. Thank you to all those attentive audiences. I also thank my examiners, Anne Løkke and Melissa Thomasson, for reading the whole thesis so carefully and thoughtfully.

I am grateful for the support of my friends and family. Despite being an ocean away, the encouragement from my mom, dad, sister, and brother always felt close. My friends, Adam and Raphaël, have been fantastic housemates for the last four years. They provide endless banter and countless moments of respite to balance out the research process. Most importantly, my partner, Rachel, has been a steadfast believer in me and helped me through the not-always-easy process of doctoral research by listening attentively, advising thoughtfully, and caring deeply.

Finally, behind the data presented in this thesis are lives and deaths of countless individuals. Some lived lives of inspiration, dutifully pursuing vocations to improve the well-being of their neighbours. Many passed too early, leaving wells of grief in the hearts of their loved ones. These tragedies deserve attention so that fewer and fewer occur in the future. History lends this attention and, when done well, shapes a better future. May this work not miss that mark by much.

Matthew Thomas Purcell

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Chapter 1: Introduction

Racial disparities in maternal and infant health have long stood as a central feature of inequality in the US South. From the early- to mid-20th century, Black mothers and infants in the region suffered the highest rates of maternal mortality, infant death, and stillbirth. Deep-rooted racial segregation and discrimination shaped these outcomes through unequal access to public goods, housing, employment opportunities, and medical care. This thesis investigates the structural, institutional, and professional causes of these disparities by using three different settings: Florida's Midwife Program, the federal Hill-Burton Act, and Lincoln Hospital, a preeminent Black hospital in North Carolina.

The following chapters explore how maternal and infant healthcare services evolved in each of these settings and shaped the health outcomes of Black mothers and infants in the US South. By integrating social capital theory, infrastructure-focused policy analysis, and a close institutional study of surgical capacity, the thesis uses multiple lens to understand the history of racial disparities in maternal and infant health. In doing so, it draws on a combination of data sources, including institutional archives, county-level health statistics, and previously unexamined delivery room records from Lincoln Hospital.

Childbirth occupies a pivotal role across all three of these settings. Policy and technological changes reshaped who provided care and what type of care a pregnant mother received—particularly in relation to antibiotics, surgical techniques, and hospital access. Changes to policy and practices affected not only the skills of birth attendants but also the availability of life-saving medical interventions such as antibiotics or caesarean sections.

I will analyse policy- and technology-based changes that affected three health outcomes: maternal mortality, infant mortality, and stillbirths. Across the early- and mid-20th century, all three outcomes improved in an absolute sense. However, within the US South, this improvement was accompanied by widening disparities in the relative rates experienced by Black and white populations. Understanding why those gaps persisted requires a close look at the institutional environments in which childbirth occurred.

As national population health improved in the early- to mid-20th century, national disparities between racial groups narrowed but remained far from equalised. Boustan and Margo (2015) identified that the narrowing of racial health disparities occurred through two stages. First, infant mortality disparities narrowed between 1920 and 1945. Second, there was a narrowing of life expectancy gaps between 1940 and 1960. Recent research has pointed out that this narrowing might have been driven by vital statistics becoming more accurate over time rather than genuine health improvements (Eriksson et al., 2018). Inaccurate vital statistics, which were more of an issue in the rural regions where much of the US's Black population lived, caused an upward bias in infant mortality rates due to the undercounting of live births. With this evidence in mind, the story of racial disparities across the early- to mid-20th century in the US has a throughline of persistent racial inequalities rather than an arc of lessen inequalities.

Much of the literature looking at the evolution of racial health disparities during the early- to mid-20th century has focused on the effects of the Great Migration, in which six million Black Americans moved out of the US South between 1910 and 1970. There is reason to believe moving to urban areas might have improved the health of Black Americans. Migrating has been linked to higher wages, and better living standards are associated with better health outcomes (Collins and Wanamaker, 2014). However, the effect on health of migrating out of the South is not consistent nor always positive. Black et al. (2015) showed that migrating led to an increase in overall mortality. Niemesh and Eriksson (2016) find that infants born to early migrants were 8.9 percentage points more likely to die than their southern counterpart. This gap diminished over time, so that infant mortality rates between migrants and non-migrants were indistinguishable by 1940.

Despite the large migration of Black Americans out of the US South, the region continued to have the largest concentration of Black Americans. Between 1930 and 1960, which covers the bulk of this thesis's period, 19 percent of the southern Black population emigrated. In terms of regional shares, this change in population dropped the US South from having 79 percent of America's Black population to 60 percent of the America's Black population living within the US South (Gibson et al., 2002). By focusing on the impact of policy- and technology-based changes within the US South, the thesis magnifies the ways in which racial health disparities evolved in the region home to the largest number of Black Americans.

Moreover, no other region had as pervasive a relationship with legal racial discrimination as the US South during this period. Jim Crow legislation codified racial segregation, limiting Black Southerners' access to quality public education and employment opportunities among other things. The overt and oppressive imposition of racial segregation and discrimination in the US South affected the health of the region's Black population (Adkins-Jackson et al., 2025). Infant health, in particular, was negatively impacted by racial residential segregation in both urban and rural areas based on research covering the early-20th century (Karbeah and Hacker, 2023 & Beach et al. 2022). Modern public health research finds an association between racial residential segregation and stillbirth rates (Williams et al., 2018).

Racial tensions in society influenced the relationship between the medical establishment and Black patients. Mistrust between Black communities and the predominantly white medical profession contributed to worse health outcomes for Black individuals (Eli et al., 2023. & Alsan et al. 2019). The indebtedness of modern obstetrical surgery to the inhumane experiments performed by Dr J. Marion Sims on enslaved Black women captures the interplay between race and medicine. Indeed, the practice of chattel slavery caused masters and physicians to take a perverse interest in the health of enslaved pregnant women and infants, which increased levels of medical distrust among Black women (Cooper, 2017 & Schwartz, 2006). While it is difficult to know how much distrust from the antebellum era carried on into the 20th century, studies on the enduring effects of other historical traumas, such as the Tuskegee Syphilis Study, have documented their lasting negative impact on trust in healthcare (Alsan et al. 2020).

Qualitative studies of Jim Crow era segregation within the Southern hospital system stress the inferior quality of care in Black-serving facilities due to a combination of resource constraints and staffing issues (Beardsley, 1986 & Gamble, 2011). Segregated hospital care appeared in two forms either by separate hospitals each serving a specified race or by one large hospital with segregated wards (Thomas, 2011). Chapter 3 and 4, which study the Hill-Burton Act and Lincoln Hospital, build on our understanding of hospital care in the Jim Crow South by doing quantitative analyses at both a county and institutional level.

The thesis resonates with the critique found in *Southern Progressivism,* which emphasized the unique nature of reform in the Jim Crow South. Southern reformers wanted a "new and more harmonious social balance," blending material progress with an entrenched,

unaltering racial hierarchy (Grantham, 1983, p. 417-418). The limitation that structural racial discrimination placed on progress is a recurrent theme throughout this thesis.

To analyse the institutional and policy-driven dynamics outlined above, this thesis centres on three core health outcomes: maternal mortality, infant mortality, and stillbirth. Before outlining the chapters that follow, the rest of this introduction defines each of these outcomes, outlines their major causes or classifications, and situates them within the broader historiography of health disparities and reform.

1.1 Maternal and Infant Health Outcomes

The choice to focus on maternal and infant health outcomes is motivated in part by their longstanding role as vital indicators of the social, economic, and medical conditions of a population (Reidpath & Allotey, 2003 and Gonzalez & Gilleskie, 2017). Across the mid-20th century, the United States saw substantial improvements in these outcomes as maternal mortality, infant mortality, and stillbirth rates declined. These gains did not occur by chance: they were shaped by an era of intense public health activity and policy investment aimed at improving birth outcomes through hygiene education, prenatal care, and expanding hospital infrastructure.

At the same time, childbirth itself was undergoing a profound medical transformation. Births increasingly shifted from homes to hospitals, bringing mothers and infants into closer contact with the expanding tools of modern obstetrics, especially antibiotics, which reduced the risk of puerperal infections and made more invasive surgical interventions safer for both mother and child. Together, these trends make maternal and infant health outcomes a fertile area for research into how government policy, technological innovation, and clinical practice intersected to shape the health of Black and white communities differently during this pivotal period.

1.1.1 Maternal Mortality and Its Leading Causes

Maternal mortality refers to deaths due to complications from pregnancy or childbirth that occur during pregnancy or within 42 days of childbirth. In the early- to mid-20th century US South, three medical causes predominated: puerperal sepsis, toxaemia of pregnancy (now typically referred to as pre-eclampsia or eclampsia), and haemorrhage.

Puerperal sepsis, a bacterial infection following childbirth, was historically the leading cause of maternal death before the advent of antibiotics. Antibiotics led to a significant decline in deaths from puerperal sepsis (Loudon, 1992, p. 84). Before antibiotics, hygiene and aseptic techniques adopted by birth attendants were the major preventive measure available. Historical studies have documented the impact of having birth attendants adopt these techniques on maternal mortality (Løkke, 2002; Woods et al. 2006; Anderson et al., 2020; Lazuka, 2018; and Kotsadam et al., 2022). Florida's Midwife Program, the context for Chapter 2, hoped to decrease rates of puerperal sepsis through educating the state's midwife workforce in the importance of hygiene and aseptic technique.

Pre-eclampsia and eclampsia, which were called toxaemia in the early-20th century, were and remain today both poorly understood and major causes of maternal mortality. High blood pressure and elevated levels of the protein albumin in the urine are the typical first sign of pre-eclampsia. As symptoms develop, malaise, blurred vision, and headaches follow. Severe cases develop into eclampsia and are extremely dangerous, ending in convulsions and the possibility of death from kidney failure or cerebral haemorrhaging (Ferris & Francisco, 1982).

Haemorrhage, including antepartum haemorrhage from placenta previa or placental abruption, and postpartum haemorrhage due to uterine atony or retained placental fragments, were another major cause of maternal mortality. These cases often needed emergency surgery to save the life of the foetus and/or mother.

These three conditions were all theoretically manageable with monitoring and skilled birth attendants. With the proliferation of antibiotics and expansion of prenatal services over time, mortality rates from these causes decreased. Inequalities in care played a central role in fatal cases as medical knowledge increased over time.

1.1.2 Infant Mortality: Neonatal vs. Post-neonatal

Infant Mortality is defined as death within the first year of life. It can be divided into two categories: neonatal mortality (deaths within the first 28 days) and post-neonatal mortality (deaths from 28 days to one year) (Porta, 2014). This distinction is crucial, since the types and burdens of disease-causes for each category vary. Neonatal mortality is most closely tied to the

circumstances of delivery and immediate postnatal care. Post-neonatal mortality, by contrast, is more heavily influenced by the home environment, infant nutrition, and access to follow-up medical care.

In the 1980s, scholars noted the different extents of racial disparity across these two measures of infant mortality using data from the National Infant Mortality Surveillance project. Black infants had a neonatal mortality rate 1.6 times higher than white infants and a post-neonatal mortality rate that was 2.1 times higher than white infants (Sappenfield et al., 1987). The authors attributed the neonatal mortality disparity to inadequate access to quality hospital care, premature births, and low birth weight, while the post-neonatal mortality disparity was attributed to structural inequities in living conditions and preventive care persisted after hospital discharge. By parsing these categories, chapter 3 of this thesis more precisely identifies where state intervention, namely the subsidising of hospital construction, made, or failed to make, an impact on infant health.

1.1.3 Stillbirths: Antepartum vs. Intrapartum

A stillbirth is defined as the death of a foetus at 20 weeks of gestation or later. Clinically, stillbirths are classified into antepartum (death before the onset of labour) and intrapartum (death during labour). This thesis focuses primarily on intrapartum stillbirths, which are more directly responsive to the quality of birth attendance and obstetrical care (Woods et al. 2006 & Schneider, 2017).

Løkke's (2012) analysis of Danish maternity ward data from 1917–1967 illustrates the distinction. Intrapartum stillbirths were most frequently associated with preventable causes such as breech presentations, obstructed labour, or cord prolapse. All of which could be addressed with caesarean section or timely obstetrical intervention. Unlike antepartum stillbirths, which stem from chronic maternal health conditions, infections, or congenital anomalies, intrapartum deaths are highly sensitive to clinical vigilance and surgical capacity. By focusing on intrapartum stillbirths, chapter 4 emphasises the effects of medical training access and birth attendant skill capacity. In settings where birth attendants lacked training or access to surgical support, foetuses with known complications did not receive life-saving interventions.

1.2 Maternal and Infant Health Trends

Maternal mortality rates have a similar general pattern across the 20th century for several nations. They start high with rates between 20 and 80 deaths per 10,000 live births in the 1920s and remain stagnant up until 1936. From then on, rates fall dramatically, converging to around 4 deaths per 10,000 live births (Loudon, 1992, p. 150-154). Within these international rates, the United States had some of the highest rates of maternal mortality but did converge with peers like England and Wales and the Netherlands by 1960. The United States' maternal mortality rate was 68.9 in 1920 compared to 43.3 in England and Wales, then 37.6 in 1940 compared to 26.1 in England and Wales, then 3.7 in 1960 compared to 3.9 in England and Wales (Loudon, 1992, p. 154).

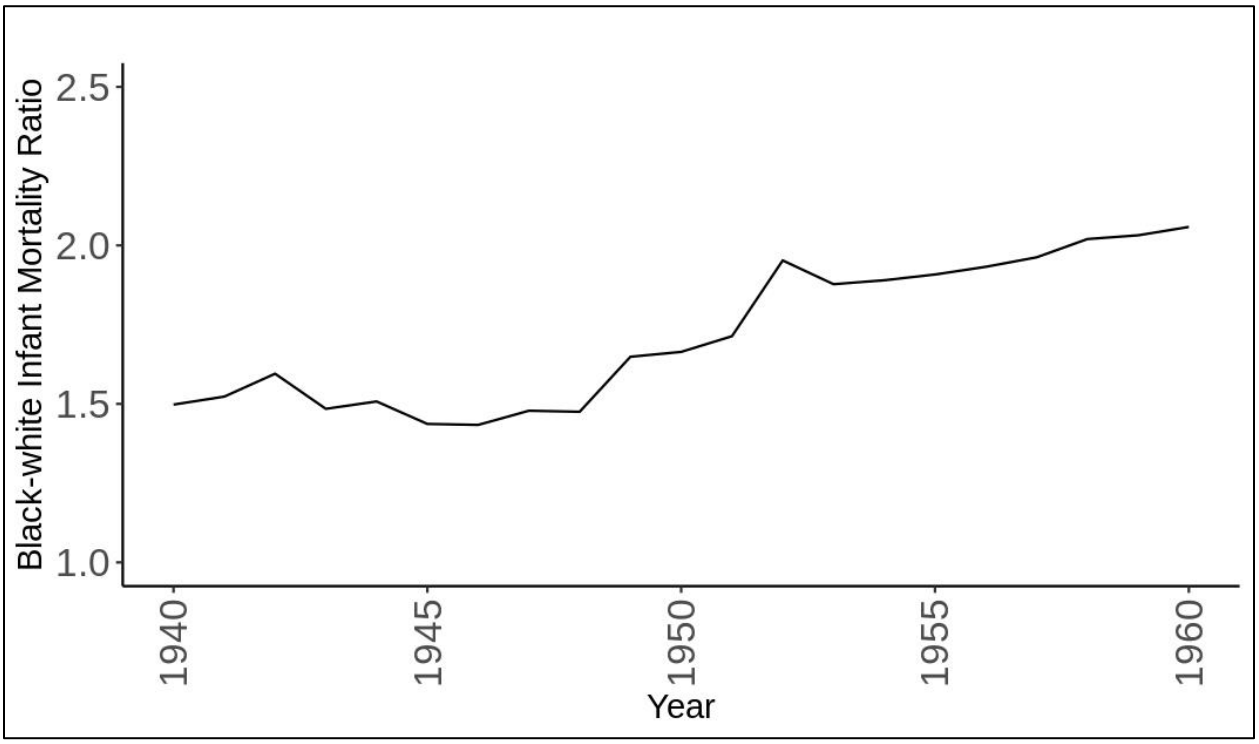
Within the United States, the highest maternal mortality rates in the early-20th century 'were largely confined to the south' (Loudon, 1992, p. 372). Southern Black women experienced some of the highest maternal mortality rates. In Florida, for example, the Black maternal mortality rate was 110.8 deaths per 10,000 live births in 1933, compared to 56.2 per 10,000 live births for white mothers. By 1960, Black mothers saw a decline in their maternal mortality rate to 19.3 per 10,000. The maternal mortality rate for white mothers substantially declined as well to 4.3 per 10,000 live births (Florida State Board of Health, Annual Report, 1961). Therefore, on absolute terms both racial populations saw dramatic declines in maternal mortality rates. However, the relative rates widened from a Black-white maternal mortality ratio of 2 to 4.5.

Infant mortality in the United States declined significantly over the 20th century, though the decline was uneven across racial lines. In 1940, the national infant mortality rate stood at 47 deaths per 1,000 live births. By 1960, it had fallen to 26 (Singh & Yu, 1995, p. 960). However, these national averages obscure the extent to which racial disparities in infant mortality widened during the 1950s. Among white infants, infant mortality rate declined steadily throughout the decade. Among Black infants, by contrast, rates plateaued and even increased, contributing to a rapid expansion of the racial gap in infant mortality during this period.

In the US South, Black infant mortality rates initially fell along with white rates in the early 1940s. However, by 1950, a reversal occurred: white infant mortality rate continued to

decline, while Black infant mortality rate stagnated and, in some areas, worsened. By the end of the decade, the Black infant mortality rate in these states exceeded its 1946 level, resulting in a Black-white infant mortality ratio that rose from 1.5 to over 2.0 (US Vital Statistics; FIGURE 1.1).

FIGURE 1.1: Black-white Infant Mortality Ratio for US South



Source: US Vital Statistics 1940-60, CDC/National Center for Health Statistics

The racial divergence was driven by trends in post-neonatal mortality. The Black-white post-neonatal mortality ratio (2.2) was higher than the Black-white neonatal mortality ratio (1.5) in 1950. The gap between the two infant mortality categories grew across the next decade as the Black-white neonatal mortality ratio rose by 10 to 12 percent, while the post-neonatal mortality ratio rose by 22 to 28 percent (Singh et al. 1995).

Thus, while national population figures suggest steady progress in infant health during the 1950s, the southern Black experience was marked by falling behind. Infant mortality disparities increased as white infants experienced a small decline, and Black infants reversed course. Chapter 3 will explore this dynamic further, investigating the impact of federal investments in the region's hospital infrastructure.

Stillbirth rates followed a similar trajectory to maternal mortality rates over the early- and mid-20th century. Stillbirth rates across various national contexts moved towards convergence after World War II despite considerable national differences in the 1920s and 1930s (Woods, 2009, p. 76). In the US, stillbirth rates went from 34 foetal deaths per 1,000 total births in 1930 to 12 foetal deaths per 1,000 total births in 1960 (Woods, 2002 p. 85 & Wou, 2014).

Black stillbirths declined by 63.3 percent between 1930 and 1960 nationally, while white stillbirths declined by 57.1 percent. In the 1930s, the Black-white stillbirth ratio was around 2.3. The ratio narrowed to 2.0 by 1960 (Sánchez-Barricarte, 2024, p. 82-83). Data on stillbirths in the US South is not well reported before the 1940s. Based on data from 1940 to 1960, the region experienced a slight widening of the racial stillbirth ratio from around 2.0 to 2.2 (CDC/National Center for Health Statistics). Again, in the US South, absolute gains in stillbirth rates across both Black and white populations were paired with a widening of the Black-white stillbirth ratio.

Importantly, the decline in stillbirths was not uniform across gestational ages. Across the mid-20th century, the share of stillbirths dropped most dramatically in later gestational ages—36 weeks or more (Sánchez-Barricarte, 2024, p. 89). This trend implies that the likelihood for a full-term pregnancy to result in a stillbirth was declining over time. Two major theories have been put forward to explain the trend: improved maternal health and improved obstetrical care. I will discuss these theories in more depth in the following section.

Trends of maternal mortality, infant mortality and stillbirths underscore a critical paradox: while maternal and infant health outcomes improved substantially in absolute terms between 1930 and 1960, Black communities fell further behind in relative terms. Gains in hospital access, obstetrical knowledge, and hygiene practices contributed to declines in mortality and stillbirth for both Black and white populations. However, those improvements did not erase inequalities. Racial disparities in maternal mortality and stillbirth rates persisted or even

widened, and infant mortality disparities—especially post-neonatal mortality—grew significantly during the 1950s. These patterns suggest that health reform and technological advances were constrained by structural racism and unequal institutional capacity, a dynamic explored in the chapters that follow.

1.3 Determinants of Health and Racial Health Disparities

Explanations for the dramatic improvement in maternal and infant health outcomes during the early- to mid-20th century typically fall into three broad schools of thought: economic growth and improved living standards, public health interventions, and biomedical innovation. Each has merit in explaining declining rates of maternal mortality, infant death, and stillbirth.

The first perspective argues that much of the historical gain in health resulted from rising incomes, which improved nutrition, housing conditions, and general living standards (McKeown 1976). Others, like Cutler and Miller (2005), Alsan and Goldin (2019), and Troesken (2002), have highlighted the importance of investments in urban water and sewerage systems as critical public health infrastructure that reduced infectious disease and lowered infant mortality in cities. However, these explanations tell us relatively little about the US South during this period. The region remained predominantly rural and economically underdeveloped well into the mid-20th century, with lower rates of industrialisation, slower income growth, and limited municipal infrastructure outside major cities. For the many rural Black families whose births occurred outside cities, improvements driven by urban sanitation or rising wages were uneven or delayed.

A second perspective stresses the role of public health campaigns, particularly in improving infant and maternal health in rural areas. Programs under the Sheppard-Towner Act (1921–1929) and local health department efforts provided education, prenatal visits, and community outreach. Moehling and Thomasson (2014) found that one-on-one visits between public health nurses and mothers had measurable effects on reducing infant deaths. Hoehn-Velasco (2018) demonstrated that county-level public health departments prevented approximately three infant deaths per 1,000 births in rural areas. These findings resonate with the Florida Midwife Program, which extended health education and hygiene standards to a predominantly rural and Black midwife workforce.

Midwifery reforms, including licensing laws and hygiene training, have been associated with improved maternal and infant health outcomes across many national settings (Løkke, 2002; Woods et al., 2006; Anderson et al., 2020; Reid, 2012; Lazuka, 2018; Kotsadam et al., 2022). However, national studies of midwifery in the US, such as Anderson et al. (2020), rely on state- or city-level data, which fail to fully capture the reality of what was a heavily rural healthcare practice by the 1920s and 1930s. National studies also understate the racial dynamics of midwifery reform in the South. Critics of southern midwifery reforms such as Susie (2009) and Bonaparte (2007) view these reforms as inherently racist, state-led campaigns to eliminate Black midwives. While racism was a factor shaping Florida's midwifery services, this thesis builds on the work of Maxwell (2009) and Mathis (1992) to argue that the Midwife Program was a genuine effort to transfer knowledge to midwives and connect midwives to the wider medical care system. The thesis shows how professional relationships shaped the program and its effort to integrate midwifery services into the developing healthcare system. Chapter 2 addresses this gap by drawing on midwife-level records as well as institutional archives from the Midwife Program to reconstruct how social capital influenced implementation and outcomes.

A third strand of research emphasizes biomedical innovation, particularly antibiotics and obstetrical technologies. Jayachandran et al. (2010) found that sulpha drugs alone reduced maternal mortality by up to 36 percent and extended life expectancy by 0.4 to 0.7 years between 1937 and 1943. Yet, their study also found that these benefits were unevenly distributed: sulpha drugs had a larger impact for white patients, suggesting unequal access or quality of care. Thomasson and Treber (2008) argue that the rise in hospital births, paired with the introduction of antibiotics, enabled physicians to perform life-saving interventions like caesarean sections with lower risk of maternal infection. However, their analysis shows that hospital care posed greater risks to Black mothers before antibiotics and was less beneficial to them after, again pointing to systemic inequalities in quality and access.

Costa (2004) highlighted how racial differences in infectious disease burdens explained most of the disparity in pregnancy outcomes in the early-20th century. The introduction of penicillin reduced the burden of many infectious diseases (Douglas, 2009; Alsan et al. 2021). One of these infectious diseases was syphilis, which Costa argued was the "primary observable explaining differences in black-white prematurity and stillbirth rates" (Costa, 2004). Therefore, in the 1950s and 1960s, medical care, including prenatal services and obstetrical care at delivery,

rose in importance as a determinant of pregnancy outcomes compared to the burden of infectious disease.

Looking at delivery records from the National Hospital of Copenhagen, Løkke (2012) developed a framework that explains a key inflection point in obstetric strategy. In the pre-antibiotic era, physicians often avoided interventions to minimize infection risk. After the introduction of sulpha drugs and penicillin, invasive procedures such as caesarean sections became safer, particularly for complicated deliveries involving conditions like placenta previa, placental abruption, and eclampsia. Løkke documents a dramatic drop in maternal infections—from 40 percent of births in 1927 to just 6 percent in 1957—and a parallel fall in maternal deaths and stillbirths. I apply this framework to the context of a Black hospital in the US South in Chapter 4. In this distinct context, bottlenecks from staff surgical capacity create unique barriers to achieving better obstetrical outcomes.

The expansion of hospital infrastructure was another critical development during this period. The Hill-Burton Act of 1946 dramatically increased the number of hospitals across the US, with an explicit goal of reducing regional disparities. Chang et al. (2016) found that the Act led to a more equal distribution of beds across rural and urban areas. Hollingsworth et al. (2024) show that similar investments by the Duke Endowment improved infant health and reduced long-run mortality in the Carolinas, with greater gains for Black infants. McCoy (working paper) is one of the few studies to assess the Hill-Burton Act's effects on mortality directly, finding county-level improvements where new hospitals were built. However, the Hill-Burton literature largely neglects two core issues. First, few studies evaluate racial disparities in outcomes, focusing instead on overall trends. Second, the South's unique experience with the Hill-Burton Act has received little scrutiny. Thomas (2011) has written an excellent historical account of the Act and its rollout within the US South, which led to the proliferation of ward-segregated public-owned hospitals. My analysis in Chapter 3 addresses both limitations. Using race-disaggregated data and a difference-in-difference model, I show that hospital construction improved access to hospitals but did not meaningfully close the racial gap in infant mortality. Rates of hospital births increased among Black mothers and Black stillbirth rates decreased relative to white populations, suggesting improvements in labour and delivery, but post-neonatal mortality continued to rise.

In sum, the existing literature explains much about the overall decline in maternal and infant mortality in the 20th century. However, it understates region-specific social and

institutional factors that shaped the implementation of policy and innovations. In the US South, racial discrimination and segregation played a central role in the persistence of Black-white health disparities even amid progress. This thesis emphasises this point through a granular, region-specific, and multi-disciplinary account of how health policy, innovations, and race affected childbirth practices and outcomes.

1.4 Outline of Thesis

This thesis is structured as a series of three papers, each addressing a different policy or institutional domain. Chapter 2 shows how social capital shaped the success and limitations of midwifery reform. Chapter 3 interrogates how federal investment in hospital infrastructure played out along racial lines. Chapter 4 enters the clinical space itself, demonstrating how human capital constraints limited the adoption of surgical practices even within a well-resourced Black hospital.

Chapter 2, titled *Networks of Care and Control: Social Capital in Florida's Midwife Program*, examines the Florida State Board of Health's Midwife Program through the lens of social capital theory. Drawing on midwife record cards, institutional reports, and archival correspondence, the chapter uses three channels of social capital—linking, bridging, and bonding—as a framework for analysing how the evolution of the public health effort shaped maternal health outcomes. While the program succeeded in reducing maternal deaths due to puerperal sepsis, it failed to integrate midwives into the expanding hospital infrastructure. Bridging ties between midwives and physicians eroded over time, especially as hospitals began to dominate the childbirth landscape and increasingly excluded midwives from public health coverage. The result was a successful transfer of basic knowledge around hygiene and aseptic technique that was limited by structural exclusion based on occupational rivalry.

Chapter 3, *The Hill-Burton Act and Early-Life Racial Health Disparities*, investigates the role of federal hospital construction funding in reshaping access to maternal and infant care across the South. Using a difference-in-difference approach on county-level data from six states, this chapter shows that the Act increased hospital births, especially among Black mothers. But the Act had an uneven impact on early-life health outcomes. White infant mortality fell, but Black infant mortality remained stagnant or worsened in some places. A breakdown of infant mortality by age of death suggests that post-neonatal determinants of health, such as poor

housing or lack of insurance, were not addressed by hospital infrastructure and underpinned the deteriorating infant mortality rates for Black infants. By contrast, stillbirth rates fell more sharply among Black populations—suggesting that obstetrical care during labour improved with expanded hospital access. This chapter contributes to both public health and policy literature by offering one of the first race-disaggregated, quasi-experimental evaluations of the Hill-Burton Act's effects.

Chapter 4, *Beyond Antibiotics: Obstetrical Interventions, Surgical Capacity, and the Persistence of Stillbirth Disparities*, looks at the obstetrical care and practices within a leading Black hospital in Durham, North Carolina: Lincoln Hospital. Using 40 years of delivery room records, the chapter examines how medical interventions like forceps and caesarean sections were employed. Despite having a strong reputation and being accredited for obstetrical training, Lincoln Hospital maintained low caesarean section rates. Bottlenecks in the surgical capacity of obstetricians drove intervention choices and pregnancy outcomes. The consequences were stark: breech births without caesareans were often stillborn, while those receiving surgical intervention were largely successful. This chapter amends the Løkke framework by showing that the adoption of medical technology was contingent on labour markets and training access. These factors were not equitably distributed in the Jim Crow South.

Together, these chapters illustrate how different domains—midwifery reform, hospital construction, and medical training—interacted to produce persistent racial disparities in maternal and infant health. By pairing historical evidence with analytical frameworks from health economics and social theory, the chapters collectively argue that racial health disparities in the US South were not simply residual gaps left behind by progress, but patterned outcomes of how policy and innovations were implemented and constrained on the ground.

1.5 Contributions

This thesis contributes to a growing body of interdisciplinary research on racial disparities in health by emphasizing the relational and institutional mechanisms through which inequality is produced and maintained. Its three primary contributions are methodological, conceptual, and empirical.

First, it introduces social capital theory as a methodological lens to historical public health research. By focusing on the quality and durability of relationships among midwives, nurses, physicians, and institutions, the analysis in Chapter 2 moves beyond binary assessments of success and failure and instead highlights how the effectiveness of reforms depended on the structure of interpersonal and inter-institutional trust. Bonding, bridging, and linking relationships affected not only knowledge transfer but also behavioural compliance and access to care.

Second, it offers an empirical assessment of the Hill-Burton Act, one of the most ambitious health infrastructure policies of the 20th century. Despite its promise, Hill-Burton's effects were uneven. While it helped close hospital access gaps, it did not close racial disparities in outcomes, particularly for infant mortality. This thesis shows that the Act's limited racial impact stemmed from two factors: a lack of integration mandates, and an inadequate response to socioeconomic disparities that extended beyond physical access.

Third, the study adapts Løkke's framework, which links the introduction of antibiotics to improvements in obstetrical care, to a new social context. Using evidence from Lincoln Hospital, this thesis demonstrates that surgical innovations only translated into improved outcomes when supported by trained labour. Structural racism in medical training and hospital staffing created bottlenecks that prevented caesarean sections from being widely performed even when clinically indicated. This suggests that human capital, shaped by segregated labour markets, must be considered as a necessary condition for intrapartum stillbirth reductions to take place after the introduction of antibiotics.

This thesis frames racial health disparities in the US South in terms of how institutional systems transformed knowledge and resources into care. In doing so, the project speaks to historians, economists, and health policy scholars interested in how health inequality persists. It also contributes to a broader reckoning with how medical progress was unevenly distributed in a society structured by segregation.

Chapter 2: Networks of Care and Control: Social Capital in Florida's Midwife Program

Abstract: This chapter examines Florida's Midwife Program (1933–1960) through the lens of social capital theory to understand how state-led maternal health reforms operated in racially segregated, rural settings. Drawing on archival data and program records, the paper uses three channels of social capital—linking, bridging, and bonding—as a framework for analysing how the evolution of the public health effort shaped maternal health outcomes. Linking channels between philanthropic institutions, such as the Rockefeller Foundation, and state health actors expanded staff capacity and enabled pedagogical innovations. Bonding among midwives fostered identity, trust, and behavioural change, contributing to a 64 percent decline in puerperal sepsis among Black mothers. However, bridging between midwives and physicians ultimately collapsed as hospitals expanded and medical professionals blocked midwives from access to clinical spaces and public health coverage. The paper contributes to historical literatures on maternal mortality, midwifery reform, and southern public health by demonstrating how social capital facilitated short-term health improvements but failed to overcome entrenched professional and racial hierarchies.

2.1 Introduction

On a humid July morning in 1935, over 100 midwives from across South Florida gathered at St. Peter Claver's Catholic Auditorium in Tampa for the opening session of the annual Midwife Institute. The auditorium, filled with women in white aprons and pressed dresses, buzzed with activity (State Archives of Florida, 1935). That day's schedule included lectures on "The Midwife Bag" and "The Physical Examination of the Expectant Mother." The six-day Midwife Institute combined midwifery instruction, public health messaging, and evening social events in a bid to reform one of the most informal, yet essential, corners of Florida's healthcare system: lay midwifery.

Among the attendees was Mattie Wilson, a 54-year-old midwife from the rural town of Coleman. Wilson was literate and educated through the fourth grade (U. S. Census, 1930 & Florida State Board of Health, Midwife Record Cards). She averaged ten deliveries per year, regularly referred patients to prenatal care, and had no recorded maternal or infant deaths in her long career. Wilson was exactly the kind of midwife that state health officials hoped to empower through education and supervision under Florida's Midwife Program.

Also seated in the Tampa auditorium was Mary Shine, a septuagenarian who had begun her life enslaved. Shine was illiterate, never formally educated, and lived in a rural area outside of Wildwood (Florida State Board of Health, Midwife Record Cards). Shine did not list midwifery as her occupation in the census (US Census, 1930). The program initially flagged her midwifery practices as "unclean" (Florida State Board of Health, Midwife Record Cards). Yet as she stayed active in the program, Shine's performance improved. She began sending mothers to prenatal clinics and referring high-risk cases to physicians (Florida State Board of Health, Midwife Record Cards). Shine embodied a different, but as important, type of promise of the Midwife Program: the possibility that rural births could be reached and integrated into the wider healthcare system through building relationships between rural midwives and the medical establishment.

Florida's Midwife Program, which began in 1932, emerged during a national crisis in maternal mortality. In 1930, the United States had higher maternal mortality rates than the industrialised nations of western Europe (Loudon, 1992, p. 151-152). The US South fared worst of all, and within the South, Black women bore the highest burden (Loudon, 1992, p. 366, 372).

Maternal mortality rates fell from 1930 to the 1950s. Both Black and white populations experienced this decline. White maternal mortality fell from 56.2 maternal deaths per 10,000 live births to 4.3 per 10,000 live births, and Black maternal mortality fell from 110.8 maternal deaths per 10,000 live births to 19.3 per 10,000 live births (Loudon, 1992, p. 387). Underlying these declines is a mixture of policy reforms, biomedical advancements, and improvements in living standards (Anderson et al. 2020; Loudon, 1992, p. 390-393; Jayachandran et al., 2010; Thomasson & Treber, 2008). Relative disparity in maternal mortality was widening as overall rates declined. In Florida, the Black-white maternal mortality ratio rose from 1.6 in 1935, to 3.3 in 1945, and reached 6.0 by 1960 (Florida State Board of Health, Annual Report, 1961).

The Midwife Program played a part in explaining this tension between absolute gains in maternal health across both races and the widening relative disparity between the two racial groups. Florida's Midwife Program succeeded in reducing maternal mortality through knowledge transfers but failed to integrate midwifery into the state's expanding medical infrastructure. The latter limited the decline in maternal mortality rates for Black mothers, since gains from antibiotics were large and disproportionately benefitted mothers connected to clinic- and hospital-based care. Using social capital theory as an analytical lens, I show how bonding, bridging, and linking channels framed the program's successes and limitations. In doing so, this study complicates traditional narratives of southern midwifery reform and reveals the tensions between Black midwifery and hospital-based care in the Jim Crow South.

This paper contributes to three strands of literature: the effects of midwifery reform on maternal health outcomes, the racialized context of southern maternal care, and the historical trajectory of maternal mortality in the United States during a period of rapid medical change.

First, this paper builds on a growing body of scholarship evaluating the impact of midwifery reforms on maternal and infant health outcomes. Using Florida's Midwife Program as a case study, it supports the findings from earlier literature covering both the United States as well as European nations that midwifery licensing and educational reforms improved maternal health outcomes (Løkke, 2002; Woods et al. 2006; Reid, 2012; Anderson et al., 2020; Lazuka, 2018; and Kotsadam et al., 2022). Additionally, this paper adds a critical racial and institutional lens often absent from national- and state-level analyses. Florida's program was explicitly built to address rural Black midwives serving segregated communities. These conditions shaped the

program's design and strategies. Scholars like Bonaparte (2007), Mathis (1992), and Maxwell (2009) have emphasized the dual nature of these reforms as both public health efforts and tools of social control. This paper complicates the binary view of reform as either abolitionist or benevolent, showing how local adaptations and structural constraints defined the program's successes and limits.

Second, this paper contributes to the literature on the historical decline in maternal mortality in the United States, especially the role of medical innovation and the hospital. As Loudon (1992), Thomasson and Treber (2008), and Jayachandran et al. (2010) have shown, the mid-1930s witnessed a turning point in maternal health due to the introduction of sulpha drugs and the rise of hospital births. However, these gains were unevenly distributed across race and region. While difference in hospital-based care played a role in racial and regional disparities, midwifery services also impacted these disparities. Midwife-attendance at southern Black births persisted well into the 20th century, shaping the decline for this specific population.

Finally, this paper adds to the historical literature on southern public health infrastructure and its intersection with gender, race, and state capacity. It builds on existing work on maternal health in the Jim Crow South by using the lens of social capital to examine how midwifery reforms functioned not just as educational programs but as networks of social and institutional relationships (Bonaparte, 2007, Mathis, 1992, and Maxwell, 2009). In doing so, the paper adds a novel theoretical dimension to the historiography of midwifery reform and southern public health policy.

The remainder of the paper proceeds in five sections. Section 2.2 introduces the theoretical framework, applying social capital theory to public health and midwifery reform. It defines the bonding, bridging, and linking channels through which social relationships shape the success of interventions. Section 2.3 offers a historical background on southern midwifery, situating the Midwife Program within broader trends in childbirth, medical professionalization, and racial segregation. Section 2.4 presents the main analysis, using archival data to explore how social capital shaped the program's implementation, outcomes, and eventual decline. Subsections focus on demographic trends, education methods, professional relationships, and institutional constraints. Section 2.5 concludes by synthesizing the findings, evaluating the program's

successes and limitations, and reflecting on the broader implications for maternal health reform in racially stratified contexts.

2.2 Social Capital and Public Health Interventions

The concept of social capital developed from the idea that "social networks are a valuable asset" (Claridge, 2018, p. 5). Social capital is a means of identifying and analysing the resources embedded within social relationships. Pierre Bourdieu, one of the earliest theorists of social capital, believed that social capital enabled individuals to exert power or influence over other individuals or groups. Physical capital exists as the property of specified entities. Human capital accrues its value within an individual. Social capital exists where there is a connection between two or more agents and loses its value without the connection. Levels of social capital are not uniformly spread across society. Instead, structural constraints based on race, class and gender determine the degree and structure of social capital across society (Bourdieu, 1986).

For the social capital framework of this paper, I borrowed from Villalonga-Olives et al. (2018) who identify social capital as appearing in public health campaigns where there is either a "structural alteration or behavioural induction" (Villalonga-Olives et al., 2018, p. 203-218). Structural alteration occurs when the public health intervention modifies or creates connections between relevant actors or groups, and behavioural induction requires activating resources within social networks to induce behavioural changes. The Midwife Program aimed at producing both structural alterations and behavioural inductions to the state's midwifery services. The program's attempt to transfer knowledge to midwives is a clear attempt at behavioural induction. Structural alterations occurred when and where the program created or modified connections between midwives and the medical and public health establishment as well as connections forged among midwives.

The Midwife Program was a state public health program, involving a network of actors. State and local public health officials, midwives, physicians, and philanthropic organisations all played a role in the program's activities. There were three channels through which social capital flows (TABLE 2.1). The bonding channel forms among individuals within similar socio-economic, ethnic, and/or spatial groups. In contrast, the bridging channel forms between individuals from distinct social groups. Social group distinctions might be racial, socioeconomic,

or other characteristics that denote a social stratification. The bridging channels in this paper are across racial groups and occupational groups. Linking channels are the social connections between institutions and individuals.

TABLE 2.1: Types of Social Capital Channels

Channels of Social Capital	**Definition**	**Examples**
Bonding	Social relationships among individuals *sharing* socioeconomic characteristics	Midwife ↔ Midwife
Bridging	Social relationships among individuals *with different* socioeconomic characteristics	White Midwife Program Nurses ↔ Black Midwives
Linking	Social relationships among institutions and individuals	Private Institutions ↕ Midwife Program Nurses

Source: Putnam, 1995; Svendsen and Svendsen, 2003; Woolcock, 2001; Szreter and Woolcock, 2004

Note: The two-way arrows signify the power structure of each relationship. Bonding is horizontal since these channels form amongst peers or members of the same community. The arrow for linking is vertical to represent the vertical nature of this relationship. Bridging is ambiguous and can take the form of horizontal or vertical relationships depending on the context. The example demonstrates the complexity of bridging channels. The program nurses have authority over the midwives within the legal context, but the midwives hold more authority within the cultural context.

While most social connections fit neatly into one social capital channel, it is possible for social connections to contain features of more than one social capital channel. Recent healthcare delivery research has explored the way bonding channels might augment relationships that primarily reflect a bridging dynamic. Alsan et al. (2019) explored how the bridging channels between a doctor and patient might be augmented if the two actors share a common racial identity. The researchers found that racial matching between the physician and patient led to an increase in demand for preventive services post-consultation (Alsan et al., 2019). The outcome of

'preventive services' is important to note. These are healthcare services that are often under-utilised in part because of knowledge gaps or scepticism about the effectiveness of preventive interventions (Abdul Raheem, 2023). Thus, the results supported the theory that racial matching facilitated the communication of health knowledge from doctor to patient (i.e. bridging channel) through leveraging trust based on a shared racial background (i.e. bonding channel).

Social capital can lead to negative effects as well as positive ones. Putnam (1995) and Bourdieu (1986) pointed this fact out. The clearest illustration of the harmful effects of social capital is seen in the tension between bonding and bridging channels. For example, Olson argued that bonding social capital creates an association effect, where individuals of a shared identity form special interest groups (Olson, 1982). These groups push for social change that protects their interests. Bridging, on the other hand, requires cooperation between groups to allow access to information and resources to flow between two distinct groups. This tension is present in the Midwife Program in social connections between midwives and physicians. Both groups have bonding channels within their occupation, but the design of the program relied on cooperation between the two occupational groups to deliver better care to pregnant women. I discuss the evolution and devolution of this cooperative relationship in further detail in section 2.4.

Bonding channels play a role in health education-focused campaigns that seek to enact behavioural changes or reshape a social norm within a target population. Norm enforcement, when social groups punish and reward behaviours to conform to the expectations of the group, is one way this can be done. Groups with high levels of bonding punish behaviour that hurts the group's reputation and reward behaviours that benefit their reputation (Raub and Weesie, 1990). Coleman emphasised the ability of small groups to monitor and pressure each other to conform (Coleman, 1988; Miller and Ali, 2009). If interventions were structured to reach smaller groups of peers, then they have a better chance at both flipping the norms within a group and leveraging norm enforcement so that groups regulate behaviours.

Trust is another resource embedded in the bonding channel, which affects health-education campaigns. The social relationship between messenger and audience plays a pivotal role in the effectiveness of vaccine coverage campaigns, with trusted neighbours outperforming celebrities (Olson et al., 2020). Matching the race or gender of a teacher with their students has positive effects on learning outcomes and scholarly achievement (Ehrenberg, Goldhaber, and

Brewer, 1995; Dee 2004, 2005; Bettinger and Long, 2005; Fairlie, Hoffmann, and Oreopoulos, 2014; & Lusher, Campbell, and Carrell, 2018). It is important to note that racial matching has most often been examined in settings where the social constructions of race has led to discriminatory policies and social segregation. These social settings are likely to produce a higher sense of solidarity among the racial groups (Portes and Sensenbrenner, 1993). Therefore, the Jim Crow South made racial solidarity 'more important' as *de jure segregation* was institutionalised (Reuf and Grigoryeva, 2018, p. 834).

The resources innate to bridging and linking include access to new information and increased mutual understanding between groups (Burt, 2000). Bridging channels have been found to have positive effects in several different contexts, including social mobility and inter-group cooperation. Loury first argued that bridging provided better social mobility for ethnic minorities by offering access to new sources of information and resources (Loury, 1977 p. 133–186). A more recent study by Chetty et al. found that an increase in relationships across peer groups has positive effects on upward social mobility outcomes, measured by income level, for the less well-off individual (Chetty et al., 2022). Bridging provides a higher return to the more disadvantaged individual since they receive more value from the trade of additional resources or knowledge which occurs in bridging relationships.

Bridging also creates a sense of mutual understanding, which can help typically distinct parties cooperate and achieve shared goals. Szreter and Woolcock noted how crucial bridging is to the success of many public health initiatives since public health initiatives span multiple layers of society (Szreter and Woolcock, 2004). They also emphasise the fact that for bridging to produce this type of value 'the onus…is on those with the power and resources to think very carefully about how to create the shared sense of fairness, including mutual respect between all concerned' (Szreter and Woolcock, 2004, p. 656). Bridging offers resources that could benefit efforts of knowledge transfers and the integration of midwifery into the clinical healthcare system.

Public health campaigns hoping to disseminate information to a target population rely on linking channels. Kawachi et al. argued that linking channels have a positive correlation with the spread of healthy behaviours throughout a community (Kawachi et al., 1999). Resources, like

educational opportunities or grant funding, become available to individuals through connections to institutions that were not available before the intervention began.

Development NGOs are a prime example of this mechanism in action today. An intervention targeting child nutrition in India found that children in families that had more contact with NGO workers had better outcomes than children in families that relied on intra-community institutions, such as religious or caste-based organisations (Vikram, 2018). The outside agents offered information and resources through home visits and community education events that improved the knowledge and resource base of parents with under-nourished children. The type of intervention also changes the impact of linking channels. However, there is evidence that health education campaigns focused on healthy behaviours appear to benefit from linking channels more than campaigns focused on vaccinations (Vikram, 2012).

Linking channels so far have been described as acting in a top-down fashion. However, local actors send information back up to the institutions as well. Local actors use their knowledge of local norms, language, governance, and other social factors to increase trust in outside organisations and help tailor the organisation's resources to local needs. Palmer emphasised this bottom-up aspect of linking in *Launching Global Health*. The Rockefeller Foundation funded public health campaigns across the Caribbean and Latin America during the early 20th century focused primarily on the eradication of hookworm and malaria. Despite the narrow target of these campaigns, Palmer finds a large variety in the design, implementation, and outcome of each country's campaign. He argued the heterogeneity was in part a product of how involved local officials were, correlating their level of involvement with factors like community buy-in and coordination across institutions and communities (Palmer, 2010).

There are limitations to linking channels. The positive effect of linking channels between outside institutions and local communities is limited by the infrastructure and social order of the local communities. In the study of the NGO promoting child nutrition in India, more developed villages saw greater improvements than less developed villages (Vikram, 2018). The authors hypothesised that more developed villages could use other forms of capital to better cater to the events and structure of NGO work (Vikram, 2018). For example, developed villages have community spaces to hold educational events in, or paved roads making home visits more efficient. Variables exogenous to the work of NGOs, such as waste management systems, also

helped the more developed villages achieve a higher return from linking channels. The results demonstrate that linking channels can be beneficial but cannot fully compensate for other forms of capital.

Furthermore, outside institutions tend to align themselves with the dominant local social order (Minkler, 1989 & Israel, 1985). In the context of the Jim Crow South, a racialized social order pervaded southern states. Elman et al. (2014) highlight the way race influenced the Rockefeller Foundation's campaign to eradicate hookworm in the US South. The structure of the campaign linked Rockefeller officials with county health departments. Higher-income counties received more funding while rural, lower-income counties received less funding despite there being a higher prevalence of hookworm in the lower-income counties. Lower-income counties were more likely to be Black-majority counties. Moreover, within higher-income counties, Black populations were more likely to be tested even though no evidence suggested a higher prevalence of hookworm among the Black community (Elman et al., 2014). The campaign perpetuated the simultaneous neglect and stigmatisation of southern Blacks that formed the Jim Crow social order. For the Midwife Program, institutional actors favoured a physician-controlled approach, causing them to protect the interests of physicians over midwives.

The social capital channels of bonding, bridging, and linking provide a framework for understanding not only how public health campaigns can implement change but also how structural barriers can disrupt or distort these flows. Before applying this framework to Florida's Midwife Program, it is necessary to situate the program within its historical context. The following section therefore traces the origins and persistence of midwifery in the United States, particularly in the rural South, highlighting how economic, racial, and institutional factors shaped the landscape into which Florida's midwifery reforms intervened.

2.3 Historical Background

Childbirth in America at the start of the 20th century was home-based. In 1900, only five percent of all births occurred in hospitals (Wertz and Wertz 1977, p. 133). Transitions away from home births towards hospital births occurred first within urban centres. By 1935, 75 percent of urban births occurred at hospitals. However, rural births remained mostly at home—only 20 percent of rural births occurred at hospitals in 1935 (Wertz and Wertz 1977, p. 135).

Familial and community-based actors performed the care work during a mother's pregnancy, childbirth, and post-partum period. There was a strong gender bias in the work, which made maternal healthcare, especially childbirth, 'an important…occasion for female solidarity' (Wertz and Wertz 1977, p. 4). Midwives, the leaders of this work, occupied a position distinct from the medical establishment and firmly rooted within a given community. Without professional credentials, it was community acknowledgment gained from a mixture of intergenerational connections, lived experiences of childbirths, manual dexterity and luck which instilled in these women a sense of identity as a midwife (Thomas, 2009, p. 117 & Wertz and Wertz, 1977, p. 4).

The community-based nature of maternal healthcare work was clear across the US's diverse landscape. Immigrant communities demonstrated this point well. Immigrant mothers often chose birth attendants with the same ethnic background. For example, Catherine Borst's study of Wisconsin birth certificates from 1870 to 1920 showed that the practices of physicians and midwives were 'built by ties based on class, ethnicity, and geography" (Borst, 1995). Borst's findings reveal that mothers of a given ethnicity were more likely to have their childbirth attended to by a medical provider of the same ethnicity regardless of whether the medical provider was a midwife or a physician. Moreover, Borst uncovered patterns in rural counties whereby whole communities coalesced in favour of either physician attendance or midwife attendance at birth with common ethnicity playing a larger role than occupational ties.

Midwives in the US South were the product of a different form of social segregation. Southern midwifery had roots in antebellum plantation society and was influenced by race-based social norms more so than ethnic ties. Small plantations and farm holders relied on enslaved women to carry out the role of caregiver to white and Black pregnant women (Kennedy, 2010, p. 63-65.). In a slave society where even basic skill acquisitions like reading and writing were rare, if not prohibited, within the enslaved Black population, the acquisition of midwifery skills granted a privileged status to an enslaved woman. By the 20th century, Black midwives remained central figures in Southern communities. While white midwives existed—mainly serving poor rural white families—Black midwives were disproportionately relied upon due to racial and economic exclusion from physician-based care (Hagood, 1996).

2.3.1 Midwifery Under Attack in the Age of Professional Medicine

Unlike in Europe, where midwifery evolved as an institutionally supported practice with formal training and manuals, American midwifery lacked institutional ties and did not organize as an occupational group (Litoff, 1978). The failure to establish institutional ties and to organize as an occupational group left midwives without many channels to pass down new medical knowledge and left the occupation vulnerable to attacks based on the perceived social authority of medical expertise.

Most midwives received informal training from local midwives or physicians or were self-taught. While there were a few midwifery schools, typically led by an obstetrician, they were greatly outnumbered by medical schools. Moreover, medical doctors often lobbied for exclusive control over medical knowledge. For example, some states banned midwifery manuals as late as the 1920s (Litoff, 1978, p. 39). The lack of an educational system weakened the ability of midwives to obtain and proliferate knowledge within their trade. This flaw became magnified as the medical sciences increased their social authority through their perceived connection to science and education.

Judith Leavitt, in her book *Brought to Bed*, used the personal accounts of 19th and 20th century mothers to argue that there was a constant desire for safer childbirth experiences. This desire, according to Leavitt, ushered in the transition from midwife-attended home births towards medicalized hospital births (Leavitt, 1986, p. 37-38). However, it does not appear that mothers were obtaining safer care within hospitals. Economic historians Thomasson and Treber find that due to 'increased operative intervention on the part of physicians and a resultant greater risk of infection' hospital births had an increased maternal mortality rate compared to home births until the late 1930s (Thomasson and Treber, 2008, P. 76). Thus, it seems that social beliefs around the authority of science underpinned mothers' decisions to seek out safer births in hospitals rather than objective health outcomes. So, while Leavitt's view deepens our understanding of changes in childbirth, the agency of mothers remained biased by structural social factors.

Scholars have documented how organized medicine leveraged political and cultural authority to sideline midwives. Starr emphasized how the professionalization of medicine served to block entrepreneurial competitors like midwives, while Litoff shows how doctors' networks—

associations, societies, and lobbying arms—ensured political dominance in the field (Starr, 1982; Litoff, 1978). Aside from blocking the publication of midwife manuals, state medical associations restricted access to obstetrical tools and pharmaceuticals and lobbied for laws regulating the practices of midwives (Anderson et al. 2020, p. 4345). Twenty-nine states passed licensing requirements by 1935, including a midwifery ban in Massachusetts. Licensing laws in California, Colorado, Florida, Maryland, New York, West Virginia, and Wisconsin prohibited midwives from using forceps and from administering any type of anaesthesia, medicinal herbs, or drug (Anderson et al., 2020). It should be noted that licensing laws were often poorly enforced or enforced with a considerable degree of leniency. I will show later that this was certainly the case in Florida. Still, the passage of the laws reflected the relative strength physician groups had compared to midwives.

Midwifery also faced attacks based on sexist and racist prejudices. Obstetricians strategically framed midwives as dangerous, warning policymakers not to continue to allow 'ignorant, unskilful, and dirty' midwives to care for pregnancies (Reagan, 1995, p. 1091). Hygiene and intelligence were the basis for most attacks on midwives, even though contemporary studies comparing birth outcomes did not show a clear discrepancy between midwives and physicians (Jacobi 1912; Mendenhall 1917; Levy 1918, 1923; Sobel 1918). These gendered and classed caricatures aligned with broader professional strategies of blocking the transition of midwifery into the science-based medical age.

2.3.2 The Persistence of Midwifery in the US South

No region of the US survived the onslaught of attacks on midwifery as well as the US South. Nationally, midwives only attended 15 percent of births by 1930. Yet, midwives in the rural US South attended 80 percent of births (Stevens 1971, p. 180). Below I will cover the key reasons for the persistence of midwifery in the US South.

First, midwifery services were more affordable than physician care. A 1921 US Children's Bureau study of Mississippi found that two-thirds of mothers attended by midwives paid less than $5, while most physician-attended births cost $10 to $25 (US Children's Bureau, 1921, p. 31–32). Payment systems were also more flexible. Rural midwives often accepted in-kind payments, such as chickens or grain, while physicians charged based on visit duration or

travel distance, reinforcing perceptions that "way out in the country doctors charge too much" (Texas State Board of Health, 1924).

Midwives often offered postpartum care at no additional cost, including household labour and childcare during the lying-in period. One Texas mother recalled paying $7.50 for both delivery and three days of postpartum help (Texas State Board of Health, 1924). The 1936 Florida Midwife Manual noted this practice, stating that midwives were required to provide care for ten days after delivery or find a licensed replacement if unable (Florida State Board of Health, Midwife Manual, 1936). Physicians, by contrast, did not offer post-partum care. Nurses might offer such care at an additional cost, which raised total costs to four to six times that of midwifery services (US Children's Bureau, 1921, p. 32).

The lower cost of midwifery services goes with the lack of educational infrastructure discussed in the prior section. Midwives did not have the cost of years of training and, prior to licensing laws, had no regulatory costs to pass on to their patients. In this respect, attack on the educational creditials of midwives was actually a critical feature driving demand for midwifery services.

Similar cost disparities were evident across states like Connecticut, Colorado, and Texas in the early-20th century (Litoff, 1978; Ladd-Taylor, 1988). However, while other regions saw physicians gradually erode the prevalence of midwifery services, the US South did not. The distorting effects of racial discrimination and segregation appear to have driven this result in several ways.

Table 2.2: Fees by Location and Birth Attendant

Location (Year)	**Attendant**	**Fee**
Connecticut (1913)	Midwife	$8
	Physician	$15-25
Mississippi (1916)	Midwife	$5-10

	Physician	$10-15
Colorado (~1910s)	Midwife	$10
	Physician	$35
Sources: Litoff "Forgotten Women" (1978) p. 236-38; Ladd-Taylor, Molly. "'Grannies' and 'Spinsters'" (1988) p. 262-63.		

Southern Black communities bore the heaviest weight of *de jure* segregation. Educational systems were underfunded, and job markets systematically discriminated against Black workers, capping income levels and reinforcing cycles of poverty (Carruthers & Wanamaker, 2017 and Fishback & Baskin, 1991). These economic realities made the affordability and accessibility of midwives critical.

Hospitals and private clinics remained largely inaccessible to Black patients. Racial discrimination, historian Kelena Reid Maxwell argued, made it improbable that white physicians would attend to rural black women (Maxwell, 2009, p. 11-12). Black-serving hospitals were few and only in large urban centres before the Hill-Burton Act of 1946, which required hospital bed provisions to be distributed at a share equal to a county's racial demographics. A report on healthcare access in the US South in the 1930s found that 22 out of the 54 counties that reported on hospital access had no Black-serving hospital, while only 6 out of the 54 counties reported no white-serving hospitals (Cornely, 1942). A 1930 report from one of the South's largest Black-serving hospitals painted a picture of "dinginess, misery, and poverty pressed...from every side" and wards infested with rats and cockroaches (Gamble, 1995, p. 47).

Racial discrimination and distrust at the personal level was also influential. Beardsley highlighted how white doctors often feared that attending to Black patients might hurt their practice's reputation (Beardsley, 1986). There is also evidence that Black patients were sceptical of the skill of Black physicians compared to white physicians. W.E.B. DuBois in his classic study, *The Philadelphia Negro*, described this stigma: "If a child is sick, the father wants a good physician; he knows plenty of good white physicians; he knows nothing of the skill of the black doctor, for the black doctor has had no opportunity to exercise his skill. Consequently, for many years the coloured physicians had to sit idly by and see the 40,000 Negroes healed principally by

white practitioners" (Dubois & Eaton, 1899, p. 113). Racial discrimination further affected the supply and skill level of Black physicians by limiting the training opportunities of medical graduates and constraining the patient population available to a physician. Limited patient populations often made specialization unfeasible from a cost perspective.

It is possible as well that Black women felt a distrust of a white-run medical establishment. However, when federal funding went towards prenatal care services during the 1920s and 1930s, more Black mothers engaged with these services than white mothers (Moehling and Thomasson, 2014 & Cornely, 1942). The fact that Black mothers sought out public healthcare options when provided suggests that structural racial discrimination had a larger role than racial mistrust in constraining access to healthcare.

This racially stratified healthcare landscape reinforced the practice of midwifery in Black communities. In the 1910s and 1920s, surveys reported that 70–90 percent of Black Southern births were midwife-attended, compared to just 40–50 percent for white Southern mothers (Dodd, 1920; Jacksonville Board of Health, 1917). By 1940, more than two-thirds of Black births in Mississippi, South Carolina, Arkansas, Georgia, Florida, Alabama, and Louisiana were still attended by midwives, while midwifery attendance for white mothers had dropped below five percent (Thompson, 2016, p. 10).

Taken together, these patterns show how income disparities and social segregation preserved a space for midwifery in the South long after it declined elsewhere. Within this landscape, Florida's Midwife Program intervened. That is to say, the program intervened not into a vacuum, but into an entrenched system of racialized, community-based care.

2.3.3 Midwifery Reform in Southern States

Health officials across the US South, confronted with the entrenched reliance on midwives in rural Black communities, recognized that the wholesale replacement of midwifery was neither workable nor desirable. Florida's Midwife Program was part of a broader Southern effort to improve the region's poor maternal and infant health.

Critics of southern midwifery reform often emphasize its coercive, disciplinary qualities. Scholars like Susie (2009) and Bonaparte (2007) argued that Southern reform efforts aimed to

marginalize and eliminate Black midwives. However, this paper offers an alternative perspective viewing the reforms as preserving midwifery as a maternal healthcare service for mothers in a modernizing world. The reforms did this by formalising the standard of care for midwifery services, transferring useful knowledge to midwives, and building connections between midwives and the medical establishment (Maxwell, 2009 & Mathis, 1992). Rather than marching Black midwifery to its demise, state-led midwifery reforms sought to transfer medical science's most basic knowledge to midwives and integrate midwifery services into a wide framework of maternal healthcare (Mathis, 1992, p. 10-12).

The program built on efforts of the Sheppard-Towner Act of 1921, which funded maternal and infant health activities through federal block grants from 1922 to 1929. The Sheppard-Towner Act had a positive impact on infant mortality, especially among non-white infants (Moehling and Thomasson, 2014). Florida used Sheppard-Towner funds to expand prenatal care for Black mothers, reporting 4,033 visits to Black women versus 2,406 to white women in 1924 (US Children's Bureau, 1924, p. 24).

Additionally, many of the strategies developed during the Sheppard-Towner era carried on into the Midwife Program era, such as midwife classes and home visits. Racial matching was another strategy implemented during the Sheppard-Towner era that the Midwife Program developed further. Black physicians and nurses, such as Dr. Ionia Whipper or Estelle Bonner, were hired to work with midwives in communities that white physicians would not serve. But as Whipper's own journals recount, these Black medical professionals often lacked deep community ties and faced distrust from the very people they were tasked with serving (Smith, 1995). Taking the language of social capital, the Sheppard-Towner Act established bridging and linking channels in much the same way that I will argue the Midwife Program did. Although the Sheppard-Towner Act was short-lived, it became a model for which state health departments looked for future midwifery reforms.

Here it is important to note that Florida's Midwife Program was not unique. Across the US South, state health departments established midwife programs. Southern physicians coalesced around the idea that these programs were the correct way to confront the reality of

midwifery services across the rural southern environment. Dr. Cornely, a leading member of the Black-led National Medical Association, acknowledged the necessity of midwives:

> "Certainly, in many areas [midwives] fill a much-needed gap in the number of professional personnel and the availability of services. This being the case, every attempt should be made by all health units confronted with this problem to develop plans for their improvement. This should be done by supervision, classes, and inspections. In addition, the utilization of trained nurse-midwives will help in supplementing and aiding this service" (Cornely, 1942, p. 1122).

Southern midwifery reforms emerged in response to obvious patterns of maternal mortality that demanded pragmatic, low-cost solutions for rural and Black communities. It is also necessary to look more closely at the medical knowledge of the time and the leading causes of maternal death that midwifery reformers believed they could address. The following section therefore outlines the epidemiological profile of maternal mortality in this era and explains how it shaped the Midwife Program's practical goals and limitations.

2.3.4 The Epidemiological Target of Midwifery Reforms: Maternal Mortality and Its Four Causes

By the early 1930s, health officials identified the four leading causes of maternal deaths in the United States to be: puerperal sepsis, haemorrhage, toxaemia (now called eclampsia), and septic abortion. Florida's Midwife Program concentrated its efforts on the first three. Septic abortions were indeed a major cause of maternal death nationwide, but public health surveys at the time noted that this cause was far more common in urban centres. In the rural South, septic abortion was a less prevalent threat, and midwife manuals and class lectures rarely addressed the issue directly, which reflected both the stigma surrounding abortion and its relative rarity in rural contexts (U.S. Department of Labor, 1934, pp. 130–132).

Of the remaining three causes, puerperal sepsis was the most preventable with basic hygienic practices. In Florida, puerperal sepsis was a major driver of maternal mortality and disproportionately affected Black mothers: in 1933, the sepsis-related death rate was 5.32 per

1,000 live births for Black mothers compared to 1.87 for white mothers (Florida State Board of Health, Annual Report, 1933). In response, the Midwife Program emphasized aseptic technique more than anything else. Educational events, the revised Midwife Manual, and local training sessions repeatedly reinforced handwashing, sterilization of instruments, use of clean linens, and careful postpartum care.

By 1948, the Midwife Program's focus on hygiene coincided with a 64 percent reduction in puerperal sepsis deaths among Black mothers. This decline occurred even as the percentage of Black births attended by midwives decreased by less than ten percent. While other factors, such as increased hospital births and antibiotics, played a role, the timing and scope of the drop suggest that the hygiene education delivered through the Midwife Program made an impact. Moreover, the impact of antibiotics was limited to hospitalised or physician-attended cases of puerperal sepsis because midwives were legally prohibited from prescribing or administering pharmaceuticals (Anderson et al., 2020, p. 4345). Since Black birth remained predominantly at home and attended by midwives, the health gains from antibiotics mostly accrued to white mothers. As a result, the Black-white maternal mortality ratio increased from 1.6 in 1935 to 3.3 in 1945 (Florida State Board of Health, Annual Report, 1946).

Haemorrhage, the second major cause, was more challenging for the program to address. Antepartum haemorrhage often resulted from placenta previa—when the placenta covers the cervix—and postpartum haemorrhage frequently resulted from a retained placenta. Loudon (1992) observed that rates of placenta previa deaths held steady at 2–3 per 10,000 births internationally from the late 19th century through the 1940s. Florida's data matched this range, with rates hovering between 2.3 and 3.0 deaths per 10,000 births from 1933 to 1936 (Florida State Board of Health, Annual Report, 1933–36). An effective treatment options for severe haemorrhage is an emergency caesarean delivery, but caesarean sections did not become 'best practice' until the post-war era after the proliferation of antibiotics. In the Midwife Program, midwives were trained to recognize warning signs but were instructed never to attempt manual removal of the placenta themselves. Instead, they were expected to summon a physician if the placenta did not pass within 30 minutes. In reality, this protocol depended on bridging channels between midwives and physicians that were often fragile or missing in rural communities.

Toxaemia (or eclampsia) was another major cause of maternal mortality that is challenging to see how the Midwife Program would have affected greatly. The disease, marked by high blood pressure, blurred vision, headaches, and swelling, remains poorly understood even today. When untreated, it could escalate to convulsions, kidney failure, or cerebral haemorrhage (Ferris & Francisco, 1982). The main preventive strategy in the 1930s and 1940s was regular prenatal monitoring to detect early warning signs. Florida's Midwife Program sought to bridge the gap between home births and clinical care by encouraging midwives to refer mothers for prenatal checkups. But this strategy required a reliable network of clinics, affordable transportation, and patient trust in medical authorities—conditions that were inconsistently met in rural Florida (U.S. Children's Bureau, 1942, pp. 19–22). As with haemorrhage, the promise of better outcomes through bridging channels often ran up against the hard limits of sparse infrastructure and weak cooperative professional relationships.

In sum, while the Midwife Program ability to address toxaemia and haemorrhage was limited, its ability to address deaths from puerperal sepsis was ample. Accordingly, health education placed an emphasis on basic hygiene training, its. Physicians' control over clinical spaces and advanced treatments left midwives reliant on fragile cooperative relationships and referrals, which the Midwife Program attempted to establish and strengthen. As later sections will show, these bridging efforts were often undone by structural barriers and professional rivalry.

2.4 The Midwife Program

The Florida Midwife Program began in 1932 following the state legislature's passage of a Midwifery Control and Licensing Act. Dr. Henry Hanson, Florida's State Health Officer, stated that the program's goal was to "*develop* the best possible midwives" (Hanson, 1935, p. 110). The program used health education events to improve midwifery services. The two overarching goals of the health education program were: 1. To reform midwives' childbirth and post-partum practices through emphasis on hygiene and aseptic techniques, and 2. to connect midwives with local medical professionals and county health departments to improve prenatal care coverage and to aid midwives with difficult deliveries.

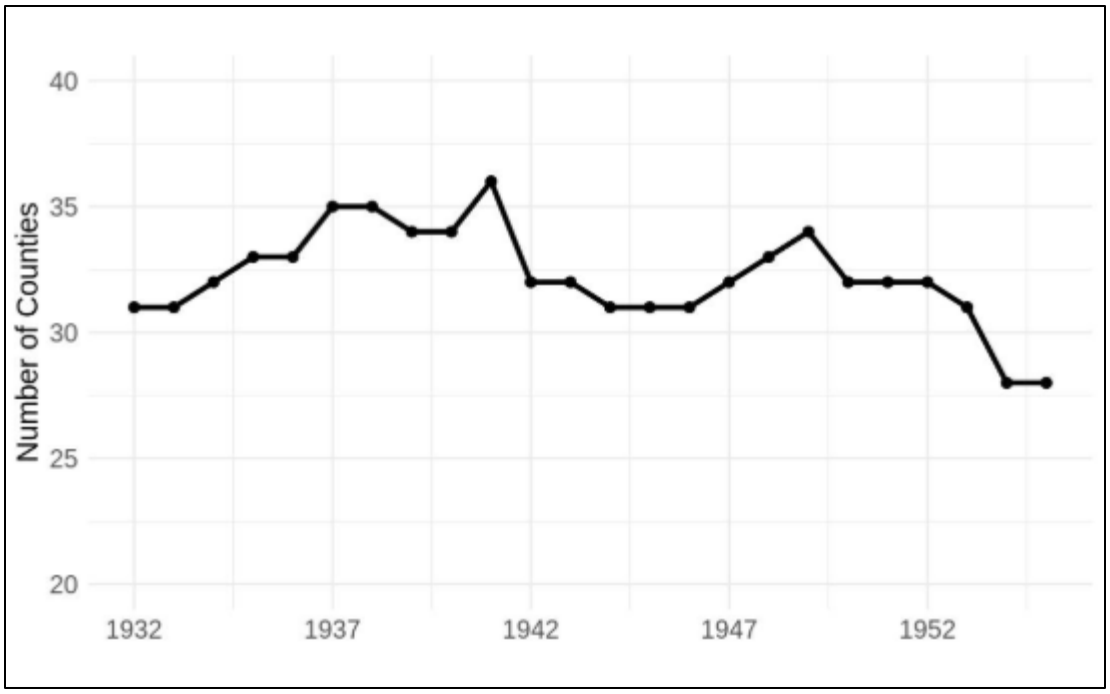
To better understand the impact of social capital channels on the program's health education activities, I will first start off with a brief overview of the archival sources I used as well as a description of the demographic features of Florida's midwife population. After that, I will illustrate the ways in which linking and bridging channels impacted the nursing staff's capacity as well as the educational tactics and materials. Then, I will analyse the strengths and limitations of bonding and bridging channels among midwives and between midwives and medical doctors.

2.4.1 Midwife Record Cards and the Demographic Features of the Midwife Population

Control over the Midwife Program remained with the State Health Department from 1932 to 1951. In this respect, Florida's midwifery reform was distinct from other southern states, who devolved control to county health departments well before 1951. Since control remained at the state level, there is a detailed archival record of the program available at the Florida State Archives. The institutional records include staff correspondences and annual reports that shed a light on the program's structural and tactical development. Additionally, I have transcribed data from the archive's midwife record cards. The cards have data related to demographic background, including birth year, education, literacy, place of residence. There are also details about the midwife's activity within the program, including attendance at educational events, connections to local physicians, reliability to send cases to prenatal care or call a doctor on difficult deliveries.

The archived midwife record cards covered a sample of the overall licensed midwife populations. The midwife record cards are complete at the county level but do not cover every county. FIGURE 2.1 reports the number of counties represented by midwives within the sample between 1932 and 1955. The yearly coverage is between 27 and 36 counties for nearly the entire sample. There are 67 counties in Florida, meaning that the sample covered between 40 and 54 percent of counties.

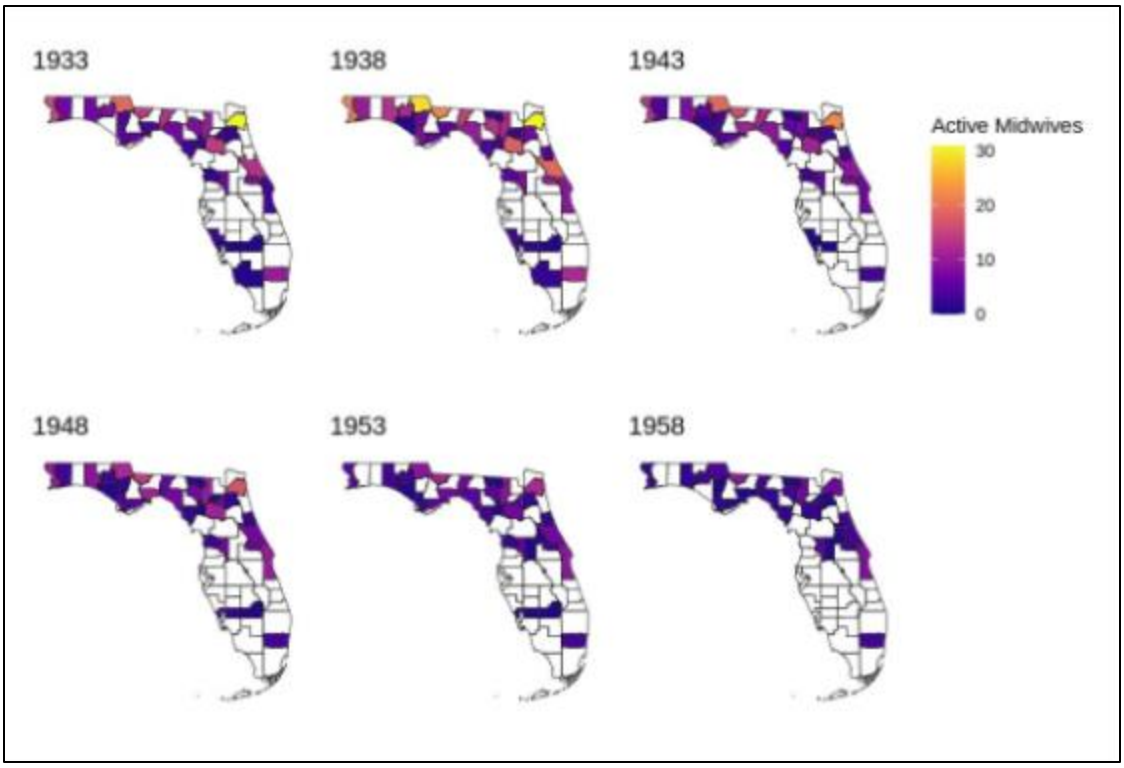
FIGURE 2.1: Counties Covered by Midwife Record Card Sample Across Time



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

The maps below plot out the county coverage spatially. The colouring gives a sense of the number of midwives reached in each county. The northern counties have the highest number of midwives in my sample. This region of the state was referred to as the 'Black Belt.' The region historically had the strongest agricultural production of cotton and had a high number of rural Black communities.

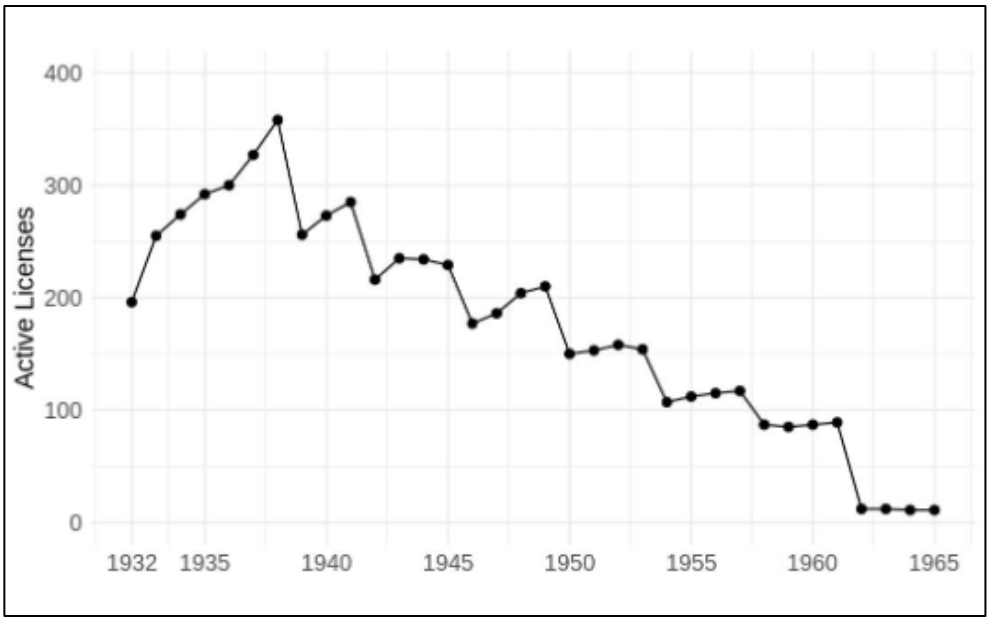
FIGURE 2.2: Spatial Coverage of Sample, Scale for Number of Active Midwives



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

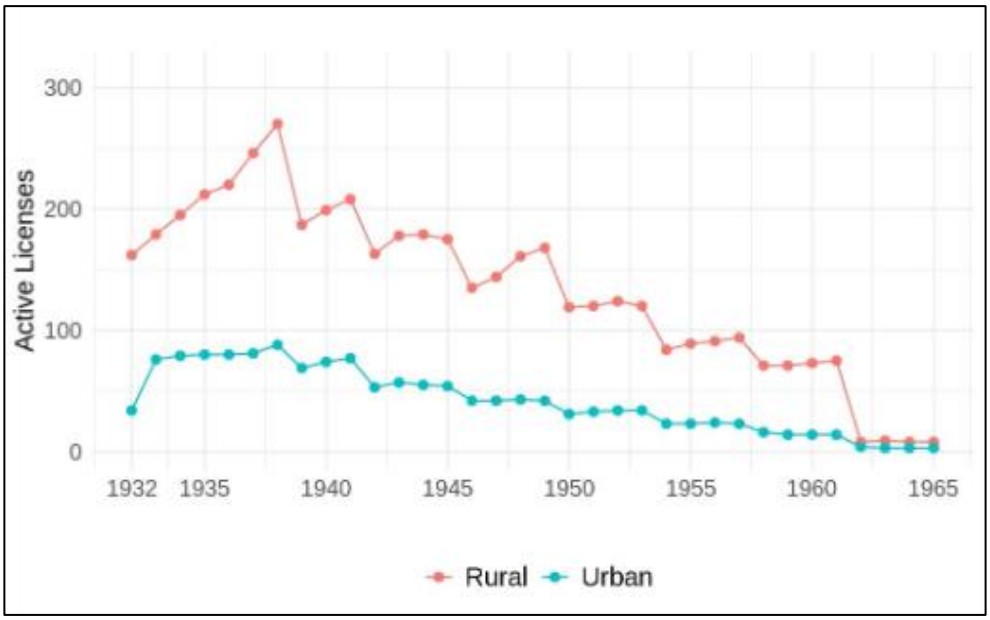
FIGURE 2.3 shows the number of active licensees in the sample of midwife record cards. In 1932, the first year of the program there were 196 licensees. This number increased over the first six years as the program's reach extended. There were 358 licensees at the sample's peak in 1938. After 1938 the count of licensees falls gradually over time. The annual reports did not systematically report the overall number of licensed midwives across time. However, the 1938 annual report stated that there were 685 licensed midwives. This would mean that the record card sample covered 52 percent of the overall licensed midwife population. In the appendix, there is an overview of how sampled counties compare to non-sample counties across populations and economic statistics. In short, the record card sample gives a representative view of the program's midwife population.

FIGURE 2.3: Active Licenses per Year from Midwife Record Cards Sample



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

FIGURE 2.4 Active Licensees by Urban/Rural Status



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

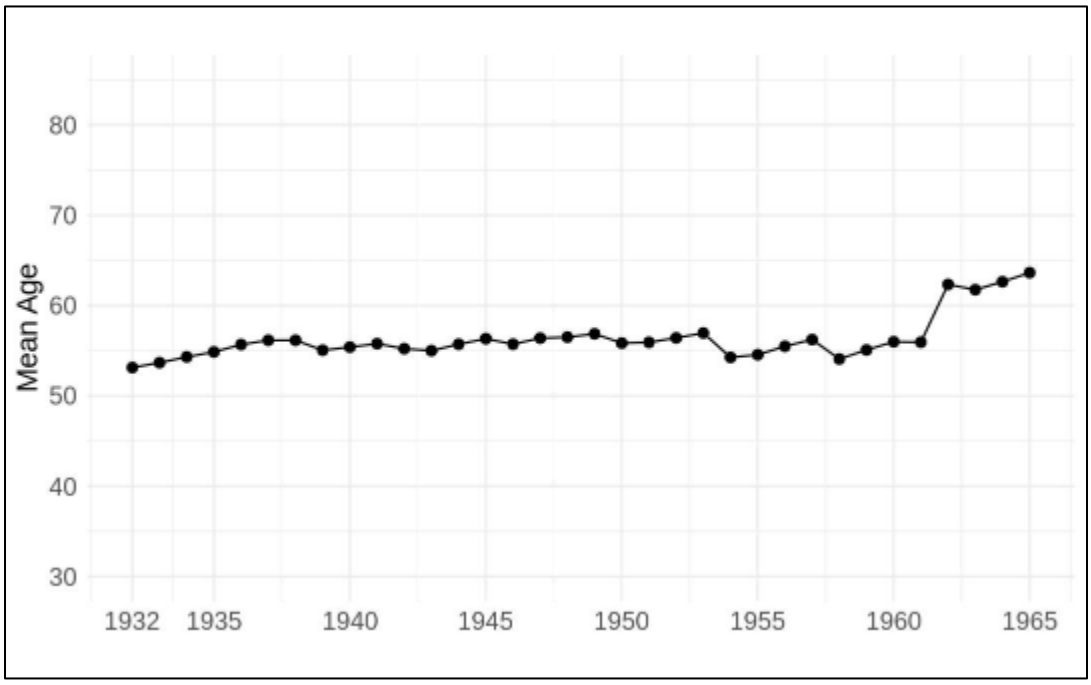
Urban (rural) status was defined as towns having more than (less than) 10,000 inhabitants. FIGURE 2.4 shows that licensed midwives were largely resident in rural areas. Moreover, the rise in licensed midwives over the program's first 6 years was driven by increase of rural midwives. Two-thirds of the increase in licensees between 1932 and 1939 was from

increases in the number of rural licensees. Furthermore, the declining population of midwives is more constant within the urban population of midwives than the rural population. The rural population has declines and resurgences in its population up until the 1950s. The decline after 1950 corresponds to a shift in health policy at the federal and state level which increased access to hospitals for mothers. In the bridging, section I will illustrate how these policies favoured physicians and led to a deterioration of midwife and physician cooperation.

2.4.2 Age and Education of Midwife Population

Understanding the age and education profile of Florida's midwives is crucial for explaining how the Midwife Program tailored its health education strategies to a workforce it could not easily replace. Annual reports repeatedly expressed the hope of recruiting "younger midwives who are high school graduates" (Florida. Board of Health, Annual Report, 1939, p. 43). Despite this stated intention, FIGURE 2.5 shows that the average age remained between 53 and 56 years old across the program. The standard deviation also remained stable between 9 and 12 across the sample. There is no evidence that the program was able to alter the age demographics of the midwife workforce. The only notable shift is at the very end of the observed period, when the average age increased to above 60 years old.

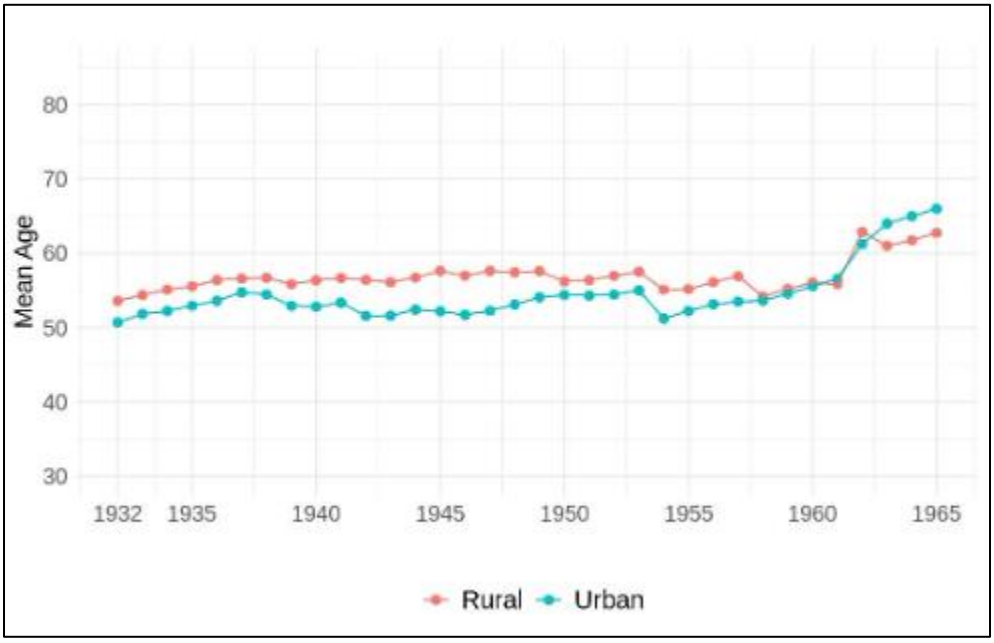
FIGURE 2.5: Average Age of Licensed Midwives



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

Place of residence does not alter our understanding of this finding. FIGURE 2.6 shows the average age of midwives by urban or rural residence. The difference in ages is slight but rural midwives are on average older than midwives in urban areas. Urban midwives had a larger variance in their age range, which reflected the higher likelihood of having midwives in their twenties or thirties. The pattern does flip in the 1960s as the number of overall midwives plummeted.

FIGURE 2.6: Average Age of Licensed Midwives by Urban/Rural Status



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

Health education campaigns must assess the educational levels of their audience to tailor their messaging to their audience's level of understanding. Two ways of understanding educational levels are the highest grade achieved in school and literacy rates.

FIGURE 2.7 shows the average education level of licensed midwives. The average education level increased over time from around a 4th grade level (not above a primary education level) to a 7th grade level (one year above primary education). The trend aligns with society wide increases in education levels. This type of cohort effect is likely to have been a stronger driver than any sort of influence from the Midwife Program. Indeed, the program showed evidence of adapting their teaching methods to better suit a low educational level audience.

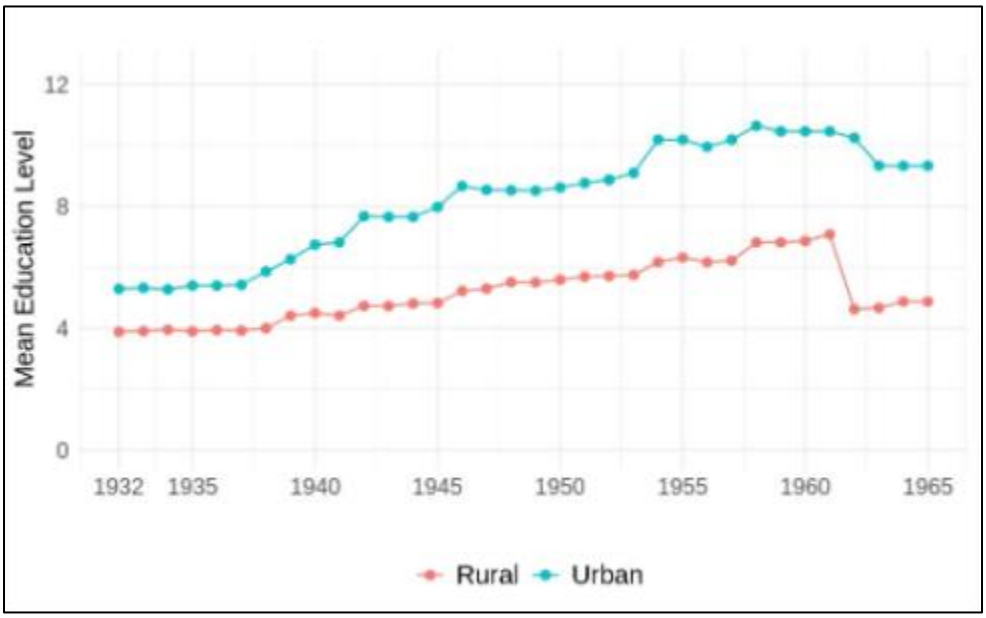
FIGURE 2.7: Education Level of Midwives

Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904 and Ruggles et al. (2025) 1930 and 1940 Full-Count US Census. IPUMS.

Note: Educational level corresponds to American school grade levels. For instance, 4 equates to 4th grade.

FIGURE 2.8 reveals that the average educational level of urban midwives was consistently higher than that of rural midwives. For most of the program, the difference was between 3 to 4 grade levels. The urban advantage in schooling reflects economic and labour market differences between the two areas. Here again, we see an inability of program to effect demographic changes onto the midwife workforce despite stated goals to do just that. Instead, the program was forced to adapt to realities on the ground and tailor its interventions to the preexisting midwife population.

FIGURE 2.8: Education Level of Midwives by Urban or Rural Status



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904 and Ruggles et al., (2025) 1930 and 1940 Full-Count US Census. IPUMS.

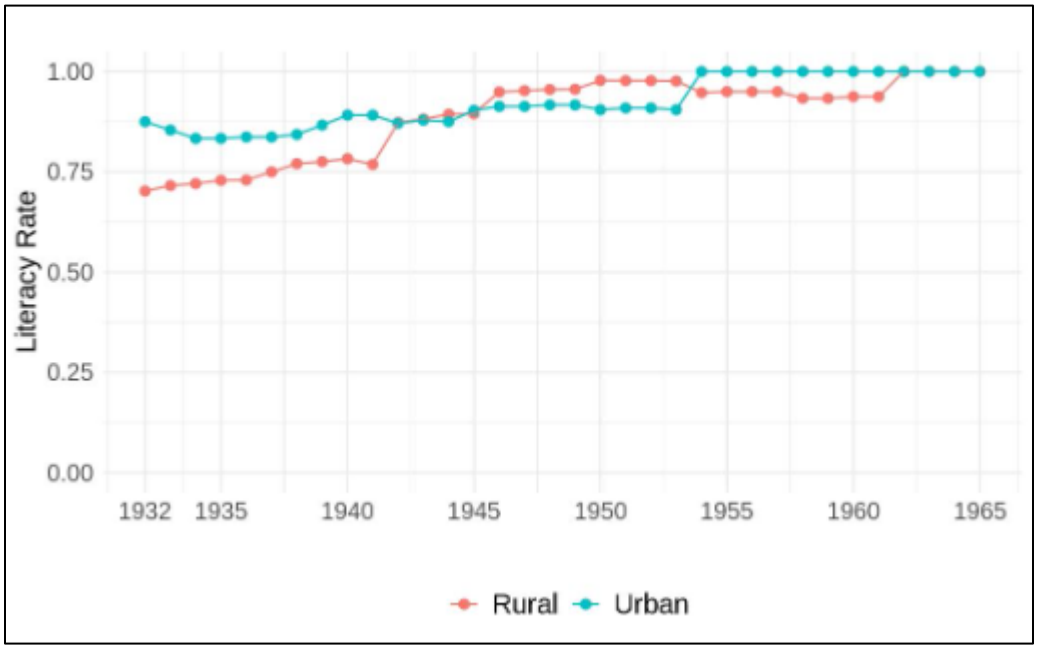
Note: Educational level corresponds to American school grade levels. For instance, 4 equates to 4th grade.

While education as measured by highest school grade did not change considerably over the course of the program, the active midwife population's literacy rate tells a different story. Midwives in the program during the first two years had a literacy rate of 76 percent. This was equal to the literacy rate found for Black females between the ages of 30 and 60 in Florida (Ruggles et al., IPUMS 2025). Urban midwives had a literacy rate of 85 percent and rural midwives had a literacy rate of 72 percent. Both rates are higher than the literacy rates for urban Black females between the ages of 30 and 60 (82 percent) and rural Black females between the ages of 30 and 60 (69 percent). Therefore, midwives reached in the earliest years of the program were more likely to be literate than their peers after controlling for urban or rural residency.

Another difference between trends in literacy and education levels appears in FIGURE 2.9. The increase in literacy rates in the early years of the program is due to a rise in literacy rates among the rural population. Rural literacy rates are rising from 1932 to 1953. There is a large increase in the rural literacy rate between 1941 and 1946. This trend occurred simultaneously with a decline in the number of licensees, suggesting that the program due place pressure on illiterate midwives. Therefore, the program shifted the midwife workforce toward a more literate

composition despite not being able to recruit many midwives with secondary or tertiary educational degrees. This makes some sense given that the program emphasised text-based learning through a Midwife Manual and stressed the importance of birth registration at home births attended by midwives.

FIGURE 2.9: Literacy Rates by Place of Residence



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904 and Ruggles et al. (2025) 1930 and 1940 Full-Count US Census. IPUMS.

These demographic patterns reveal not only how the midwife population evolved over the course of the Midwife Program but also the reach and limits of the Midwife Program's strategy. In general, Florida's midwives were overwhelmingly older, rural, and drawn from communities with limited formal education. These factors shaped how health knowledge could be shared, retained, and enforced. Despite its stated goals, the program could not easily replace this workforce with younger, better-educated recruits. Instead, it adapted its interventions to work within these constraints. The importance of mutual understanding, trust, and peer influence makes clear why the success of the Midwife Program was not achieved through simple top-down rules but through complex social interactions. The next sections examine how bonding, bridging, and linking social capital channels both enabled and constrained the program's effectiveness.

2.4.3 Early Signs of Linking and Bridging Channels

At the start of the Midwife Program, the educational capacity was low within the program and across the state's county health departments. Only 12 counties had the capacity to run midwife classes through local health departments (Florida State Board of Health, Annual Report, 1933, p. 52). The program's staff was small, consisting of six female nurses. All of whom were white and had backgrounds in maternal and child health nursing. Of the six nurses, only two were solely focused on the Midwife Program. These two nurses had the titles of head Supervisor of Midwives and the Assistant Supervisor of Midwives. The other cadre of nurses assisted with the Midwife Program in addition to their usual work carrying out public health campaigns focused on maternal and child healthcare needs, such as deworming, vaccinations, school visits, and prenatal care visits (Florida State Board of Health, Annual Report, 1933).

The Midwife Program's educational events followed three models: institutes, classes, and one-on-one supervision. Institutes were large events, sometimes having over 200 midwives in attendance and lasting several days. Classes had audiences of 30 midwives or less and involved 'a minimum of four hours of instruction' (Florida State Board of Health, Annual Report, 1933, p.51). One-on-one supervisions were individual based teaching interventions.

The program relied on midwife institutes over the first four years. While institutes were large events, occurring in urban centres and concentrating lots of resources into a few days. The program utilized city health officials and private city physicians to supplement their relatively lower capacity level. The northwestern region of the state held its institute in Tallahassee; the northeastern region held its institute in St. Augustine; and the southern region institute occurred in either Tampa or Miami.

PHOTO 2.1: Lecture at Midwife Institute

Description: The photo taken early in the program's history shows a Midwife Program Staff Nurse instructing a group of Florida midwives at the campus of Florida A&M. Goggins is using a maternity doll as a demonstration aid.

Source: Florida State Archive, HTTPS://WWW.FLORIDAMEMORY.COM/LEARN/EXHIBITS/MEDICINE/MIDWIVES/

The Midwife Program used linking channels between community interest-groups and program officials to help fund the cost of midwives' travel and housing for the institute. These groups included the national-level Black advocacy group, the Urban League, and state-level groups like the State Medical Association and State Federation of Women's Clubs, both of which were the biracial counterparts to white-only social groups. In total, Black interest groups sponsored travel scholarships for 25 percent of the attendees (Florida State Board of Health, Annual Report, 1933, p. 6).

A lecture program from the 1935 Midwife Institute in Tampa highlighted the capacity-filling role that non-program-affiliated professionals had in delivering health information. Only one member of the Midwife Program staff, Jules Graves, gave a lecture. A group of physicians, a social worker, and a community leader led the other sessions. This Institute's lectures included the following: "The Midwife Bag" delivered by Jules Graves, "The Physical Examination of the Expectant Mother" delivered by Dr J. S. Spoto, "Care at Delivery and Immediate Care" delivered

by Dr Rowlett, "The Responsibility of the Midwife to her Community" delivered by Mrs Bishop, social worker, "Postnatal Care" delivered by Dr G. W. P. Johnson, Negro City Hospital (Tampa) (Florida State Board of Health, Annual Report, 1936, p. 50-51). The expertise of these professionals provided midwives access to new information.

However, the strength of these bridging channels was limited by the spatial distance between city professionals and rural midwives. There was also doubt about whether institutes were reaching enough midwives. Despite achieving attendance levels in the hundreds (see TABLE 2.3), the midwife record card sample reveals that around 20 to 25 percent of midwives had never attended an institute.

Table 2.3: Attendance at Midwife Institutes

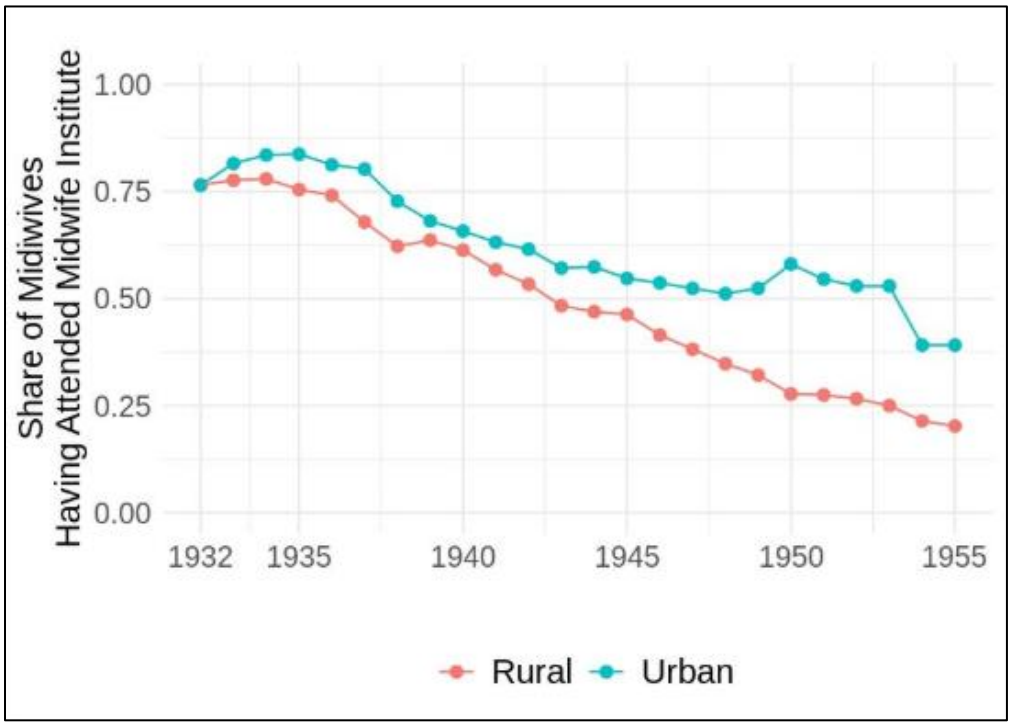
Location (Year)	**Number of Midwives**
Tallahassee (1933)	234
Tampa (1933)	96
Tallahassee (1934)	125
St. Augustine (1934)	107

Source: Florida State Board of Health, Annual Report, 1934, p. 25 and Florida State Board of Health, Annual Report, 1935, p. 46

Note: Tallahassee served the North-West region of the state which contained a group of counties referred to by the program staff as the 'Black Belt' for its disproportionately large Black population compared to the rest of the state. This demographic factor combined with the fact that its economy was largely rural and agricultural meant it contained a large fraction of the state's active midwives.

FIGURE 2.10 shows that place of residence was an important factor in whether a midwife had attended a Midwife Institute. Rural midwives were less likely to attend institutes at the early years of the program and saw their share of attendance decline at a faster rate over the course of the program.

FIGURE 2.10: Institute Attendance by Licensed Midwives by Place of Residence



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

Clearly, the program was not reaching every midwife with the institute model and needed to orientate resources away from institutes and toward the other two educational models, classes and one-on-one instruction. However, the program first needed to expand its staff's capacity to carry out this transition.

2.4.4 Linking to Rockefeller, Building Staff Capacity

The Midwife Program relied on its link to the Rockefeller Foundation, the philanthropic organisation started by John D. Rockefeller, to increase its staff's educational capacity. The value created through this relationship came in the form of access to scholarships for the program's staff, which opened educational opportunities that did not exist in Florida or the US South. The scholarships were to the Lobenstine Midwifery Clinic in New York City, which was started in 1931 by Dr Lobenstine, who was a proponent of the idea that midwifery had a critical place in maternal healthcare systems. One of the school's hallmark programs was for nurses who wanted to specialise in midwifery education and a certified nurse-midwife course. This program

provided the Midwife Program's staff with the knowledge and resources to craft more effective pedagogical design and tactics of the program over time.

Joyce Ely, the program's first Supervisor of Midwives, received a Rockefeller Foundation scholarship in 1934 to the Lobenstine Midwifery Clinic. After completing a 10-month program, Joyce Ely became the state's first Certified Nurse-Midwife (Rockefeller Foundation Records. RG10. 17). Ely also put her new knowledge into action by re-designing the program's Midwife Manual. The manual served as the main educational text of the program. All staff members and midwives had one, and its contents covered basic maternal health topics, including prenatal care, childbirth, postpartum care and infant care.

Prior to Ely's edition, the program relied on the same manual used during the Sheppard-Towner Act. Ely's manual provided seventeen step-by-step teaching demonstration guides that county and program nurses used to guide their midwife classes (Florida State Board of Health, Midwife Manual, 1936). These guides included visual aids and were written in a simple manner, avoiding technical terms. The focus of the content was hygiene and aseptic techniques for delivering normal births (Florida State Board of Health, Midwife Manual, 1936; & Susie, 2009, p. 151 & 177). Thirteen of the seventeen topics covered by the demonstrations guides related directly to hygiene and aseptic techniques (see TABLE 2.4).

TABLE 2.4: List of Demonstration Guides in 1936 Instruction Manual	
No.	Topic
1	A midwife's equipment (includes newspaper pads, cap, mask, gown, sleeves, cord dressings, wipes)
2	Making the Bed
3	Making a Bed with a Patient in it
4	How to Place and Remove a Bedpan
5	How to Administer an Enema
6	Cleaning a Bed Bath
7	Placing an abdominal binder on the expectant mother
8	The sterile OB Package
9	Shaving the patient
10	Preparing the delivery bed
11	Partial Bath before Delivery
12	How to Scrub Hands for Delivery
13	Sterile Wash Down before Delivery
14	Tying and Cutting Umbilical Cord
15	Administering Silver Nitrate in Baby's Eyes
16	Attending to a Mother's Toilet Tray
17	Perineal Care
Source: Florida State Board of Health, The Midwifery Series, Midwife Manual ed. 1936 **Note**: Thirteen of the seventeen topics related to hygiene and asepsis techniques. Additionally, only five of the demonstrations dealt with obstetrical procedures. The emphasis is placed on the midwife's personal hygienic behaviours and less so on transferring obstetrical knowledge.	

It was not until the Midwife Manual's 1940 edition that information on foetal positioning during delivery and an obstetrical key terms list appeared (Florida State Board of Health, The Midwifery Series, Midwife Manual ed. 1940). The pace of this progression has led some historians to downplay the educational aspect of the midwife classes. For example, Susie critiqued the lack of obstetrical knowledge dispensed in classes and over emphasis on personal hygiene and clean appearances (Susie, 2009, p. 70-80). What this view does not account for is the low capacity of the staff during its earliest years. In 1936, only one nurse on staff had post-graduate training as a certified nurse-midwife. From 1938-1940, three members of the program's staff attended post-graduate training in nurse-midwifery through scholarships from the Rockefeller Foundation as well as other philanthropic groups. Through these scholarships, the staff accessed knowledge critical to modifying the educational materials of the program, including courses titled 'Obstetrical Lectures,' 'Administration of Delivery Service,' and

‘Informing the Laity’ (Rockefeller Foundation Records, RG32). Linking channels drove the increase in the staff’s capacity, which in turn led to new knowledge entering the program’s educational materials.

Another member of the program’s staff who received a Rockefeller scholarship for graduate training in nurse-midwifery was Ethel Kirkland. Kirkland joined the Florida State Board of Health in 1934 as the only Black nurse within the Bureau of Public Health Nursing. By 1936, Kirkland received the position State Midwife Teacher. This role handled most of the one-on-one instruction. It involved travelling to homes of midwives, often staying in counties for two weeks to four months, and observing “midwives on antepartum, postpartum cases and actual deliveries of their patients in the normal environment... [and] giving constructive teaching. " (Florida State Board of Health, Annual Report, 1942, p. 114-115).

Kirkland’s work did not go unnoticed. Annual reports mentioned her success: “She has accomplished a great deal and has enabled this Bureau to have a more accurate record of the midwives and has assisted in the reduction of the maternal death rate by observing more closely the midwives who were not conducting their work properly” (Florida State Board of Health, Annual Report, 1936, p. 49). Kirkland’s promise prompted the State Board of Health to grant her leave as she took a Rockefeller scholarship to attend the Lobenstine program, making Kirkland Florida’s first Black certified nurse-midwife.

Kirkland’s case added another layer to the linking channel between the program and the Rockefeller Foundation due to Kirkland’s race. As a Black nurse, she had few educational opportunities available to her within the US South and no opportunities available in a maternal health specialisation. Kirkland represented a continuation of the racial matching strategy that had developed during the Sheppard-Towner Act. The program assigned Kirkland to underperforming counties. Most of these were in Florida’s ‘Black belt,’ a region in the North-central area of the state, home to counties with the highest proportion of Black residents. Since Kirkland was Black and from a rural community in South Georgia along the Florida-Georgia border, bridging channels between her and midwives were supported by bonding channels based on their shared socioeconomic background.

PHOTO 2.2: Nurse Kirkland Instructing Midwife

Description: Pictured is Ethel Kirkland instructing a midwife on proper diapering technique.
Source: Midwife being trained in proper diapering technique. 1940 (circa). State Archives of Florida, Florida Memory. <https://www.floridamemory.com/items/show/44628>

It is difficult to assess the direct impact Kirkland had on midwives, since the program's records did not record which midwives she trained. But, Kirkland's career arch suggests that she gained respect from her peers. She stayed with the program into the 1950s and participated in the 1952 White House Commission on the Health Needs of the Nation, as a maternal and child health expert. (Florida State Board of Health, Annual Report, 1952, p. 65). Perhaps more telling of her impact was the way her hiring invigorated a trend in the program. In 1942, three Black nurses received grants for a six-month course in midwifery at Tuskegee University. After completing the course, these nurses "were assigned to the [county health units] where they previously worked, having full charge of the midwife work in their county, holding meetings, accompanying the midwives on deliveries, following up the cases to determine that the proper after care has been given." (Florida State Board of Health, Annual Report, 1942, p. 159). By 1945, there were 8 graduate-trained Black nurse-midwives active within the state's health system (Florida State Board of Health, Annual Report, 1946).

Linking between the staff of the Midwife Program and philanthropic organisations, especially the Rockefeller Foundation, grew the capacity of the program in a manner that is difficult to imagine without private aid. The increased capacity affected the pedagogical strategies deployed by the program and allowed for the program to expand its usage of midwife classes.

2.4.5 Midwife Classes: New Bonding Channels

FIGURE 2.10 revealed that the share of midwives who had ever attended a midwife institute decreased after 1936. The steady decline corresponded with a tactical shift toward more midwife classes and less institutes. Midwife classes decreased the cost of travel for midwives. Additionally, bonding channels increased among midwives after the shift toward a more localised educational model. These bonding channels reinforced the behavioural change mission of the program.

Midwife classes promoted a stronger sense of identity among midwives from the same or neighbouring communities than institutes had. One scholar of the Florida Midwife Program wrote about how the localised educational format produced a sense of strength and solidarity from which they had previously been isolated in their individual communities (Susie, 2009, p. 43).

A way in which this sense of identity appeared was through the creation of midwife clubs, which gathered midwives at the county level and encouraged their attendance to midwife classes and their adoption of new behaviours through competition. Clubs would measure goals such as mothers sent to prenatal care, safe home births, and meetings attended to create a friendly competition between county midwife clubs (Florida State Board of Health, Newspaper Clippings, From Key West Citizen and Okeechobee News, September 1937).

Through competition and a greater sense of identity, midwife clubs reinforced behavioural changes via peer group norm enforcement. The program's leadership theorised that "coaxing [older midwives] into thinking that they are helping to train the new ones" would improve outcomes as younger midwives took over more deliveries over time (Florida Board of Health, Leon County Midwife Program). The program acknowledged the authority of older midwives within Black communities. Leveraging this authority with bonding channels improved the adoption of new behavioural practices by Black midwives.

In the background section of this paper, I highlighted research that stressed the lack of organising power within the midwife occupation as a key factor in its demise in other parts of the US. Ironically, the midwifery reforms began to foster this type of organising power. However, as I will show in the next section, the organising capacity of physicians far outpowered the nascent gains of midwives.

2.4.6 Bridging Built and Burnt

The Midwife Program's leadership saw another benefit aside from bonding between midwives in the move toward a more localised educational model:

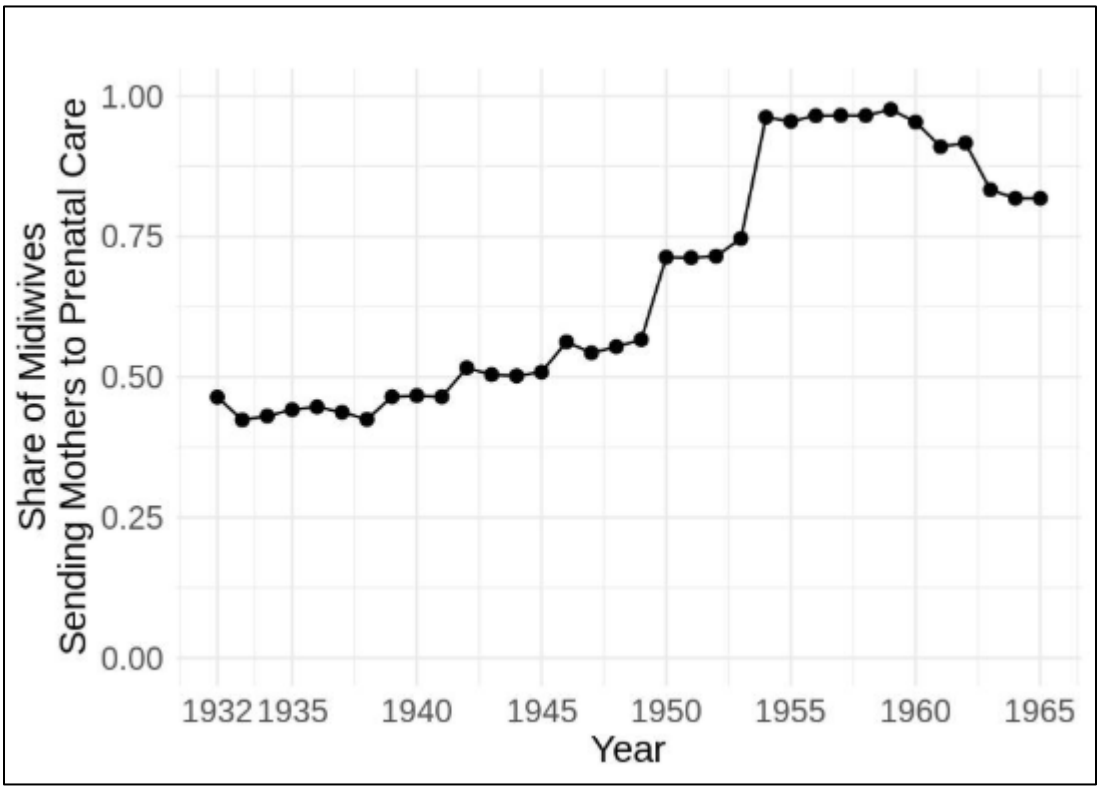
> "By holding [midwife classes] in smaller groups, more intimate instruction will be possible and a closer contact with local nurses and local medical professionals will be possible" (Hanson, October 1936, p. 246)

Midwife classes brought midwives into contact with local nurses and physicians. Where the county health department had the capacity, county health nurses and physicians ran the midwife classes taking over the duties from the State Board of Health (Florida State Board of Health, Annual Report, 1936, p. 117). The 1939 Annual reports commented that 'doctors are becoming interested in [the Midwife Program], offering their assistance' (Florida State Board of Health, Annual Report, 1939, p. 43).

The bridging channels supported the program's goal of integrating midwifery services with clinical care in the form of prenatal services and hospital care in the case of complicated pregnancy. I proxy the development of these bridging channels through measures like the share of midwives sending cases to prenatal care and the share of midwives with a physician recommendation on their record card.

FIGURE 2.11 shows the change in the share of midwives sending their maternal cases to prenatal care. The growth appears slow at first and unreactive to the shift to a more localised teaching model. However, this is likely due to the relative lack of prenatal services during that period. A report from 1939 reported that only seven counties in Florida had full-time health units offering prenatal care services (Cornely, 1942). By 1950, this number had increased to 57 counties (Florida State Board of Health, Annual Report, 1950, p. 156).

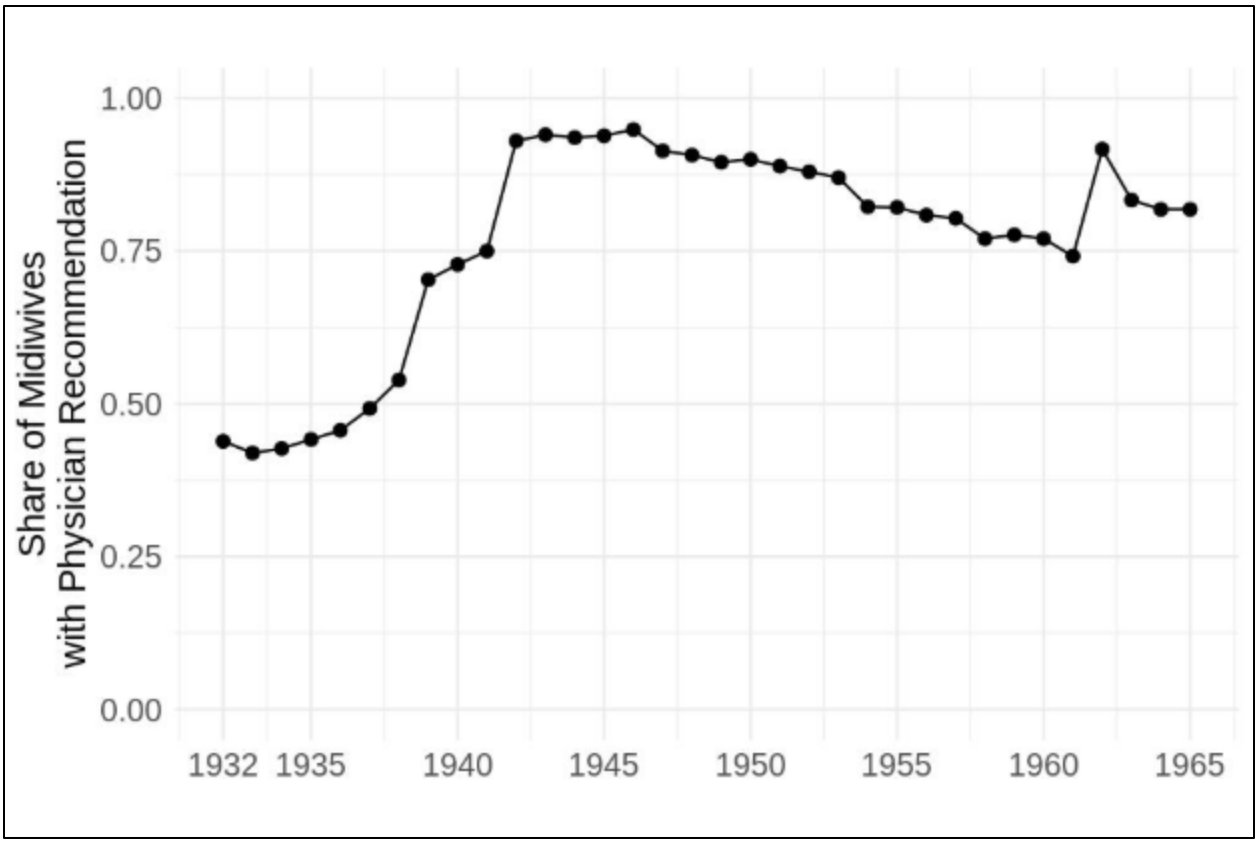
FIGURE 2.11: Share of Midwives Sending Maternal Cases to Prenatal Care



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

Another measure of bridging channels is found on the midwife record cards in the form of physician recommendations. These were not a requirement for midwives, but they were encouraged since they would show a connection between a midwife and at least one local physician. These local physicians could be called on if births showed signs of a difficult childbirth. FIGURE 2.12 shows the number of midwives with at least one physician recommendation appearing on the record card. The share grows from 42 percent at the start of the program to 95 percent by 1946. The increase in the share of midwives with physician recommendations shows that connections between midwives and physicians formed and became a strong indicator of whether a midwife would remain active within the program. Moreover, there is a noticeable increase in the share of midwives with at least one recommendation after the shift to more localised instruction.

FIGURE 2.12: Licensed Midwives with Physician Recommendations



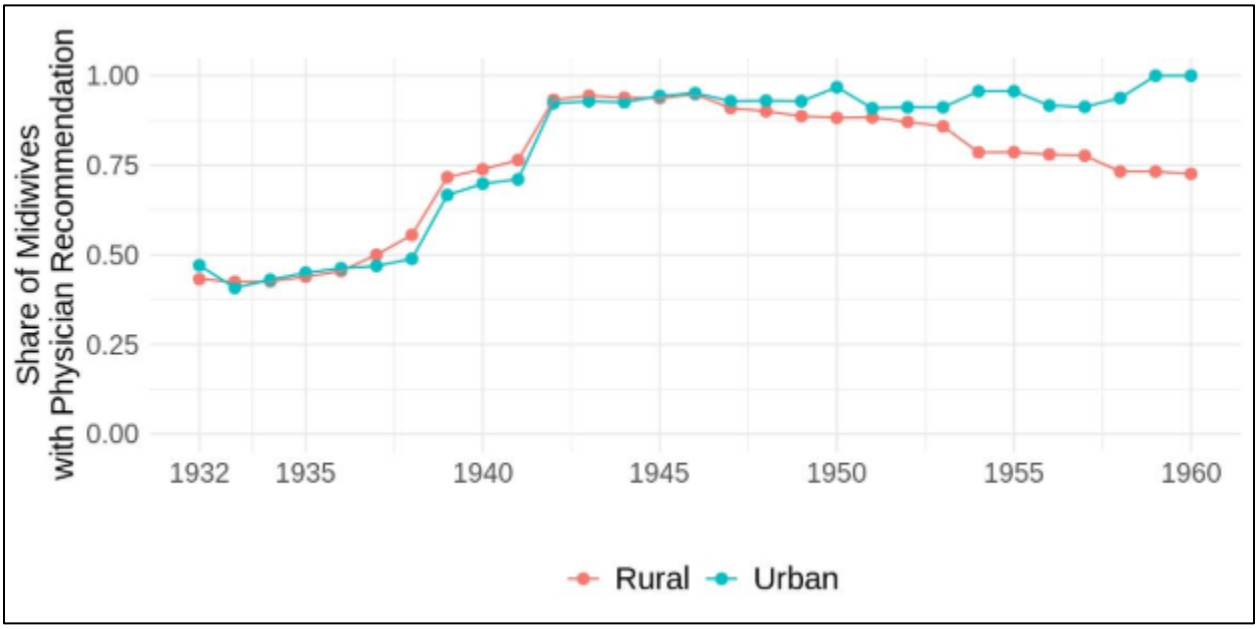
Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

However, the share of midwives with evidence of these bridging channels declined after 1950, falling from a 90 percent to 74 percent by 1961. The decline corresponds with a couple major changes in health policy within the state. First, the State Health Department devolved control over the Midwife Program to county health departments in 1951. This transition introduced substantial variation in program implementation, weakening central oversight and reducing the emphasis on documenting physician recommendations. The resulting inconsistency may have produced both real declines in midwife-physician connections and gaps in recordkeeping.

Second, the onset of the decline occurred during the expansion of rural hospital infrastructure following the passage of the Hill-Burton Act by the US Congress. In addition to increased hospital infrastructure, the Florida legislature designed a maternal health plan that subsidized the care of low-income mothers. The plan promoted hospital births for 'normal and abnormal obstetrical cases' with the explicit aim of '[reducing] the necessity for midwives [in areas with a hospital]' (Florida State Board of Health, Annual Report, 1956, p. 63). While

framed as a public health improvement, this shift had the effect of severing the fragile bridging channels between lay midwives and clinical institutions—particularly in rural areas, as shown in FIGURE 2.13.

FIGURE 2.13: Share of Midwives with Physician Recommendation



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

Oral histories from midwives and program staff during this era illustrate how professional exclusion played out on the ground. Mary Lee Jones, an active midwife at the time, attributed the decline in her caseload to health insurance reforms and hospital expansion, which systematically excluded midwives from both coverage and clinical spaces (Susie, 2009, p. 197). Gertrude Lee, a state nurse, echoed this sentiment in a later interview: “Hospital management and physicians [were] not going to let those lay midwives” into the delivery wards (Lee, 2016). These accounts make clear that hospital gatekeeping—not community preference—constrained midwifery practice.

Other accounts highlighted how cooperative intentions eroded over time. Evelyn Reynolds, the daughter of midwife Georgia Reynolds, linked the decline of her mother’s practice not to overt hostility but to a cultural drift toward institutional norms. “It wasn't so much as to maybe destroy midwifery,” she reflected, “as it was a strong feeling of helping the newborn and

the mother-to-be by making sure that it was done under the safest and most sanitary conditions" (Susie, 2009, p. 54).

These recollections underscore a key point: while bridging social capital enabled early cooperation between midwives and physicians, it proved fragile in the face of institutional expansion and occupational rivalry. Professional organization was at the root of the breakdown in bridging channels. As hospitals multiplied and maternal care became increasingly medicalized, physicians reinforced their professional boundaries. They did this first by excluding midwives from access to pharmaceuticals in the 1931 Midwifery Control and Licensing Act, then again by excluding midwives from hospital wards and health plan coverage.

In theory, bridging channels could have sustained a hybrid maternal healthcare model—one where midwives continued to attend births in low-resource areas while coordinating with physicians for high-risk cases. In practice, however, professional self-interest and institutional gatekeeping prevented true integration. As physician networks consolidated their authority over both knowledge and space, bridging social capital was progressively undermined by occupational bonding among doctors—a dynamic that re-marginalized midwives just as public health infrastructure reached the communities they served.

2.5 Conclusion

This paper argues that a social capital framework can inform our understanding of southern midwifery reforms. Florida's Midwife Program illustrated the ways in which linking, bridging, and bonding channels drove and hindered the program's impact.

Linking channels between the program and philanthropic institutions, particularly the Rockefeller Foundation, played a foundational role. They provided training opportunities that were not available within the state or through state funds. These resources helped build the program staff's capacity as well as capacity at lower county levels. Black nurses, who faced systemic educational barriers in the Jim Crow South, benefitted from linking channels to private philanthropic institutions. Increases in Black nursing capacity underpinned the strategy of racial matching pursued by the program through one-on-one instruction. In general, the program's staff

leveraged linking channels to tailor pedagogical tactics to a primary school educated and rural audience.

The shift from regional institutes to localized classes and midwife clubs fostered bonding channels that improved the shared identity. These peer networks reinforced hygienic behaviours and created an informal system of mutual enforcement. Such networks contributed to the program's greatest epidemiological success: a 64 percent decline in maternal deaths from puerperal sepsis among Black mothers between 1933 and 1948.

Bridging channels showed early potential but ultimately faltered. While the program initially fostered collaborative relationships, the expansion of rural hospitals and the systemic blocking of midwives by physician maternal care exposed the fragility of these ties. Physicians, supported by professional associations and state policy, restricted midwives' access to pharmaceuticals, hospitals, and coverage under maternal health plans. This occupational rivalry undermined efforts to create a hybrid maternal care model, reasserting hierarchies that excluded lay midwives from institutional spaces.

Social capital enabled cooperation, but it could not override entrenched professional and racial hierarchies. The Midwife Program succeeded in adapting to the realities of its workforce, transferring vital health knowledge. Yet its inability to embed midwifery within the expanding medical system reveals the limits of reform when institutional access and structural power remain unequal. The failed attempt to fully integrate midwifery services with physician-based care is one reason for the widening racial disparity ratio in maternal mortality occurring across the mid-20th century: the Black-white maternal mortality ratio rose from 1.6 in 1935 to 3.3 in 1945 and reached 6.0 by 1960 (Florida State Board of Health, Annual Report, 1961). For scholars and policymakers, Florida's Midwife Program is both instructive and cautionary. It improved outcomes and preserved midwifery care in marginalized communities, but it also illustrates how public health interventions can be constrained by existing social hierarchies.

Chapter 3: The Hill-Burton Act and Early-life Racial Health Disparities

Abstract: The Hill-Burton Act of 1946 transformed healthcare infrastructure across the United States by funding the construction and modernization of hospitals. The Act's funding structure advantaged underserved regions, like the US South, and led to a convergence in hospital bed capacity across regions (Chung et al., 2017). The Act also proliferated race-segregated hospital facilities by permitting funds to go to such facilities so long as the share of beds available to each race were equal to their share of the local population. In this chapter, I investigate the Act's impact on racial maternal and infant health outcomes in the US South, using county-level data across six states between 1940 and 1960. The chapter evaluates the effects of Hill-Burton funding on rates of hospital births, infant mortality, and stillbirths with a difference-in-difference analysis. Counties receiving Hill-Burton funds saw a significant increase in hospital births compared to counties that did not receive funds. Black births being pulled into the hospital was the main driver of this result. The white infant mortality rate experienced a greater reduction than the Black infant mortality rate, worsening existing racial disparities. By contrast, Black populations showed more pronounced declines in their stillbirth rate. The implication is that investments in hospital-based care at this time had a larger impact in reducing perinatal mortality than post-neonatal mortality. Hospitals equipped with delivery rooms and antibiotics were instrumental in addressing complications during childbirth, reducing intrapartum stillbirths. However, the broader social determinants of health—such as income inequality, inadequate housing, and limited health insurance coverage—played a significant role in perpetuating post-neonatal mortality disparities.

3.1 Introduction

The Hill-Burton Act (1946), officially titled the Hospital Survey and Construction Act, marked a watershed moment in US health policy. Designed to address the need for hospital infrastructure, the Act offered federal subsidies for the construction and modernization of healthcare facilities (Hospital Survey and Construction Act, 1946). Hill-Burton funds facilitated the creation and upgrading of thousands of hospitals nationwide, and its impact was felt the strongest in America's most underserved regions—the US West and South. However, the program's implementation in the Jim Crow South conformed to the racial social order of the era. The Act included provisions that allowed federal funds to support race-segregated facilities under a "separate but equal" clause, which raises important questions about its impact on racial disparities in health outcomes.

This chapter explores the impact of the Hill-Burton Act in the US South on the region's racial early-life health disparities. Specifically, the analysis focuses on three health outcomes: the percentage of hospital births, infant mortality rates, and stillbirth rates. Using a difference-in-difference analysis across 446 counties in six Southern states—Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina—from 1940 to 1960, the analysis will answer two questions: 1. How did the racial health outcomes in counties receiving Hill-Burton funds experience change compared to counties that did not? 2. What mechanisms account for the observed changes in racial disparities?

Counties receiving Hill-Burton funds saw a significant increase in hospital births, particularly among the Black mothers, reflecting a shift from home deliveries to hospital births. The trend was more pronounced in counties receiving a new hospital rather than upgrading a pre-existing one. Improvements in infant mortality rates were minimal during the period, but what gains did occur accrued to a larger extent within the white population. By contrast, stillbirth rates showed greater reductions among the Black population. These results are evidence that expanded access to hospital care improved outcomes during and soon after childbirth even as broader disparities in infant healthcare remained unresolved.

The three outcomes examined in this paper speak to different dimensions of early-life health and intersect with the broader literature on the drivers of long-term health improvements, namely the "three I's" of incomes, innovations, and infrastructure. Each factor contributed to

health advances in the 20th century, but their impact was often distributed unequally across racial populations. The distribution of these health improvements is central to understanding racial inequalities in health.

Incomes matter because higher earnings improve living conditions, nutrition, and access to education and healthcare (McKeown, 1976; Boustan & Margo, 2015). However, income gains alone did not uniformly translate into better health outcomes for Black Americans. Research shows that despite higher incomes for Black migrants outside the South, mortality increased for Black Americans born in the early 20th-century South (Black et al., 2015). Income gains in the US South did little to address the fact that many Southern Black Americans remained in segregated residential areas and without health insurance coverage (Beach et al., 2022 & Thomasson, 2006).

Sulpha drugs and penicillin, which became widely available in the US by 1937 and 1945 respectively, were innovations that had a considerable impact on the efficacy of clinical medicine (Løkke, 2012 & Alsan et al., 2021). Sulpha drugs reduced overall mortality by 2 to 3 percent and increased life expectancy by 0.4 to 0.7 years (Jayachandran et al., 2010). Yet, these life-saving innovations disproportionately benefited white patients, with smaller gains for Black populations who often lacked hospital access or faced inferior care (Jayachandran et al., 2010).

Infrastructure also contributed to health improvements and had a large impact on infant health. Major public works projects, such as water and sewage systems, greatly reduced the burden of water-borne disease on infants (Troesken, 2002 & Cutler and Miller, 2005 & Alsan and Goldin, 2019). Still, patterns of residential segregation in the South shaped access to these improved systems, leaving many Black infants in neighbourhoods with poorer environments that harmed infant health (Troesken, 2022 & Beach et al., 2022). Another form of infrastructure that rose in importance across the mid-20th century was hospital infrastructure. Hospitals were essential in delivering the innovations discussed in the previous paragraph to the broader population. Recent work highlights that hospital construction improved early-life outcomes. For instance, investments by the Duke Endowment significantly reduced infant mortality, with larger gains for Black infants than for white infants (Hollingsworth et al., 2024).

By focusing on the Hill-Burton Act—a major federal infrastructure intervention implemented within the segregated South—this chapter contributes to understanding how policy-

driven improvements in infrastructure interacted with persistent racial inequalities. The findings suggest that while hospital investments improved perinatal outcomes, they fell short of addressing post-neonatal mortality disparities rooted in structural social determinants of health.

3.2 Racial Health Disparities in the Mid-20th Century

The mid-20th century saw some progress in narrowing racial health disparities at the national level. But this narrowing was far from converging. Boustan and Margo (2015) found that between 1940 and 1960 Black life expectancy had an average annual increase of 0.5 years while white life expectancy increased by 0.28 years. From 1945 to 1965, the average annual reduction in infant deaths per 1,000 live births was 0.73 for Black infants and 0.68 for white infants. The differences in rates of improvement though were insufficient to close the gap between the two racial groups. From 1940 to 1960, the Black-to-white mortality ratio for infant mortality and stillbirths remained above 1.5, reaching 3.0 at times in the late 1950s for infant mortality.

TABLE 3.1: Improvements in Life Expectancy and Infant Mortality Rate, by Race

Average annual additions to life expectancy (in years)		
	White	Black
1900-40	0.39	0.28
1940-1960	0.28	0.5
1960-70	0.09	0.11
Average annual reductions in infant deaths per 1,000 live births		
	White	Black
1920-45	1.65	2.58
1945-65	0.68	0.73
1965-80	0.69	1.36

Source: Boustan, L. P., & Margo, R. A. (2015). *Racial differences in health in the United States: A long-run perspective*. In The Oxford Handbook of Economics and Human Biology, Appendix

Eriksson et al. (2018) pointed out that the narrowing in infant mortality disparities between 1900 and 1940 was in part driven by vital statistics becoming more accurate over time rather than genuine health improvements. Inaccurate vital statistics, namely an under-enumeration of births in more rural areas, caused an upward bias in infant mortality rates. Since most of the US Black population lived in rural areas across the US South, Black infant mortality rates were particularly vulnerable to this bias. The conclusion from this research is that 'progress in Black health proceeded at a slower rate' than previously thought (Eriksson et al., 2018, p. 2015). I am not concerned about this data bias for my analysis since the birth reporting coverage improved and remained strong for the periods under analysis (Shapiro and Schachter, 1952).

Previous literature on racial health disparities during the mid-20th century has emphasized the Great Migration—the mass movement of Black Americans out of the US South and into urban areas in the North, Midwest and West Coast. Contemporary social scientists believed that Black out-migration would lead to better health outcomes. Central to this belief is the positive association between income and overall health (Myrdal 1944).

Collins and Wannamaker (2014) documented the economic gains of Black migrants who moved before 1940, and they attributed nearly all of the racial wage convergence to inter-regional migration. Studies that focus on the post-1940 period offer less support for the long-run transformative power of moving out of the South (Maloney 1994, Margo 1995, Donohue and Heckman 1991). Derenoncourt (2022) found that the long-run effects of the Great Migration on economic mobility were negative for Black men. She argued that the main driver of this effect was the degradation of neighbourhood environments in urban areas over time.

Literature focused on the Great Migration's impact on health has a gloomy outlook. Black et al. (2016) found that migration out of the South reduced life expectancy. The authors note that any benefits due to "economic and social improvement were apparently swamped by other forces, such as changes in behavioural patterns... including higher propensities to smoke and consume alcohol" (Black et al., 2016, P. 17). In addition to these behavioural choice factors were structural factors, such as discriminatory housing policies, that left Black Americans in unhealthy neighbourhoods.

Rural Southern areas had lower infant mortality rates than the urban North and Midwest early in the 20th century. The so-called 'urban penalty' was driven by poor urban sanitation and infrastructure (Haines 2001). The 'urban penalty' appears in the results of scholars looking at the Great Migration's effect on infant mortality. Eriksson and Niemesh (2016) find that infants born to parents that migrated out of the US South early in the Great Migration suffered an increased likelihood of death in the first year of life. Over time, urban areas invested in better infrastructure, improving urban health. Eriksson and Niemesh's study ends in 1940, at which point the disparity between North and South infant mortality rates had almost completely diminished. Thus, the evidence suggests that the Great Migration did not contribute to better infant health outcomes for Black infants.

Research using data from the Johns Hopkins Hospital revealed persistent racial disparities in stillbirths dating from turn-of-the-century up to the 1930s (Costa 2004). Costa attributed the stillbirth disparity to higher prematurity rates among Black births, which she argues is related to the higher rates of syphilis within the Black female population. The findings align with broader public health research showing that Black communities faced disproportionately high rates of infectious diseases like syphilis, due to a lack of access to adequate healthcare and public health interventions (Parran 1937: 161-174; Costa 2004).

Research on the Great Migration and detailed studies of Johns Hopkins Hospital records are important for understanding some aspects of racial health inequalities. However, they do not capture the state of racial disparities fully. Despite the considerable number of Southern Black emigrants, 60 percent of the America's Black population still lived within the US South by 1960 (Gibson et al., 2002).

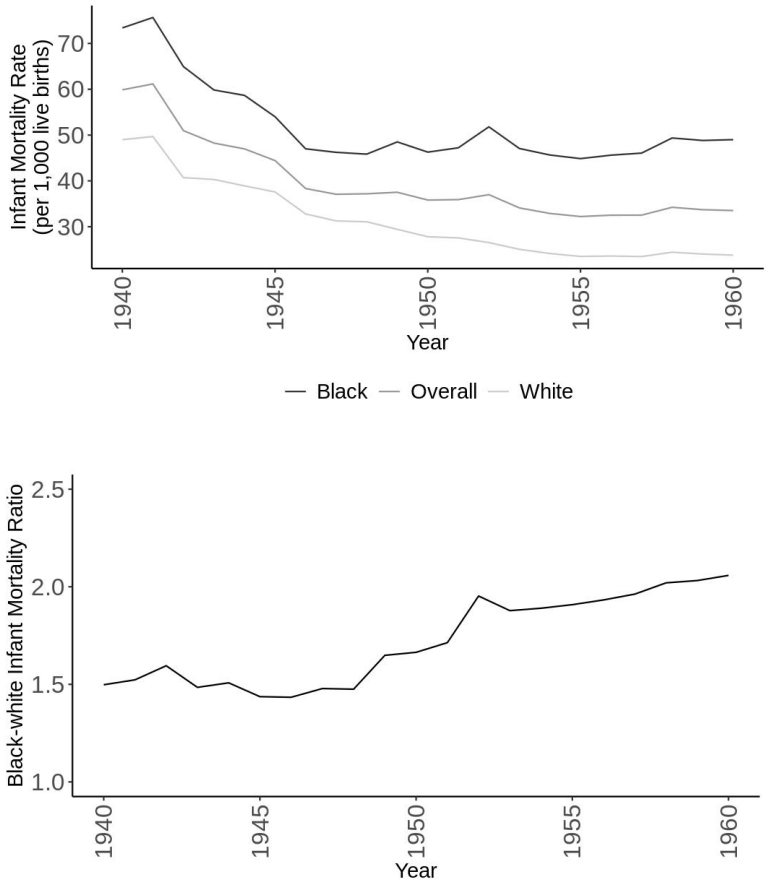
The overt and oppressive imposition of racial segregation and discrimination in the US South impacted the health of the region's Black population (Adkins-Jackson et al., 2025). Infant health, in particular, was negatively impacted by residential segregation in both urban and rural areas based on research covering the early-20th century (Karbeah and Hacker, 2023 & Beach et al. 2022). Qualitative studies of impact of Jim Crow era segregation on hospital-based care stress the inferior quality of care in Black-serving facilities due to a combination of resource constraints and staffing issues (Beardsley, 1986 & Gamble, 2011). However, the Hill-Burton Act offered an inflow of funds to this system of healthcare, and some have argued that the Act

improved hospital conditions for both races (Beardsley, 1986 & Thomas, 2011). Thus, this chapter builds on our understanding of racial health disparities by focusing on a critical region and doing a quantitative analysis of the Hill-Burton Act's impact on racial health outcomes.

3.2.1 Racial Disparity in Maternal and Infant Health in the US South

FIGURE 3.1 shows the infant mortality rates from 1940 to 1960 for the overall, white, and Black populations across the six Southern states included in this paper's analysis—Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina. The Black population has a higher infant mortality rate than the white population across the entire period. The period with the most dramatic decline occurs between 1940 and 1945, before the implementation of the Hill-Burton Act. After 1946, declines in infant mortality slowed down across the population. The Black population experienced a reversal of fortune, ending the period with a higher infant mortality rate than it had achieved in 1946.

FIGURE 3.1: Infant Mortality Rates by Race and Black-white Infant Mortality Ratio

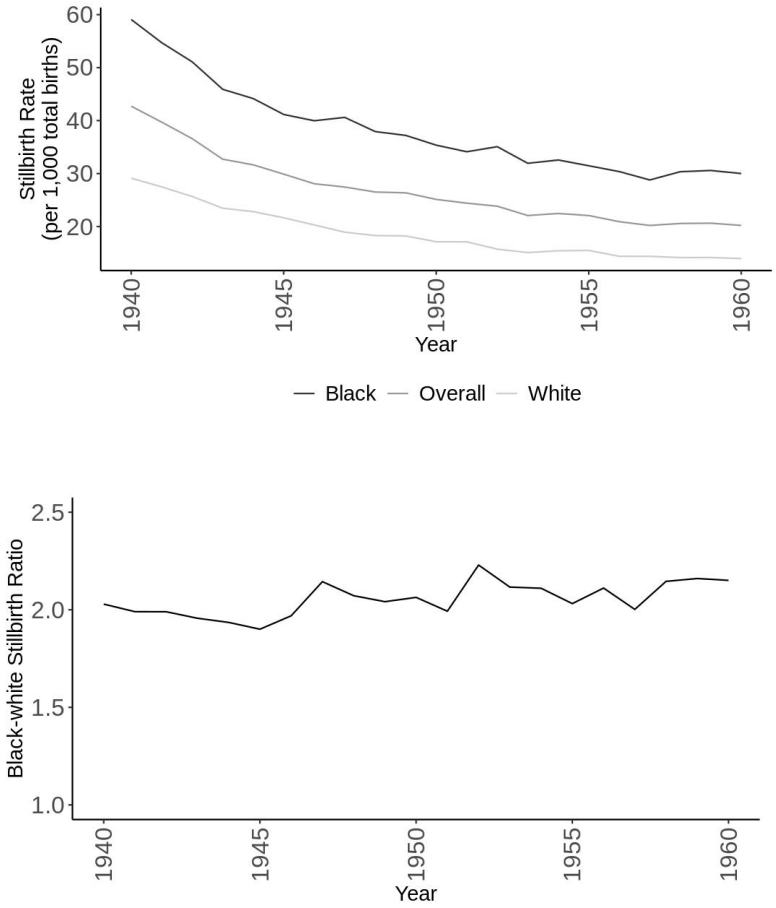


Source: US Vital Statistics 1940-60, CDC/National Center for Health Statistics

FIGURE 3.1 also plots the Black-white infant mortality ratio, which began around 1.5 in 1945 and rose above 2 by 1950. Since the white population's infant mortality rate continued to decline as the Black population's rate stalled and rose, the disparity between the two racial groups increased across the period for the Southern region.

Stillbirth rates (FIGURE 3.2) again show a large decline in the period before the Hill-Burton Act. However, rates continued to decline for all populations after 1946. The Black-to-white stillbirth ratio remained more stable than the infant mortality ratio. FIGURE 3.2 shows that the disparity grew between 1940 and 1960, but the ratio stabilized around a mean of 2.1 during the period after the Hill-Burton Act.

FIGURE 3.2: Stillbirth Rates by Race and Black-white Stillbirth Ratio



Source: US Vital Statistics 1940-60, CDC/National Center for Health Statistics

Stalling infant mortality rates with an increasing disparity ratio and declining stillbirth rates with a persistent disparity ratio characterize the period from 1946 to 1960. These trends form the context within which the difference-in-difference results of this paper appear.

3.2.2 Hospital-Based Care and Health Outcomes

Hospital infrastructure is the treatment effect in this paper's difference-in-difference analysis. Previous literature has found that hospitals made a difference to health in the 20th century. In their study of the Duke Endowment's effort to modernize hospitals in North and South Carolina from 1927 to 1942, Hollingsworth et al. (2024) found that Duke-funded hospitals reduced their infant mortality rates by 7.5 percent. Furthermore, the effect size for Black infants was nearly three times larger than the effect size for white infants. Looking at the effects of the

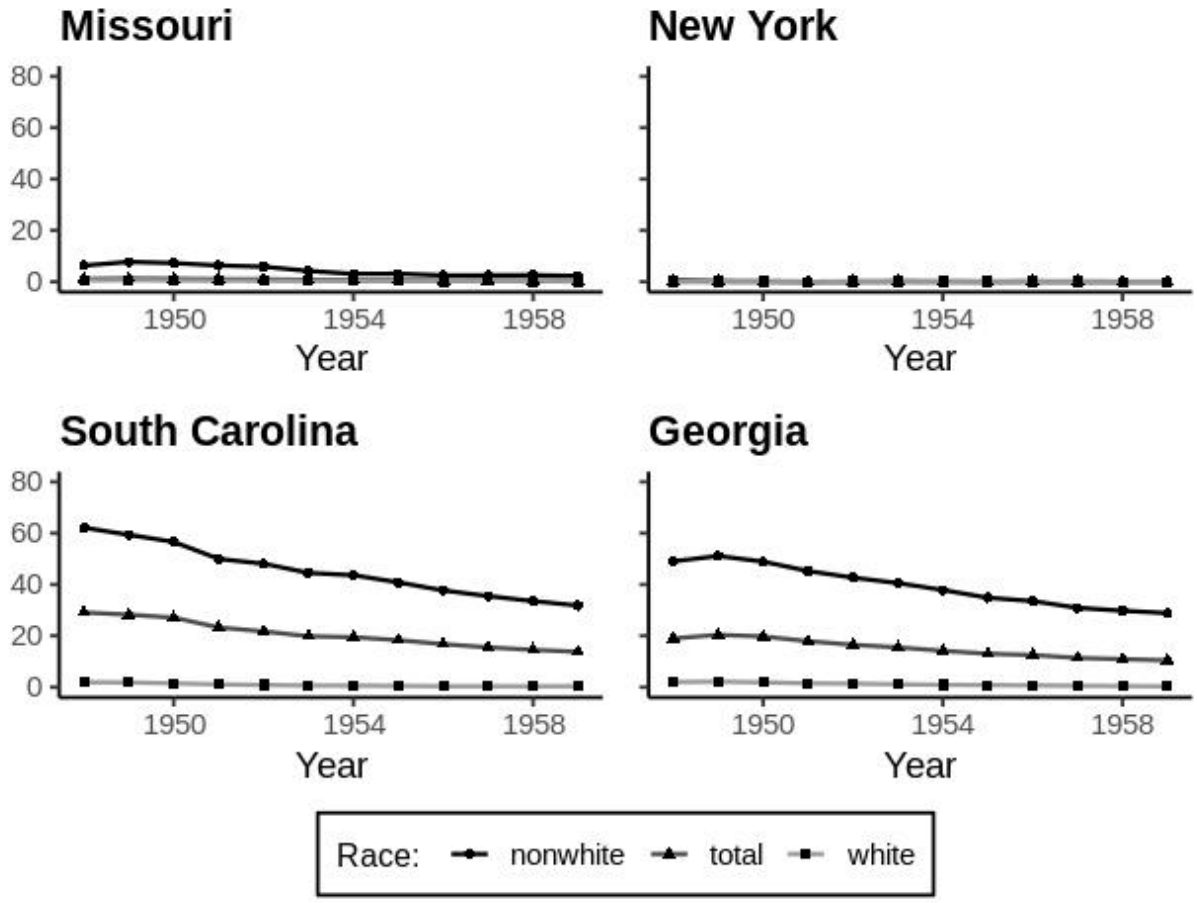
Hill-Burton Act at the national level, McCloy (working paper) reports that counties that received funds for hospital infrastructure reduced their overall crude mortality rates compared to counties that did not receive Hill-Burton funds.

Figinski and Troland (2020) highlight the complementary effects of health insurance and hospital bed capacity on the percentage of hospital births and infant mortality rates in Appalachian coal mining counties. Their results suggest that union-based initiatives that expanded health insurance were the primary driver of improving health outcomes. Expanded hospital bed capacity had a small but complementary effect on health outcomes within these communities (Figinski and Troland, 2020, p. 24).

3.2.3 Mechanisms for Stillbirth and Infant Mortality Rate Decline

Hospital care in the mid-20th century had its most dynamic impact on early-life outcomes around the time of childbirth. Childbirth had moved away from the home and into the hospital for most Americans by the 1930s. Southern Black mothers were the slowest to transition to hospital births. Figure 3.3 shows natality data disaggregated by race and birth attendant for two Southern and two non-Southern states. Data by race is only available from 1946 onward, but the stark regional patterns are clear: the US South had higher shares of midwife-attended than other regions and the region's Black population had the lion's share of these births.

FIGURE 3.3: Share of Midwife-attended Births for Select Non-Southern (top) and Southern (bottom) States



Source: Vital Statistics of the US - Natality and Mortality data for the United States, various volumes 1940 - 1968.

Thomasson and Treber (2008) point out that hospital births only achieved better health outcomes for the mother and child after the introduction of sulpha drugs in 1937. Jayachandran et al. (2010) estimate that sulpha drugs contributed to a 24 to 36 percent reduction in maternal mortality and significant improvements in infant survival rates. Their study makes a note of the fact that benefits were larger for the white population than the Black population nationwide. They leave the question of hospital supply and accessibility unaddressed. Penicillin, an antibiotic that was mass produced in the US in 1945, had a similarly striking impact of penicillin on overall mortality (Alsan et al. 2021). It was this connection between hospital and innovations, specifically antibiotics, that won hospitals an association with better health outcomes.

The pairing of hospital-based care and antibiotics has also been found to have impacted stillbirth rates. Løkke (2012), studying maternal and perinatal outcomes in Denmark, highlighted two possible pathways. In the first, antibiotics improved women's cohort-level health lessening the burden diseases like tuberculosis and syphilis had placed on maternal health. The second pathway involved obstetrical care. Antibiotics allowed for more invasive interventions to save the babies at risk of foetal death without endangering the life of the mother. Intrapartum interventions, such as forceps deliveries or caesarean sections, in the antibiotic era were less likely to lead to post-operative infections. Stillbirths from intrapartum causes like placental abruption, cord accidents, prolonged labour, or preeclampsia, were avoidable when properly attended to in a hospital.

3.3 The Hill-Burton Act: Hospital Expansion in the Segregated South

The Hill-Burton Act (1946) marked a major federal intervention in US hospital infrastructure. Motivated by concerns about the capacity of America's hospital infrastructure, especially in rural counties, the Act provided generous subsidies of between one-third and two-thirds of the total project costs for hospital construction and modernization. At the time of passage, 22 percent of US counties had no hospital, with these gaps heavily concentrated in rural areas of the West and South (Chung et al., 2017). Before the Act, hospital funding came largely from municipal, state, or private sources, limiting investments in poorer regions.

The original Act provided $75 million ($1.2 billion in 2024 dollars) in funds to be distributed among US states over 4 years. After state officials expressed a desire for more funds to build up their hospital bed capacity, Congress raised the amount of funds in 1949 to $150 million ($2.4 billion in 2024 dollars) over another 4 years. The Act was continuously renewed until it was incorporated into the Public Health Service Act as Title XVI in 1975.

In total, the Hill-Burton Act funded 5,567 general hospital projects (Chung et al., 2017). This number includes both new constructions as well as renovations to existing hospitals. The Act drove a 511 percent increase in county-owned general hospitals and a 1,500 percent increase in bed capacity between 1948 and the 1970s (Thomas, 2011). These investments helped establish the modern system of community and university-affiliated hospitals still seen today.

Although the Act also funded specialized facilities (for tuberculosis, mental health, and other needs), 60 percent of Hill-Burton projects were for general hospitals. And many of these general hospital projects were new constructions rather than upgrades or expansions. In the six Southern states analysed in this paper, 49 percent of funded projects involved building entirely new hospitals, while 51 percent upgraded or expanded existing ones.

Yet increases to bed capacity alone did not guarantee access to care or outcomes for all populations. Southern hospitals funded under the Act maintained racial segregation, under a "separate but equal" clause. Moreover, the Act only made a vague stipulation about charitable care, leaving many who could not afford hospital care with little improvements. These structural barriers limited the potential of Hill-Burton to close persistent racial gaps in maternal and infant health. Understanding how these dynamics shaped the delivery of hospital services in the Jim Crow South is crucial for understanding the Act's effect on early-life health outcomes analysed later in this chapter.

3.3.1 Hill-Burton Scope and Spending in US South

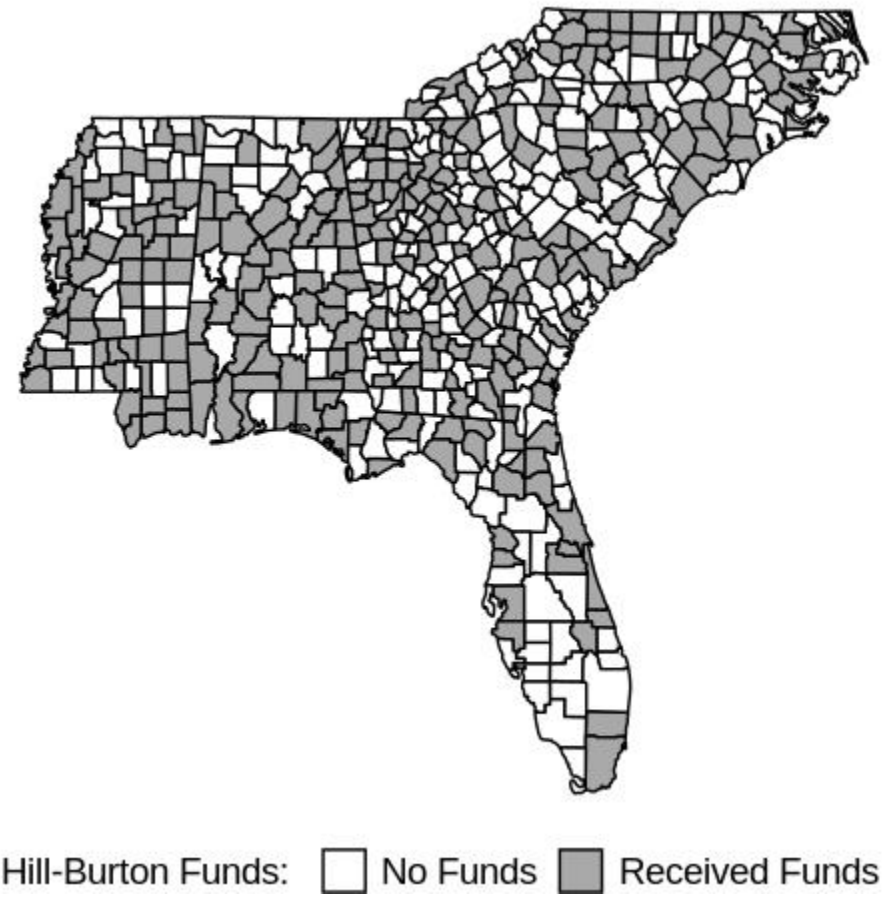
The Act aided the convergence of hospital bed capacity across US regions as well as between rural and urban areas. Results from Chung et al. (2017) support the view that Hill-Burton truly did make a difference for the neediest areas. Counties with median family income in the bottom quintile saw an increase of 2.3 beds per 1,000, while the growth in the top quintile was only 0.5 beds. The US South added 1.8 beds per 1,000 while the Northeast added only 0.7 beds. Across the US, rural counties had an increase of 2.4 beds per 1,000 while non-rural counties saw a decrease of 0.25 beds over this period. Overall, the standard deviation of beds per 1,000 across counties decreased from 5.9 in 1948 to 2.5 in 1975.

The Hill-Burton Act's success in narrowing the hospital bed capacity gaps in the US was due to the needs-based formula used to distributed funds (see Appendix 3.A.1 for more details). The formula caused poorer states to receive a larger amount of funds per capita than richer states. Looking specifically at the program's fund distribution for 1950, Georgia was one of the lowest per capita income states and received $2.6 million in funding, which amounts to $0.76 per person. Meanwhile, California, one of the wealthiest states, received $1.6 million, or $0.15 per person (Chung et al., 2017). Once distributed to the states, funds went to counties based on state plans designed and implemented by state officials. The primary predictor for receiving funds was

the disparity between a county's hospital beds per capita and the ideal hospital bed capacity of 4.5 beds per 1,000 population.

FIGURE 3.4 shows the extent to which the Hill-Burton Act reshaped the hospital infrastructure of the US South. 49 percent of counties across these six Southern states received Hill-Burton funds for a new hospital. The six Southern states benefited disproportionately from Hill-Burton subsidies: they received 17.6 percent of general hospital beds funded nationally between 1946 and 1960, and 19 percent of total funds distributed for general hospital projects.

FIGURE 3.4: Map of Southern Counties Receiving Hill-Burton Funds for a New Hospital



Source: Register, H.-B. P. (1947-1971). Hill-Burton Project Register. US Department of Health, Education; Welfare, US Public Health Service.

TABLE 3.2 gives a sense of the material impact of Hill-Burton projects. Funds helped to provide 31,184 beds between 1946 and 1960 across the six Southern states and covered 44 percent of the total cost of all general hospital projects. Nationally, Hill-Burton funds covered around 31 percent of the total cost of general hospital projects. Despite receiving more federal aid, hospital projects in Southern states were more cost-efficient with their funds, spending $4,622 less per bed provided than the national average. This is likely the result of two factors. First, the US South had lower wages than the nation. Southern projects saved on the cost of labour because of this. Second, Southern projects prioritized hospital bed capacity over

investments in cutting-edge technology. In a sense, 'catching up' to other regions was cheaper than adding more beds in higher-capacity regions.

TABLE 3.2: Summary of Hill-Burton Funds toward General Hospital Beds				
	Total Beds Provided	*Total Hill-Burton Funds (in millions)*	*Total Cost (in millions)*	*Expenditure per Bed Provided*
Southern States	31,184	$224	$507	$16,274
Nationwide	177,109	$1,160	$3,700	$20,896
Source: Register, H.-B. P. (1947-1971). Hill-Burton Project Register. US Department of Health, Education; Welfare, US Public Health Service.				

Race was a central feature in the debate among federal officials over the impact of the needs-based funding formula. Rep. Helen Gahagan Douglas, writing in the Journal of the National Medical Association in 1948, doubted that the Hill-Burton Act would help the poorest of Black communities as they lacked the resources to raise matching funds or sustain hospital operations (Thomas, 2011 p. 848). In contrast, Dr Vane Hoge, chief of the Hospital Facilities Division of the US Public Health Service, reassured sceptics that the Act's funding system offered special consideration to "population groups less adequately served because of race, creed, or colour. All these factors will work in favour of the groups with the greatest need of all—the Negroes in the rural South" (Hoge, 1948 p. 104).

Both views could be supported by the outcomes of the Act. The Hill-Burton Act led to an increase of Black beds in the US South. For example, in Mississippi—one of the poorest Southern states—Black beds increased by 211 percent through Hill-Burton funds (Thomas, 2006). Yet, TABLE 3.3 reveals that counties in the US South that received no funds from the Act were typically smaller, more rural, poorer, and had larger Black population shares. These findings are consistent with prior research on the Act's impact in North Carolina (Thomas, 2011, p. 196-198). Among funded counties, those receiving support for new hospitals more closely resembled unfunded counties than did those receiving upgrades, suggesting that the new construction component was more successful in reaching the most underserved areas.

TABLE 3.3: Summary Statistics, by Treatment Type				
Variable	*Never Received Hill-Burton Funds*	*Received Hill-Burton Funds*	*Received Funds for a New Hospital*	*Received Funds for Upgrading a Hospital*
Number of Counties	152	294	235	157
Population, 1950 (Median)	12,952	26,004	23,414	35,409
Birthrate, 1950 (per 1,000 population)	25.6 (4.43)	26.1 (4.41)	26.3 (4.34)	26.0 (4.51)
Non-white Share of the Population, 1950	45.5 %	39.6 %	40.9 %	37.2 %
Percentage Rural, 1950	97.4 %	84.4 %	87.2 %	73.2 %
Median Family Income, 1950	$1,448	$1,722	$1,632	$1,947
Source: Treatment status is based on Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service. Other county-level variables are from Area Resource File (1983). US Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Workforce, Rockville, MD.				

TABLE 3.4 shows the rollout of Hill-Burton funds between 1946 and 1959 by the type of projects funded. The share of never-treated counties made up between 34 and 49 percent of the total sample. This variation in funding exposure across counties created a natural setting for the difference-in-difference analysis presented in the following section. By leveraging this variation, the analysis looks to identify the extent to which Hill-Burton investments influenced racial disparities in maternal and infant health outcomes across the rural South.

TABLE 3.4: Treatment Rollout with Count and Share of Counties Included in Analysis, by Project Type

Received Hill-Burton Funds			**Received Funds for a New Hospital**			**Received Funds for Upgrading a Hospital**		
Year Receiving funds	*N*	*% of Counties Included in Analysis*	*Year Receiving funds*	*N*	*% of Counties Included in Analysis*	*Year Receiving funds*	*N*	*% of Counties Included in Analysis*
Never treated	152	33.93%	Never treated	152	39.28%	Never treated	152	49.19%
1946	20	4.46%	1946	19	4.91%	1946	1	0.32%
1947	57	12.72%	1947	51	13.18%	1947	10	3.24%
1948	41	9.15%	1948	30	7.75%	1948	15	4.85%
1949	29	6.47%	1949	21	5.43%	1949	24	7.77%
1950	24	5.36%	1950	18	4.65%	1950	10	3.24%
1951	17	3.79%	1951	11	2.84%	1951	13	4.21%
1952	8	1.79%	1952	7	1.81%	1952	9	2.91%
1953	9	2.01%	1953	6	1.55%	1953	3	0.97%
1954	17	3.79%	1954	13	3.36%	1954	9	2.91%
1955	17	3.79%	1955	12	3.10%	1955	11	3.56%
1956	15	3.35%	1956	13	3.36%	1956	8	2.59%
1957	14	3.13%	1957	13	3.36%	1957	14	4.53%
1958	13	2.90%	1958	9	2.33%	1958	14	4.53%
1959	15	3.35%	1959	12	3.10%	1959	16	5.18%

Sources: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service

Note: For the 'New' and 'Upgraded' project types, I excluded counties that received funds for the other type of project from that project-type sample (e.g. in the sample looking at counties receiving funds for a new hospital, I excluded counties that received funds for upgrades but did not receive funds for a new hospital). This exclusion made for a better baseline comparison group in the analysis. Excluding these counties is why the share of never-treated counties grew to 39 percent and 49 percent in the 'Received Funds for a New Hospital' and 'Received Funds for Upgrading a Hospital' categories.

3.3.2 Race-Segregated Hospitals

The segregated structure of Southern hospitals further constrained the potential of Hill-Burton to reduce racial health inequalities. The Act was the only piece of federal legislation that codified a "separate-but-equal" philosophy by allowing race-segregated hospitals to receive funding so long as projects '[made] equitable provision based on the need for facilities and services of like quality' (Hospital Survey and Construction Act, § 622(f)(1)). Equitable provision was defined as equal to the share of the overall local population of each racial group.

This clause was essential to securing the support of Southern legislators but represented a major setback for advocates of medical integration. Dr. W. Montague Cobb, a leading medical civil rights figure, denounced Hill-Burton as "a kind of deluxe Jim Crow" (Cobb, 1952), underscoring how the Act reinforced the very inequalities it was ostensibly meant to address. Writing on hospital renovation efforts in St. Louis during this era, Cobb characterized plans to create two segregated municipal hospitals as an "old-clothes-to-Sam" pattern, whereby Black Americans were handed "secondhand products" while white communities received newly built, modern facilities (Gamble, 2011, p. 10).

Prior to the Hill-Burton era, southern Black population with access to a hospital were accustomed to receiving care in neglected spaces within the public hospital system. In Atlanta's Grady Memorial Hospital, for example, NAACP leader Walter White documented that Black wards in the 1930s were "infested with rats and cockroaches" and so burdened by "dinginess, misery, and poverty" that "even a well person could not avoid feeling a little sick in those surroundings" (Gamble, 2011, p. 47).

Attempts to improve these conditions through outside philanthropy also exposed the structural barriers faced by Black healthcare providers and patients. The Rosenwald Fund's experience with Knoxville General Hospital offers a revealing case. In 1931, the Fund donated $50,000 to create a sixty-bed Black wing in what was then an entirely segregated municipal hospital, with the city and county providing an additional $200,000 and local Black residents contributing funds originally raised to build an independent Black hospital. However, the new wing remained under white supervision. Black physicians had to admit their patients under the direction of white staff, with the promise of full privileges only after demonstrating competence. Laboratory and radiology services were to be shared, but final control over medical management

remained with the white superintendent (Gamble, 2011, pp. 112–113). The Knoxville example illustrates the prevailing model of "biracial" institutions, expanded services but still tightly controlled by white medical professionals.

The Hill-Burton Act amplified this pattern in the postwar period. Most Hill-Burton-supported hospitals in the South were biracial. That is, one single hospital with segregated wards. The architectural plans for these projects often mimicked designs that were first developed by the Public Works Administration in the 1930s. The alternative design option was to have two independent hospitals, one that was white-serving and one that was Black-serving. These types of projects were far fewer. Before the Act, the number of Black hospital beds was evenly split between black and biracial institutions. By 1960, approximately one-third of black beds were in black hospitals and two-thirds were in biracial hospitals (Thomas 2011, p. 851). This shift reflected both the growth of newly constructed biracial facilities and the closure of underfunded Black hospitals unable to meet new federal standards.

Though the Act significantly increased hospital infrastructure in an absolute sense, the "separate but equal" clause codified and reinforced the relative disparities that had long characterized segregated care in the South. A major shortcoming of the data used in this chapter's analysis is that projects do not have information on what type of race-segregation they followed (e.g. the hospital was exclusively white-serving, exclusively Black-serving, or biracial). I have been unsuccessful so far in finding a data source with sufficient spatial coverage to include in the analysis. Without this information, the results of this paper can only speak to the effect hospital infrastructure investment in a broad sense and cannot speak directly to the effects of specific race-segregated care models or hospital management policies. Thus, the analysis conducted in this chapter is determining the effects of increase in hospital infrastructure investments could improve racial health outcomes, even when those investments occurred within a healthcare system structured by deep racial discrimination.

3.4 Data and Methods

To analyse the effect of the Hill-Burton Act on racial maternal and infant health outcomes, I focused on three early-life health statistics: percentage of hospital births, infant

mortality rate, and stillbirth rate. I performed a difference-in-difference analysis using the Callaway-Sant'Anna (CS) model to identify the effect of a county receiving Hill-Burton funds on these three health outcomes (Callaway & Sant'Anna, 2021).

Earlier studies of the Hill-Burton Act have employed an instrumental variable (IV) analysis to examine healthcare-related outcomes, but the outcomes studied in this analysis call for a difference-in-difference approach (Chung et al., 2017 and McCloy, working paper). IV methods were well-suited to analyse changes to hospital bed capacity since these changes can be approximated through cross-sectional data and are not heavily influenced by time trends. However, this study focuses on infant mortality and stillbirth rates at the county level, outcomes that are far more sensitive to underlying temporal and regional trends. The difference-in-difference framework allows me to control for both time-invariant unobserved heterogeneity at the county level and common time trends, providing a more robust approach to isolating the causal effect of Hill-Burton hospitals on infant mortality and stillbirths. By leveraging variation across counties over time, the difference-in-difference design is better suited to account for the dynamic nature of health outcomes and the broader socioeconomic factors influencing them.

The data are at the county level and cover the years 1940 to 1960 for counties in Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina. These states make up what is colloquially known as the 'Deep South.' Other definitions of the 'Deep South' may include Louisiana. I chose to exclude Louisiana, since the state had a history of public-run hospital care dating back to the 1930s, complicating the effect of the Hill-Burton Act. The states selected for this analysis have common ties to agricultural economies and historical ties to Black enslavement in the antebellum and colonial era. They imposed Jim Crow segregation policies as the Reconstruction era ended and continued to enforce racial segregation across the period examined in this analysis. Moreover, the six states selected were among the most aggressive US states in terms of obtaining Hill-Burton funds.

To analyse the Hill-Burton Act's impact on racial health outcomes, I used the same classification as the vital statistics reports: white and non-white populations. This racial grouping system is unable to produce as precise an analysis as modern racial grouping systems can. However, the dual classification is discrete enough for a general analysis of disparities between racial majority and minority groups. The white population of European ethnic groups constituted most of the US South's population and, more importantly, held distinct social and

political advantages within the Jim Crow system. The 'non-white' population is a broad category used by the Census Bureau to include many minority groups. This includes what today would be called African American or Black individuals as well as non-white Caribbeans and Latinos, mainly of Cuban and Puerto Rican heritage, in the 'non-White' population, especially in counties bordering the Gulf of Mexico and in southeastern Florida.

The mixed nature of the non-white classification does not present threats to my analysis. First, the 'non-white' population by and large consisted of previously enslaved individuals and their descendants. Second, the discrimination faced by Caribbeans and Latinos classified as 'non-white' resulted in their being sorted into/out of the same healthcare facilities as other 'non-white' individuals. To the extent that the results of this paper speak to how access to healthcare facilities within a social context of racial discrimination affects health outcomes, the dual racial classification system should not create spurious results.

After describing the data and difference-in-difference model in more depth, I will conclude this section by providing evidence of a lack of pre-trends for the stillbirth and infant mortality rates outcomes as well as a rationale for why the parallel trends assumption is valid and unviolated.

3.4.1 Data Sources

The birth attendance data used in this paper to calculate the percentage of hospital births within a county was collected by Finkelstein and Williams from the US Vital Statistics Reports (NBER). For the infant mortality rate, I used data from the work of Bailey et al. (2018). I transcribed the stillbirth data from the US Vital Statistics Reports from 1940 to 1960. The infant mortality rate was defined as infant deaths per 1,000 live births, and the stillbirth rate was defined as stillbirths per 1,000 total births.

The stillbirth rate includes foetal deaths after completing 20 weeks of gestation. Foetal death reporting presents some challenges to historical demographers studying the US, since regulatory differences between states creates quality and completeness issues with the data (Woods 2009). The extent of under-reporting differed across states due to variations in their data recording requirements. It was estimated that 10% of foetal deaths occurring at 28 weeks or later went unregistered in the early 1950s (Chase 1967, 14–17). Reporting issues were most common in the US South due to lower state capacity and the ruralness of the region. Since this issue was

region-wide and a rural issue, the analysis should account for completeness issues through county- and year-fixed effects.

Another data issue is that some early neonatal deaths were mistakenly recorded as stillbirths, though the exact number is unclear. This issue is important to note since neonatal deaths mistakenly identified as stillbirths influence the two mortality outcomes of this paper. That is, if these cases were correctly identified stillbirths would go down but infant deaths would increase. Improvements to reporting that occurred over time would therefore give an impression of foetal health improvements but infant health deterioration. However, the time-variant controls employed by my analysis should minimize this threat. As a robustness check, I ran a perinatal-and-infant mortality outcome defined as stillbirths plus infant deaths per 1,000 total births.

The data on Hill-Burton funds came from the Hill-Burton Project Register. The register describes the hospital and medical facility projects approved under the Hill-Burton Act from 1947 to 1971. The data was transcribed by Heidi Williams (Dartmouth College) and graciously provided to me for this research paper.

Originally published by the US Department of Health, Education and Welfare, the register reports project-level variables on the location (city, county, and state), name of the facility, facility type, construction type, the number of beds provided, the Hill-Burton funding provided, the project's total cost, and the date funding is received (Register, Hill-Burton Project, 1947-1971). I restricted the analysis to Hill-Burton funds spent on non-federal general hospitals, since these facilities provided critical maternal and infant health services, including prenatal and obstetric care.

To harmonize the data for each racial grouping, I dropped 75 of 521 counties (14.4 percent). Dropped counties did not report the number of stillbirths and infant deaths by race. Dropped counties were not statistically different in terms of total population, birth rate, median family income or medical doctors per capita compared the included counties. The counties not included had lower Black population shares of their overall population than counties included (10 percent vs 41 percent). So, I do not find that by dropping these counties I am missing important data that could bias statistics for a minority population.

3.4.2 Difference-in-Difference Model

There are three different treatment types assessed in independent analyses. The first type of treatment identifies counties that received Hill-Burton funds for the construction or upgrading of a general hospital. In the results, this treatment type is labelled as 'Any' or 'Any Type of Hospital Project'. The second type of treatment identifies counties that received Hill-Burton funds to construct a new general hospital. This treatment type is labelled as 'New' or 'New Hospital Project' in the results table. The third type of treatment identifies counties that received Hill-Burton funds to upgrade an existing general hospital. This treatment type is labelled as 'Upgraded' or 'Upgraded Hospital Project' in the results table.

The staggered rollout of Hill-Burton funding presented one of the first challenges in choosing a method for the analysis. The standard two-way fixed effects model (TWFE) suffers from a 'negative weight' issue in a staggered treatment setting (Goodman-Bacon, 2021). Intuitively, the issue occurs when treated groups are compared not only to the 'untreated' but also to the 'not-yet-treated' units and 'already-treated' units. The inability to consistently compare treated groups to untreated groups across time makes the TWFE model imprecise and in violation of the common intuition behind a canonical 2x2 diff-in-diff. The Callaway-Sant'Anna model (CS) fixes the 'negative weight' issue by grouping all treated groups by the year of their first treatment and using the never treated units as a control group. These never-treated cohorts are large enough to avoid having to use the 'not-yet-treated' specification in the CS model.

The CS model calculates an aggregated treatment effect by first identifying each group-time effect:

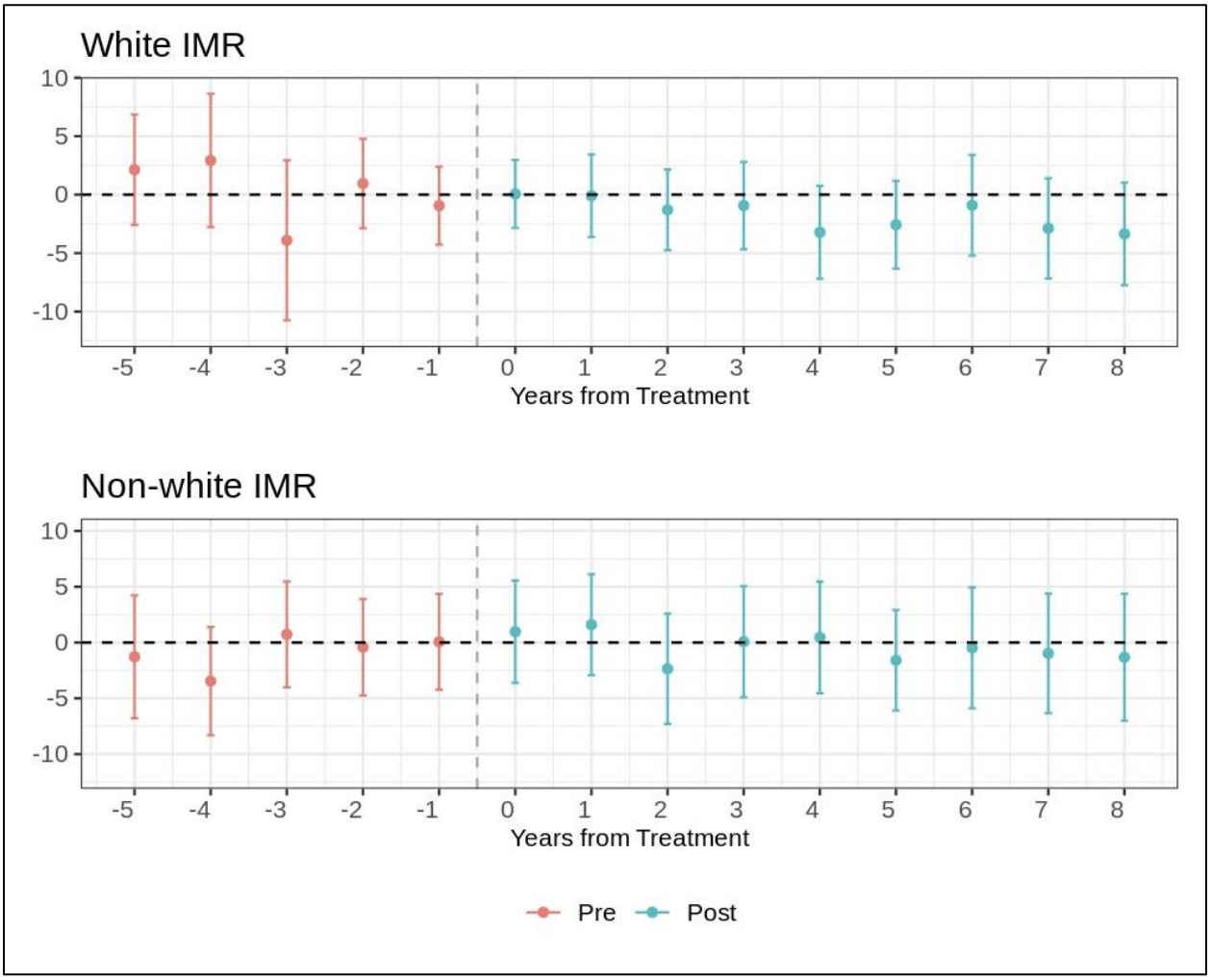
$$ATT\,(g,t) \;=\; E[Y_t - Y_{g-1} \mid G_g = 1] - E[Y_t - Y_{g-1} \mid C = 1]$$

g is for each treatment group (i.e. units treated in 1950) and t is the observation year. For the group-time effect, the CS model calculates the expected value of the difference between the outcome Y for each year in the G treatment group and the Y for the year before treatment. Using the never-treated group as a control group, the model calculates the expected value of the difference between the year-specific outcome Y and the year before treatment. The model aggregates these effects to calculate an aggregated average treatment effect on the treated (ATT).

The staggered rollout of treatment caused some units to receive treatment longer than others, with some units receiving treatment for up to fourteen years. Differences in exposure to treatment might cause the difference-in-difference analysis to wrongly incorporate exogenous changes in the later years of early-treated units into the ATT. To minimize this issue, I specified an exposure-to-treatment limit of eight years, so that the overall ATT only aggregated treatment effects up to eight years after the treatment year. Chung et al. (2017) found that the average duration of construction was between 2 and 3 years. I chose an eight-year constraint to account for this period of construction and capture somewhere between 4 to 6 years of clinical activity.

A fundamental assumption of the difference-in-difference method is parallel trends between the control and treated groups in the years preceding the treatment. FIGURE 3.5 and 3.6 are event study plots that show no evidence of the two groups differing pre-treatment.

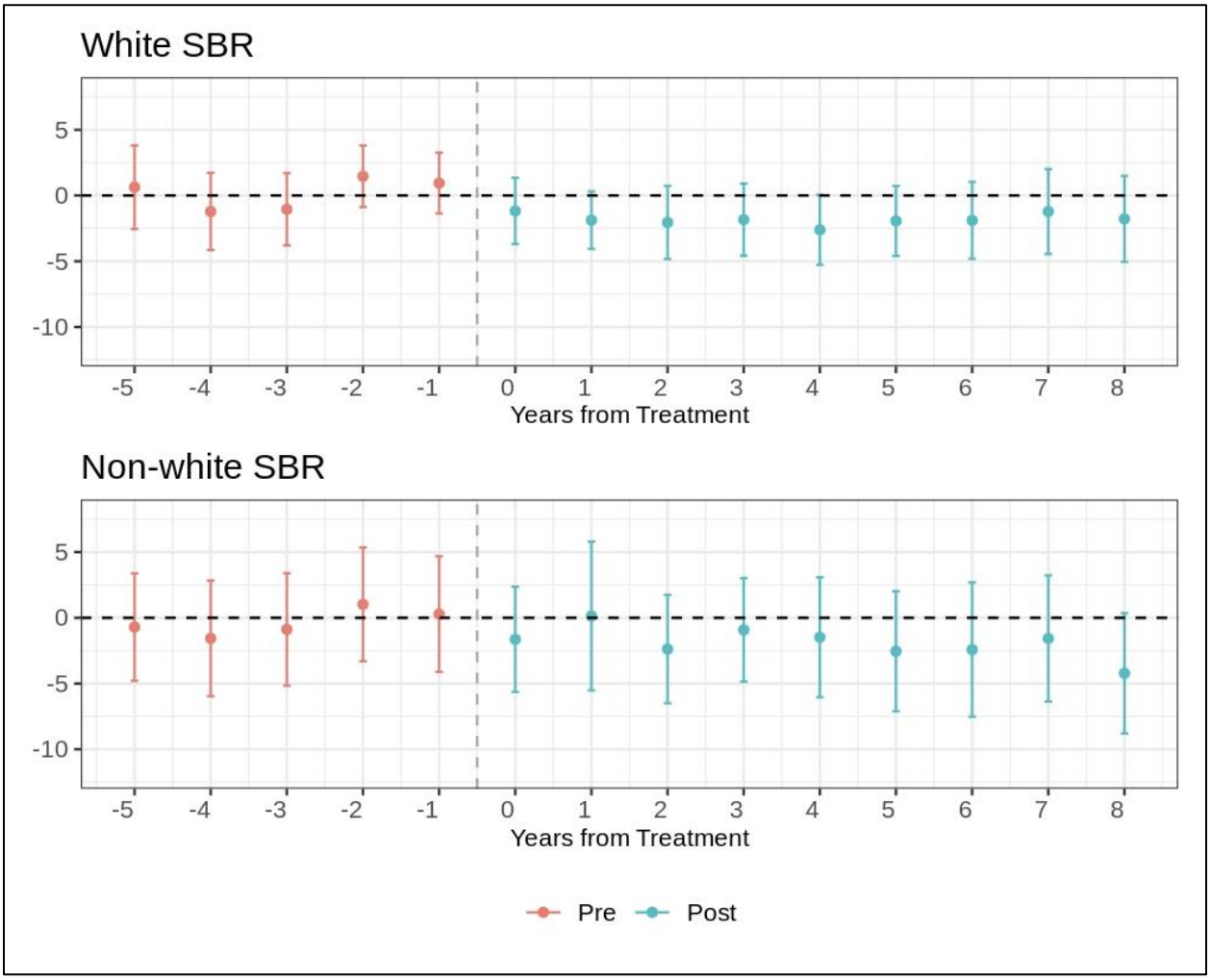
FIGURE 3.5: Event Study for White and Non-white Infant Mortality Rates (IMR) with Treatment Type as 'Any Type of Hospital Project'



Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level IMR from Bailey et al. (2018)

Note: Pre-trend plots for the other types of treatment did not show any concerns for the infant mortality outcomes. See Appendix for pre-trend plots for the other types of treatment.

FIGURE 3.6: Event Study for White and Non-white Stillbirth Rates (SBR) with Treatment Type as 'Any Type of Hospital Project'



Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level SBR transcribed from US Vital Statistics 1940-1959

Note: Pre-trend plots for the other types of treatment did not show any concerns for the stillbirth outcomes. See Appendix for pre-trend plots for the other types of treatment (FIGURES 3.A.1 - 3.A.4).

The figures plot coefficients for the white and non-white stillbirth and infant mortality rates for the pre-and post-treatment periods when the treatment is 'Any Type of Hospital'. Effects before treatment are not statistically different from zero, implying that there is no evidence of pre-trends. The lack of pre-trends provides support for continued parallel trends into the post-treatment period, which means that the control counties provide an appropriate group from which to predict counterfactual trends for the treated groups. Moreover, the lack of pre-

trends means that there is no need to consider other weighting procedures to balance the treatment and control groups.

3.5 Results

3.5.1 Percentage of Hospital Births

First, I will assess the extent to which hospital construction altered the childbirth experience of women by looking at the change in the percentage of hospital births at the county level. The US South had high rates of home births well into the 20th century. Births in other regions had almost entirely transitioned away from home births by the 1950s. Looking at the results in Table 3.5, we can see that the Hill-Burton Act led to an increase in the percentage of hospital births. Once broken down to the racial level the increase is mainly driven by non-white births moving into hospitals.

The average treatment effect on the treated was greater for the non-white population relative to the white population for all treatment types. For the treatment type 'Any', a county receiving Hill-Burton funds increased the share of non-white hospital births by 4.67 percentage points. The largest effect for non-white births was within counties receiving Hill-Burton funds for a new hospital. In that treatment type, the result implied a 5.58 percentage point increase in the number of non-white hospital births. The coefficients for the percentage of white hospital births on the other hand were small and not statistically significant for the 'Any' and 'New' specifications.

TABLE 3.5: ATT for Percentage of Hospital Births, by Treatment Type & Population			
	Any	*New*	*Upgraded*
White Hospital Births	0.56 (1.09)	2.14 (1.18)	-4.13 *** (1.30)
Non-white Hospital Births	4.67 *** (1.11)	5.58 *** (1.25)	3.45 ** (1.53)
Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service & Area Resource File (1983) & Bailey et al. (2018). US County-Level Natality and Mortality Data, 1915-2007. **Notes**: '*' 90% Confidence Interval; '**' 95% Confidence Interval; '***' 99% Confidence Interval			

For the treatment type 'Upgraded', the coefficient for non-white hospital births stayed positive, implying an increase of 3.45 percentage points. The white births coefficient flips to negative, implying a decrease of 4.13 percentage points in treated counties. The fact that these projects merely added improvements to pre-existing facilities might be driving this result. Where there were pre-existing facilities, the white population already had high in-hospital birth rates. Construction projects might have forced hospitals to rely more on outpatient services for a few months, placing negative pressure on the in-hospital birth rates.

Another possibility is that the model is vulnerable to spillover effects. For example, populations in the never-treated units might have lived nearby hospitals across county lines and chosen to travel to that hospital for childbirth. However, these spillover effects would only mean that my analysis is underestimating the true effect of receiving access to hospital compared to an area that cannot access a hospital.

The non-white coefficient for the treatment type 'any' explains about 11% of the overall growth in hospital births within the non-white population for the entire sample. Comparing counties that received new hospitals with those that did not receive any funds, 13% of the overall increase in the percentage of non-white hospital births is due to the Hill-Burton Act. Overall, the Hill-Burton Act played an influential role in drawing more births into hospitals, especially non-

white births. However, attracting more patients does not always equate to delivering better health outcomes as shown in the following mortality analysis.

3.5.2 Infant Mortality and Stillbirth Rate Results

Turning to the impact of receiving Hill-Burton funds on county-level mortality outcomes, infant mortality rates and stillbirth rates had different trends both in magnitude and within racial groups. At a population level, the white infant mortality rates decreased, while the non-white infant mortality rates increased. The white infant mortality rates declined from the pre-period to the post-period by a little less than 8 infant deaths per 1,000 live births, while non-white infant mortality rates rose by 7.5 infant deaths per 1,000 live births. This overall context is important to keep in mind when interpreting the county-level results of the difference-in-difference.

The ATTs for non-white infant mortality rates are not distinguishable from zero for all three treatment types. For white infants, the results imply some material gains. For example, 2.55 fewer white infant deaths occurred per 1,000 live births in counties receiving Hill-Burton funds. This accounts for 32% of the decrease in the white infant mortality rate for the overall sample. For the treatment types 'new' and 'upgraded', the results account for around 29 and 25 percent of the decline in the white infant mortality rates, respectively.

TABLE 3.6: Aggregated ATT for Infant Mortality Rate (IMR) and Stillbirth Rate (SBR), by Treatment Type & Population

Treatment Type		*Any*	*New*	*Upgraded*
IMR	White	- 2.55 ** (1.13)	- 2.34 * (1.21)	- 1.68 (1.41)
	Non-white	-0.83 (1.57)	- 1.59 (1.78)	- 0.70 (2.05)
SBR	White	- 2.12 ** (0.99)	- 1.90 * (1.07)	- 2.03 (1.27)
	Non-white	- 3.34 ** (1.55)	- 2.85 * (1.72)	- 3.99 ** (1.83)

Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service & Area Resource File (1983) & Bailey et al. (2018). US County-Level Natality and Mortality Data, 1915-2007.
Notes: '*' 90% Confidence Interval; '**' 95% Confidence Interval; '***' 99% Confidence Interval

The racial group results reveal a growing disparity in infant mortality, with white infants benefitting more from investments in hospital infrastructure than non-white infants. The largest difference between the two coefficients occurs in the 'any type of Hill-Burton Project' treatment status, where the difference between the white ATT and non-white ATT is 1.72 infant deaths per 1000 births. This disparity accounts for a little under 10% of the overall rise in absolute disparity between the two racial groups across the period.

The results for stillbirth rates also reflect an overall benefit from receiving hospital infrastructure investments. However, the racial trends are reversed, so that receiving Hill-Burton funds for a hospital resulted in a more negative effect for non-white stillbirth rates than white stillbirth rates. Overall, effects within treatment types 'any' and 'upgraded' were statistically significant for all racial groups. The results for new hospitals were only distinguishable from a null effect for the white stillbirth rate. The weaker statistical power of the 'new hospital' treatment type might be because these cases had a significant lag period between receiving funds and finishing the project.

For the treatment type 'any', the results imply that two white stillbirths were avoided per 1,000 total births in counties that received treatment. This effect increased to 3.34 avoided stillbirths per 1,000 total births within the non-white population. These figures mean that 41 percent of the decline in stillbirths for the sample can be attributed to hospital infrastructure and 43 percent of the decline in non-white stillbirths. Turning to the treatment type 'upgraded', the size of the coefficients increases in magnitude to -2.87, -2.03, and -3.96 for the overall, white, and non-white populations, respectively. Up to 63% of the overall decline in stillbirths can be attributed to hospital infrastructure within this restricted sample as well as 42% and 56% of the white and non-white stillbirth rate declines, respectively.

The modest difference between the white and non-white ATTs means that the overall racial stillbirth disparity was only partially closed due to the Hill-Burton Act. The absolute gap between white and non-white stillbirth rates closed by 2.99 stillbirths across the pre-treatment and post-treatment periods. This means that hospital infrastructure investments accounted for 40% of the closure to the racial disparity in stillbirth rates.

3.5.2 Robustness of Infant Mortality and Stillbirth Rate Results

One robustness check involved analysing perinatal-and-infant mortality rates (PIMR), which combine stillbirths and infant deaths into a single measure of early-life health outcomes. This combined measure helps address the possibility of deaths being misclassified between stillbirths and infant deaths—a risk that was likely higher in rural counties with weaker reporting systems. Table 3.7 shows that counties receiving funding for new hospitals experienced somewhat larger reductions in perinatal-and-infant mortality than those receiving upgrades to existing facilities. This pattern suggests that opportunities to access newly built care—rather than improvements to older infrastructure—were more effective in improving outcomes. The consistently negative results across treatment types and for both racial groups also indicate that the declines observed in infant and stillbirth rates were not simply driven by misclassification. Instead, the PIMR findings reinforce the conclusion that Hill-Burton investments produced genuine improvements in perinatal care. To further test the robustness of the findings, I next present results from models that adjust for baseline socioeconomic characteristics using inverse probability weighting.

TABLE 3.7: Aggregated ATT for Perinatal & Infant Mortality Rate (PIMR), by Treatment Type & Population				
Treatment Type		*Any*	*New*	*Upgraded*
PMR	White	- 4.54 ** (1.51)	- 4.13 ** (1.61)	- 3.43 * (1.78)
	Non-white	- 4.03 * (2.36)	- 4.28 * (2.41)	- 4.79 * (2.84)

Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service & Area Resource File (1983) & Bailey et al. (2018). US County-Level Natality and Mortality Data, 1915-2007.
Notes: '*' 90% Confidence Interval; '**' 95% Confidence Interval; '***' 99% Confidence Interval

One potential concern with the difference-in-difference estimates is that counties receiving Hill-Burton funds may have differed systematically from non-recipient counties in ways that could bias the estimated treatment effects. Income and racial composition of the county population could have shaped both a county's likelihood of receiving funding and its underlying trends in maternal and infant health outcomes. To address this concern, Table 3.8 presents aggregated average treatment effects on infant mortality, stillbirth rates, and the percentage of hospital births by treatment type and racial group, adjusting for the 1950 median family income and the non-white share of the population using inverse probability weighting. Other baseline controls, such as hospital beds per person and medical professionals per person, were considered. However, these controls showed no variation across treated and untreated counties in the pre-treatment period. Moreover, adding these controls as continuous variables would be inappropriate, as treatment would have a direct effect on their levels.

TABLE 3.8: Aggregated ATT for Infant Mortality Rate (IMR) and Stillbirth Rate (SBR) with Controls, by Treatment Type & Population				
Treatment Type		*Any*	*New*	*Upgraded*
Percent Hospital Births	White	2.31 ** (0.91)	2.90 *** (0.95)	- 0.71 (1.19)
	Non-white	3.30 *** (1.07)	4.64 *** (1.09)	1.10 (1.91)
IMR	White	- 2.35 * (1.26)	- 1.91 (1.23)	- 3.74 (1.88)
	Non-white	0.06 (1.87)	- 1.00 (1.94)	1.85 (3.25)
SBR	White	- 1.57 * (0.93)	- 1.61 (1.11)	- 1.00 (1.51)
	Non-white	- 3.19 * (1.78)	- 3.09 * (1.72)	2.94 (5.52)
Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service & Area Resource File (1983) & Bailey et al. (2018). US County-Level Natality and Mortality Data, 1915-2007.				

Comparing the controlled results (Table 3.8) to the baseline results (Tables 3.5 and 3.6), several patterns emerge. For percentage of hospital births, the estimates remain positive and statistically significant for non-white populations across the "Any" and "New" treatment types, with magnitudes similar to the results without controls. This suggests that the association between Hill-Burton funding and increases in hospital births among non-white populations is robust to adjustment for baseline income and racial composition. The white infant mortality rate results similarly remain positive for "Any" and "New" treatments, with some increases in magnitude relative to the baseline.

For infant mortality rates, controlling for income and racial composition attenuates the estimates somewhat for white populations, though effects remain negative and generally comparable to the uncontrolled results. For non-white populations, however, IMR estimates in the controlled models are smaller in magnitude and imprecise, with some positive point estimates, particularly for the "Upgraded" treatment type. The results for stillbirth rates delivered

a similar conclusion. For stillbirth rates, the negative effects for white populations are somewhat smaller but remain consistently negative across treatment types. For non-white populations, the controlled model still finds sizable and statistically significant reductions in SBR for "Any" and "New" treatment types. However, the "Upgraded" treatment type result becomes positive and highly imprecise.

Recalling that the "Upgraded" units were more dissimilar to the "Never Treated" units than the "New" units were, it makes some sense for these treatment type to experience the largest change after controls. One point of caution I have with this is that the comparison groups become quite small after IPW controls are put in, so the controlled results in the "Upgraded" treatment type likely reflect smaller sample sizes and greater heterogeneity in the types of counties receiving these upgrades. Overall, the attenuation in this treatment type suggests that baseline differences in socioeconomic composition explain part of the association between hospital funding and non-white IMR outcomes.

The results from the model with controls reinforced the positive association between Hill-Burton funding and increased hospital births among non-white populations. However, the effects on IMR and SBR diminish with the robustness controls, especially for "Upgraded" units. For the "New" units which were closest in profile to the "Never Treated" units results remained more stable. These patterns are consistent with the idea that while the expansion of hospital infrastructure improved access to perinatal care, persistent structural inequalities limited gains in post-neonatal outcomes. The results without controls in Tables 3.5 and 3.6 therefore likely reflect both the direct effects of Hill-Burton investments and broader improvements in counties with more favourable baseline characteristics, while the results with robustness controls in Table 3.8 provide a more conservative lower bound.

3.6 Discussion

The results of this chapter show that Hill-Burton investments improved early-life health outcomes in the US South, particularly by reducing stillbirths. These gains were strongest in counties that received funding for new hospitals, which emphasised the connection between increasing the opportunity to receive hospital-based care and better childbirth outcomes. Further

evidence of this connection is that hospital births increased most significantly for non-white mothers in counties receiving funds for a new hospital, and those same counties experienced the large declines in their non-white stillbirth rates. Yet, my model found null effects for non-white infant mortality rates in these counties. Understanding why the effects of hospital expansion varied across outcomes and racial groups requires examining both the pathways through which hospital care influenced early-life health, and the structural inequalities that shaped access to care and health risks in this period.

3.6.1 The Racial Gap in Post-neonatal Mortality

The divergent results for white and non-white infant mortality reflect persistent racial gaps in post-neonatal mortality, which proved more resistant to improvements in hospital infrastructure. The evidence presented in Table 3.8 shows that while the Black-white neonatal mortality ratio declined modestly after Hill-Burton investments, the post-neonatal mortality ratio increased dramatically.

TABLE 3.9: Black-white Infant Mortality Ratio in the Southern States		
	Pre-treatment Sample	*Post-treatment Sample*
Neonatal Mortality Ratio	1.36	0.84
Post-neonatal Mortality Ratio	1.61	5.21

Note: Pre-treatment sample was compiled from Georgia, Mississippi, and North Carolina State Board of Health Annual Reports from 1946. Post-treatment sample was compiled of Georgia and North Carolina State Board of Health Reports from 1959 and 1960. Neonatal mortality included cause-specific mortality from the leading causes of neonatal mortality: birth complications, congenital malformations, and prematurity. Post-neonatal mortality included the following leading causes: pneumonia and influenza, gastrointestinal disease, infection/parasites, and respiratory illness.
Source: Georgia Vital Statistics Report, Board of Health 1946, North Carolina Vital Statistics Report, Board of Health 1946, Mississippi Vital Statistics Report, Board of Health 1946, Georgia Vital Statistics Report, Board of Health 1959, North Carolina Vital Statistics Report, Board of Health 1960, Mississippi Vital Statistics Report, Board of Health 1960

National health statistics also reflect this trend for the period. Singh and Yu (1995) found a national Black-white post-neonatal mortality ratio of between 2.2 and 3 from 1950 to 1965.[1] Conversely, the neonatal mortality ratio rose from 1.5 in 1950 to 1.6 in 1965. The larger disparity ratio in post-neonatal mortality is likely due to two causes: larger disparities in racial living standards and limited access to health insurance.

3.6.2 Structural Inequality, Access to Care, and Limits of Hospital Investments

While the Hill-Burton Act expanded hospital capacity, it made only a feeble attempt at addressing how the poorest patients would access care. As Hamilton (1987) notes in her biography of Senator Lister Hill, "free care for the poor was almost completely ignored" in the Act's design. The legislation merely stipulated that a "reasonable volume" of free care be provided annually, without offering clear guidelines or enforcement (US Congress, 1946). In practice, hospitals varied widely in their interpretations of this requirement. A 1950s study found that fewer than half of Southern residents were enrolled in hospitalization insurance plans, compared to about two-thirds in the Northeast and Midwest (Anderson, 1954). Obstetrical care was one area where hospitals were somewhat more likely to extend charity coverage, as this was

[1] The post-neonatal mortality ratio decline after 1965 is rapid, but it levels out around 2 in 1980.

a relatively low-cost service that some states supported through public assistance (Duke Endowment Annual Report, 1960; Bureau of Public Assistance, 1960). However, even with these provisions, limited insurance coverage and vague charity requirements left many poor and Black families paying out-of-pocket for much of their care.

These weaknesses in access to care were embedded in broader patterns of structural inequality. Racial wage disparities in the South placed Black families at a significant disadvantage relative to whites in affording both healthcare and adequate housing. Despite some national narrowing of the racial wage gap (Smith and Welch, 1989; Margo, 1995), the Southern labour market saw an inter-regional divergence that disproportionately harmed Black workers (Wright, 1986). Poorly funded, segregated schools further widened racial gaps in earnings and opportunity (Carruthers & Wanamaker, 2017). In housing, discrimination and redlining practices sharply limited the quality of Black neighbourhoods and placed many Black infants in environments with elevated health risks (Aaronson et al., 2020; Karbeah and Hacker, 2023; Beach et al., 2022)

Insurance gaps further compounded these disadvantages. In the pre-Medicaid era, most insurance was obtained through employment-based group plans. Only 52 percent of Black households in the South had health insurance, compared to 75 percent of white households, even though Black and white household heads were equally likely to be employed (Thomasson, 2006). Thomasson attributed about half of this disparity to differences in earnings and job characteristics, but the remainder reflected discrimination and unobservable barriers to access.

Altogether, Black infants in the South faced multiple challenges that the Hill-Burton Act did not address, including lower family incomes, poorer housing, limited insurance coverage, and weak protections for charity care. These factors shaped not only exposure to post-neonatal health risks but also access to follow-up care after birth. This helps explain why gains in perinatal outcomes under the Hill-Burton program were not matched by similar reductions in post-neonatal mortality, and why Black infants were less likely to benefit from the small improvements seen in overall infant mortality during the fourteen years after the Act's passage.

3.6.3 Complementarity of Hospital Births and Stillbirth Reduction

The stillbirth rate results underscore the idea that hospital-based care had its most meaningful impact at the perinatal stage. Coefficients for the stillbirth rates analysis were larger in magnitude than the infant mortality rate results across both racial groups and all treatment types. The non-white population had a larger shift toward hospital births and reduction in its stillbirth rate than the white population. This alignment suggests a complementary effect between increased hospital births and the decline in stillbirths.

As Løkke (2012) argues in the Danish context, antibiotics in the mid-20th century improved both cohort-level maternal health and the safety of obstetrical interventions. Similarly, in the US South, the complementarity of hospital infrastructure and biomedical innovations led to improved maternal health and obstetrical interventions such as caesarean sections and forceps deliveries.

Forceps rates have a striking increase during the Hill-Burton era, while caesarean section rates increase at a lower rate (these dynamics are explored further in the following chapter). These procedures, which were previously placed the mother and foetus at extreme risk, became safer and more effective when paired with antibiotics that reduced the likelihood of postoperative infections. Intrapartum stillbirths caused by complications such as prolonged labour, placental abruption, or cord accidents were more likely to be prevented when women gave birth in modernized hospital settings equipped with both antibiotics and skilled obstetric care (Patel & Murphy 2004). In this way, the results highlight how the Hill-Burton Act's expansion of hospital infrastructure contributed meaningfully to perinatal health, particularly for non-white populations previously excluded from such care.

3.7 Conclusion

The Hill-Burton Act expanded the healthcare system of the United States, increasing hospital capacity in some of the country's most underserved areas, particularly in the rural US South. The Act led to a substantial increase in hospital births for Southern non-white mothers, many of whom had long relied on midwife-attended home births. The Act's impact on racial disparities in early-life health outcomes was two-sided. In terms of infant mortality, the Southern white population experienced modest reductions, while no significant effect was found for non-

white infants. In contrast, both racial groups saw reductions in stillbirth rates, with non-white populations experiencing larger declines after receiving hospital investments. These stillbirth reductions highlight the importance of hospital-based obstetric care in the antibiotic era. Obstetrical interventions in complicated deliveries led to a decline in intrapartum stillbirths. The stronger effects for non-white populations reflect the complementary impact of more non-white births being drawn into hospitals through Hill-Burton funding. The following chapter will explore how despite this gain, disparities in physician-level surgical capacity impeded total convergence in stillbirth rates.

The divergent results for infant mortality and stillbirth rates highlight both the potential and limitations of infrastructure-focused policy when deployed in an unequal and segregated social context. The lessons of this study extend beyond the Hill-Burton era. Policymakers seeking to reduce racial health disparities must recognize that hospital investments alone are not enough. Infrastructure spending must be paired with deliberate efforts to address the social and economic barriers to care—through expanded health insurance coverage, stronger enforcement of civil rights protections in healthcare, and investments in the community resources that support maternal and infant health.

Future research could build on this work in several directions. First, more granular data on the racial segregation of Hill-Burton hospitals would allow for a more nuanced estimate of how segregation shaped health impacts. Second, linking county-level hospital infrastructure changes to long-term health outcomes beyond infancy could help assess whether perinatal gains were sustained over time. Finally, comparative work across different regions of the country could clarify whether the patterns observed in the South were unique to its social structure or mirrored in other racially stratified healthcare systems.

Overall, this chapter contributes to our understanding of how health infrastructure policy intersects with racial inequality. It reinforces the idea that access to care is not only a matter of physical proximity to a facility, but also one of affordability, institutional trust, and equitable treatment. In the case of the Hill-Burton Act, new hospitals brought real improvements—but they did not close the gap.

Chapter 4: Beyond Antibiotics: Obstetrical Interventions, Surgical Capacity, and the Persistence of Stillbirth Disparities

Abstract: This paper looks at the obstetrical practices in a preeminent Black hospital to analyse how obstetrical care contributed to the persistent Black-white stillbirth disparity in the mid-20th century US South, despite a general decline in absolute stillbirth rates from 1930 to 1960. Adopting Løkke's (2012) framework linking antibiotic availability to increased obstetrical interventions, particularly caesarean sections, I compare intervention rates within the hospital to other contemporary hospital's rates. I find a continued preference for forceps over caesarean sections, contrary to the trends Løkke found in Denmark. Moreover, the limited use of caesarean sections resulted in many high-risk births receiving no intervention. A counterfactual analysis suggests that aligning Lincoln Hospital's intervention rates with national averages could have prevented some stillbirths. Qualitative evidence indicates that discriminatory residency practices, rather than a lack of surgical skill, created capacity constraints, hindering the adoption of caesarean techniques by Black physicians. This study shows how unequal access to clinical training attenuated the potential benefits of antibiotics for intrapartum care. The interplay of innovation and human capital, shaped by racial exclusion, offers one explanation for the persistence of the Black-white stillbirth gap.

4.1 Introduction

Beginning in the 1930s, there was a considerable decline in stillbirths across several Western Countries, including the United States (Woods, 2009, p. 82). Within the United States, the Black-white stillbirth disparity gap remained a persistent feature of racial early-life health inequalities across the 20th century (Sánchez-Barricarte, 2024).

Between 1930 and 1970, there was some convergence. The national Black-white stillbirth ratio fell from 2.3 to 1.9 (Carter et al. 2006). Mass production of antibiotics is a hallmark feature of this period. Antibiotics have been shown to have greatly reduced the burden of infectious diseases and to have improved early-life health outcomes (Jayachandran et al., 2010 & Alsan et al., 2021). Costa (2004) argued that the higher burden of infectious disease, particularly from syphilis and tuberculosis, among Black women was the main contributor to Black-white stillbirth disparities in the first half of the 20th century. Given the large impact of penicillin on syphilis rates, one would have expected a larger convergence in stillbirth rates after its introduction in 1944.

Across European contexts, Woods (2009) and Løkke (2012) have argued that obstetrical care dispensed within a hospital setting was revolutionized after the introduction of antibiotics, with the long-term impact being fewer stillborn deliveries. Studies covering the United States have found that the gains from antibiotics and improved care in hospital settings were distributed differently across racial populations, with Black Americans receiving less benefits from these changes compared to white Americans (Jayachandran et al., 2010 & Thomasson and Treber, 2008). To explain these differences scholars often placed the blame on the "the inferiority of the health care available to [Black populations]" (Jayachandran et al. 2010) Particularly, in the US South, "giving birth in the hospital did not...guarantee receipt of high-quality care for Black mothers and their babies" since policies of racial segregation infiltrated every field of healthcare delivery (Anderson et al. 2020, p. 24).

Black hospitals, often underfunded and professionally isolated, have been characterized as delivering inferior care compared to their white or biracial counterparts. Many Black hospitals struggled with outdated facilities, limited surgical capacity, and insufficient access to cutting-edge technologies (Gamble 2011, p. 47-50). In this narrative, the disparities in birth outcomes were a byproduct of unequal institutional capacity.

This paper revisits that assumption through a study of one of the South's most prominent Black hospitals, Lincoln Hospital (Durham, North Carolina), from 1930 to 1970. Lincoln Hospital stood out as an elite institution within the Black hospital network. It held residency training accreditation, received sustained philanthropic support from the Duke Endowment, and benefited from a relatively prosperous and politically active Black community. And yet, Lincoln Hospital experienced stillbirth rates that mirrored broader disparities—rates that fluctuated but consistently outpaced those at white hospitals even as clinical resources improved. This presents a puzzle: why did a well-respected, Black-led institution, operating during a period of rapid medical advancement, fail to close the gap in stillbirth outcomes?

To investigate this, I draw on the hospital's delivery room case records to evaluate changes in obstetrical practices and outcomes over time. I situate this analysis within a broader theoretical framework developed by Løkke (2012), who argues that the introduction of antibiotics in the 1930s and 1940s enabled a shift in obstetrical practice. By greatly diminishing the risk of a fatal iatrogenic infection, antibiotics allowed physicians to adopt and refine obstetrical interventions, especially caesarean sections. This shift explains much of the observed improvement in birth outcomes across the mid-20th century within the National Hospital Copenhagen. Caesarean sections, in particular, became the preferred intervention for managing high-risk deliveries.

But the Lincoln Hospital data complicates this story. Intervention rates rose over time, but the increase was driven by forceps use, not caesarean sections. Caesarean sections remained low throughout the period—even as stillbirths from clearly high-risk cases, such as breech presentations, placenta previa, placenta abruption, and preeclampsia, persisted. Many of these births received no surgical intervention at all. I argue that the failure to adopt caesarean sections at scale was not a product of medical conservatism or ignorance, but rather of limited staff capacity and constrained access to surgical training.

The hospital staff's capacity to perform obstetrical interventions underlied this preference for forceps. The introduction of new anaesthetics, which were simpler to administer, drove the rise of forceps deliveries in the post-antibiotics. On the other hand, the delivery room case records revealed that a single Black physician—trained in caesarean procedures and a member of the American College of Abdominal Surgery—performed the overwhleming majority of

caesarean sections during the hospital's peak years. When he was not present, the caesarean section rate dropped sharply, and the stillbirth rate for high-risk births increased.

This paper adds to the Løkke framework by analysing obstetrical practices at the case level in a new social context and emphasising the importance of human capital. I argue that social structures, especially racially discriminatory residency and fellowship opportunities, shaped who had access to surgical training. Inequalities in access to surgical training led to surgical capacity constraints that dictated the interventions provided within hospitals. Improvements in obstetrical care depended not only on the introduction of new drugs or equipment, but on the labour markets that governed who learned to use them. Lincoln Hospital's experience suggests that staff capacity, not just surgical willingness, was a critical bottleneck in the adoption of life-saving obstetrical techniques. These results provide a new account of why racial disparities in stillbirth outcomes persisted, even as hospital care led to large declines in stillbirths.

4.2 Background on Lincoln Hospital

Lincoln Hospital was an elite Black institution with a unique history. The typical Black hospital of the Jim Crow era was founded and led by white philanthropic actors. In contrast, Lincoln Hospital was founded through a biracial effort between local elites (Gamble, p. 5-6, 2011). Washington Duke, a white man, heir of one of the largest family fortunes in America and the head of the Duke Endowment Foundation, gifted $85,550 to Dr A.M. Moore and John Merrick for the establishment of a Black hospital (Watts and Scott, 1965).

Dr. Moore was a Black physician in Durham and a staunch advocate for the healthcare needs of the city's Black population. Dr. Moore became the hospital's first superintendent (1901-1923) (Watts and Scott, 1965). John Merrick founded the North Carolina Mutual Life Insurance Company, which was one of the most successful Black-owned firms in the US at the turn of the century. Mr. Merrick and Dr. Moore were prominent figures within Durham's burgeoning Black community.

The underlying agreement at the hospital's founding was that the Duke family would put up the economic capital, but managerial control of the hospital would be with members of

Durham's Black elite (Gamble, p. 118, 2011). Thus, the hospital became one of the few Black hospitals dedicated to training and employing Black physicians and nurses. The hospital began with a focus on primary care. Services included general medical outpatient and inpatient services, emergency care, well-baby clinic, and Obstetrics/Gynaecological services. The services highlighted most prominently in the hospital's early annual reports were maternal and child health, surgery, and infectious diseases (i.e., TB and STIs) (Lincoln Hospital Annual Report, 1926).

Over time the facilities grew, and services expanded. Two major renovations to the hospital were completed in 1924 and 1952. Funding for the former renovation came from community funds and matched funding from the Duke Endowment Foundation, while the latter renovation used community funds and federal funds from the Hill-Burton Act (Watts and Scott, 1965). By the 1950s, the Lincoln Hospital was a robust general hospital, which also offered specialty clinics in cancer detection, dermatology, orthopaedics, and urology. Lincoln Hospital's distinctive place within the network of Black hospitals makes it a particularly valuable site through which to examine the persistent puzzle of Black-white stillbirth disparities in the mid-20th century

4.2.1 What was the Lincoln Hospital's patient population?

The success of Durham's Black community earned acclaim among contemporary civil rights leaders. Booker T. Washington commented that he "never saw in a city of [its] size so many prosperous carpenters, brick masons, blacksmiths, wheelwrights, cotton mill operators and tobacco factory workers among Negroes" (Washington, p. 61, 1981). This may lend one to believe that the patient population served by Lincoln Hospital was out of character with other Black hospitals. However, Lincoln Hospital treated patients from outside the boundaries of Durham County. It was the only hospital within a 25-mile radius of Durham that would treat African Americans until the mid-1960s when Duke University Hospital integrated its wards. Karen Thomas in her book Deluxe Jim Crow wrote about how one patient "chose to drive eighty miles to deliver her three children at Lincoln Hospital in Durham...rather than endure inferior treatment on the Jim Crow ward in Roanoke Rapids Hospital only five miles away" (Thomas 2006, p. 845).

Another view on the patient population can be gained by looking at how much free care the hospital dispensed. TABLE 4.1 below shows the percentage of free care dispensed by Lincoln Hospital compared to Duke Endowment-funded Black and biracial hospitals in North Carolina. Black hospitals dispensed a much higher percentage of free care than biracial hospitals, around twice as much in 1939 and three times as much in 1958-59. Noteworthy is the fact that Lincoln Hospital dispensed a similar amount of free care as other Black hospitals, which suggested that the economic makeup of their patient population was not dissimilar from the average Black hospital in North Carolina.

TABLE 4.1: Percentage of Free Care Dispensed by Duke Endowment Hospitals

	Percentage of Free Care Dispensed in 1939	Percentage of Free Care Dispensed in 1958-59
Lincoln Hospital	71.6	36.9
Black-only Hospitals	71.3	39.6
Biracial Hospitals	36.5	13.3

Source: Duke Endowment Annual Reports of the Hospital and Orphan Sections, 1939 and 1959, Duke Endowment Archives, David M. Rubenstein Rare Book & Manuscript Library, Duke University

4.2.2 What was Lincoln Hospital's reputation?

Lincoln Hospital's reputation in its earliest years was strong, culminating in its accreditation as a residency site by the American Medical Association in 1924. This distinguishment made Lincoln Hospital one of the few southern Black medical institutions that offered accredited residency training.[2] The head of medical services for the Duke Endowment recognized Lincoln Hospital as the best black hospital in the Carolinas and a model for other black facilities in the South (Gamble, p. 117, 2011).

However, the hospital's fortunes appeared to have changed by the early-1930s. The hospital's surgical mortality rate had increased to twice that of other Black hospitals. According to Dr. Wilburt C. Davison, Dean of the Duke University Medical School, many Black patients refused to be hospitalized at Lincoln and would rather die than to go there (Gamble, p. 117,

[2] Other top Black medical institutions included Homer G. Philips (St. Louis, MO), George W. Hubbard Hospital (Nashville, TN), and the Freedman's Hospital (Washington, DC).

2011). To make matters worse, the American Medical Association rescinded its accreditation as a residency site in 1934. The hospital's finances, hit hard from losing patient volumes, and reputation were at a low point.

Lincoln Hospital struck a compromise with the Duke Endowment Foundation to turn around the hospital's fortune. The hospital would allow the Duke Endowment Foundation to select the hospital's next superintendent, giving up one of the strongest levers of control that the local Black community had over the direction of the hospital, and to appoint an advisory committee of white physicians. In return, Black physicians were guaranteed that no physician on the advisory committee would have admitting privileges at Lincoln (Harris, 1972).

The Duke Endowment Foundation selected William M. Rich, a former banker, to be the next superintendent. A position he held from 1935 to 1960. Under Rich's leadership, the advisory committee began reviewing the work of Black physicians in the hospital. The aim of this audit was to determine which physicians should retain their staff privileges and which should not. Surgeons received the most scrutiny. Reports reveal that white physicians on the advisory committee held the view that Black physicians were generally inferior. One advisory committee member stated that Black surgeons "frequently lacked surgical judgment" (Harris, 1934). The advisory committee recommended that all surgical cases have a white physician present as a supervisor. However, this appeared to have only been a temporary measure while the hospital recovered its reputation. By 1937, Black physicians re-took a prominent role in the hospital, and the American Medical Association reinstated the residency accreditation in 1939 (Gamble, p. 119-120, 2011). Over the 1940s and 1950s, the hospital maintained a strong reputation. The hospital received training site accreditation from the American College of Obstetrics and Gynaecology (ACOG) in 1955.[3]

The final era of the Lincoln Hospital begins after 1963 and lasts until 1974. During this era, the hospital slowly loses relevance. The Civil Rights Act of 1964 and the Social Security Act of 1965 caused Black hospitals to compete directly with white and biracial hospitals. Larger hospitals skimmed off parts of the Black hospital's market share, causing financial distress for many Black hospitals. This was especially the case for Lincoln Hospital, as now it was forced to

[3] At the time, there were 438 accredited obstetric residency training programs.

compete with Duke University Hospital. The patient volumes within the Lincoln Hospital's Obstetrics Ward declined by 40 percent from 1960 to 1970 (Lincoln Hospital Delivery Records). There is also some evidence that high-risk deliveries were transferred during this period from Lincoln to Duke University Hospital, where they would ostensibly receive higher-quality care. This trend extended beyond the obstetrics department and ultimately caused Lincoln Hospital to close in 1974. As the analysis to follow will show, the evolution of obstetrical practice at Lincoln Hospital was shaped as much by broader structural issues as by innovations within the field of obstetrics.

4.3 Data Sources and Description

This paper uses a novel archival source from Duke University's Rubenstein Library, the Lincoln Hospital's Delivery Room Records, as its primary source of analysis (Delivery Room Records, Lincoln Hospital). The delivery room records cover the years 1930 to 1970. I transcribed all deliveries occurring within a two-year period with a three-year gap interval, so that the data included 1930 and 1931, then 1935 and 1936, then 1940 and 1941, and so on. The final year, 1970, only had data up to June. To increase the data coverage in this final period, I transcribed data from the second half of 1968 and all of 1969. This is why the final period in the analysis is 1968-1970.

The delivery records reported the mother's name, physician(s) in attendance, gestational age at birth, born alive or stillborn, pregnancy and labour complications, foetal presentation, anaesthesia use, and obstetrical interventions. The records also had a column 'other notes'. From this column, I could transcribe valuable information for some cases, such as neonatal deaths minutes or hours after delivery. Additionally, mother's parity and the child's birth weight were reported after 1946 and 1955, respectively. Since parity and birth weight were not reported throughout the dataset, I use them for descriptive statistics patient population at specific period rather than controls for the analysis over time.

Following the Rubenstein Library's sensitive materials use policy, I have anonymized the names of patients and physicians in attendance into a numerical code. The physicians' codes

were used to see the distribution of deliveries, the intervention rates, and the outcome rates—stillbirth rate and infant survival rate—among attending physicians.

Pregnancy and labour complications included medical issues such as pre-eclampsia, gestational diabetes, placenta abruption, and congenital malformations, which manifest in during pregnancy. Additionally, there were complications that would manifest intra-partum such as umbilical cord prolapse, placenta previa, foetal-pelvic disproportion, and dystocia. Presentation at birth was its own variable, however, breech presentation should be considered an intra-partum complication (see Appendix 4.A.1 for discussion on these pregnancy complications and stillbirths).

The obstetrical interventions recorded for this study were instances of surgical interventions and pharmacological interventions. The surgical interventions analysed for this paper were births involving forceps use or caesarean section. Intervention rates were broken down by time period and physician in attendance. Moreover, by combining case-level information on interventions with stillbirth and neonatal death outcomes, I quantified the success rates of the two types of interventions.

Pharmacological interventions reported included labour inductions and anaesthetics. Inductions were transcribed simply as a binary variable, reporting their occurrence. The use of an anaesthetic was recorded as a binary variable. These anaesthesia cases were further broken down to cases of regional and general anaesthetic.

Data from the Duke Endowment's Annual Reports, US Vital Statistics, and selected surveys of US maternal health were used to complement and contextualize the results of the Lincoln Hospital analysis. The Duke Endowment Annual Reports covered all hospitals in North and South Carolina that received philanthropic aid from the Duke Endowment Foundation (Statistics, Duke Endowment). This data covered the years 1926, 1930, 1931, 1935, and 1936. The data included births and stillbirths both of which are further broken down into preterm births, births with forceps use, and caesarean section births. There is also data on the complications of preeclampsia and placenta previa. The data is reported as an aggregation of all hospitals and broken down into white-only hospitals, biracial hospitals, and Black-only hospitals.

To extend this data past the 1930s, I used state-level data transcribed from US vital statistics reports covering 1940 to 1970 for stillbirth rates and preterm birth rates (US Vital Statistics). These outcomes are available by race. For forceps rates, I relied on federal surveys covering the 1960s and 1970s (GAO, 1979).[4] I used this same source as well as surveys from academic literatures for caesarean section rates (Wolf, 2017 & Blincow, 1955 & GAO, 1979). When patched together these sources provided coverage on caesarean section rates from 1954 to 1972.

The patchwork of sources offered a reference point from which to compare the Lincoln Hospital data. However, the data is not as strong of a peer comparison as the Duke Endowment Annual Reports are since the surveys cover a more diverse range of patient populations, geographic locations, and hospital types. The GAO survey from 1979 has national statistics disaggregated by race but not by location. The academic surveys do not provide disaggregated statistics. While this makes the comparison group more dissimilar to the patient population at Lincoln Hospital, I believe valuable conclusions can still be drawn.

4.3.1 Delivery Counts Over Time at the Lincoln Hospital

TABLE 4.2 below records the count data for the Lincoln Hospital's delivery room across this paper's period. Deliveries were at a low point at the start of the dataset and grew over time. The 1930-31 and 1935-36 periods are during the hospital's reputational and financial low point. From 1935 onwards there is a steady increase in total deliveries up to 1960-61.

TABLE 4.2: Delivery Counts from Lincoln Hospital Records
(Percentage in parentheses is share of total deliveries)

Years	*1930-31*	*1935-36*	*1940-41*	*1945-46*	*1950-51*	*1955-56*	*1960-61*	*1965-66*	*1968-70*
Deliveries	102	266	405	622	879	948	1129	707	671

[4] I mainly relied on the GAO report, which distilled results from the National Natality Survey of 1972, Commission on Professional and Hospital Activities Survey (1963), and the NINCDS Collaborative Perinatal Project (1959-1974). I am aware of the National Natality Survey of 1964-1966. However, the data on delivery type from this serve has an extremely high non-response rate. For the overall survey, 62 percent of respondents did not answer the delivery type question. The problem magnifies when I refined the data to Black respondents (67 percent) and grows more problematic when I refined the data to southern Black respondents (86 percent). I chose to leave out this survey for this reason.

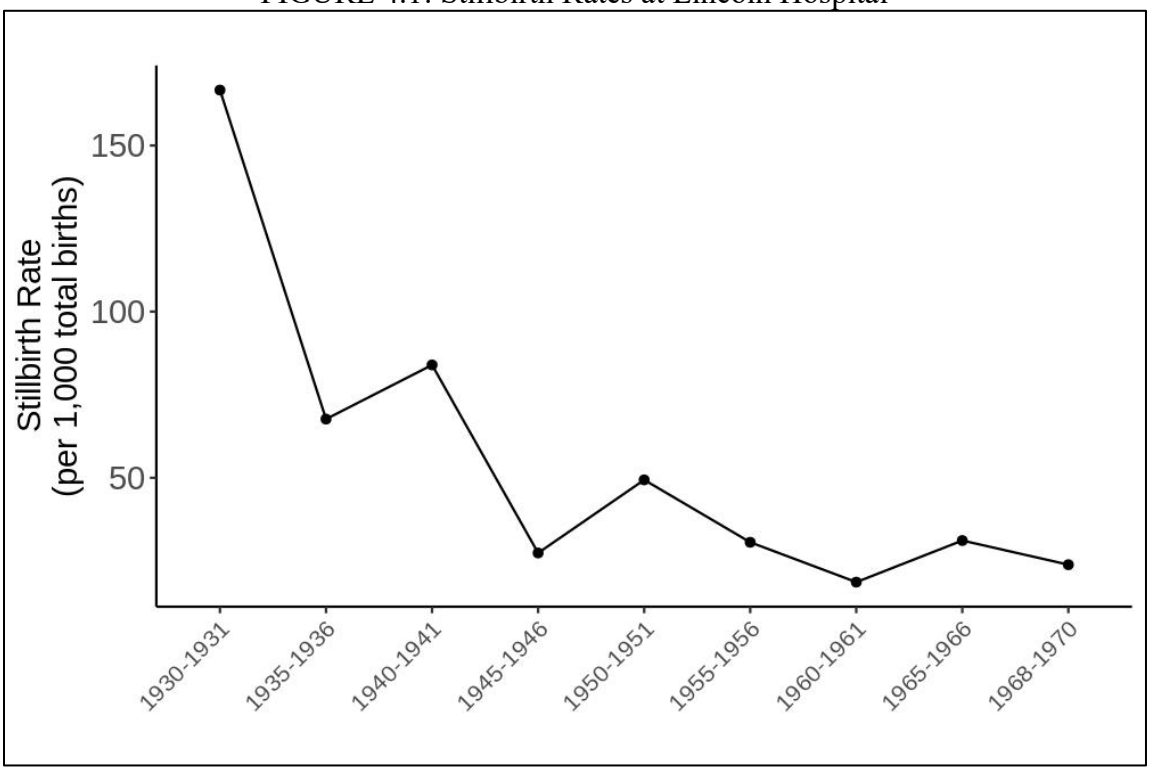
Live Births	85 (83%)	248 (93%)	371 (92%)	604 (97%)	828 (94%)	919 (97%)	1108 (98%)	685 (97%)	655 (98%)
Stillbirths	17 (17%)	18 (7%)	34 (8%)	17 (3%)	43 (6%)	29 (3%)	21 (2%)	22 (3%)	16 (2%)
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University									

Deliveries fall 37 percent between 1960-61 and 1965-66, then level off to end the period with 671 deliveries in 1968-70. The decline from 1960-61 to 1965-66 coincided with legal changes that barred hospitals from discriminating against racial groups. These policy changes led to the decline of Black Hospitals as Black patients shifted to previously segregated hospitals (Beardsley, 1986). Duke University Hospital gained market share from Lincoln Hospital after integration measures were implemented. This phenomenon even appears in the delivery room records. Notes appear in the remarks section of the delivery room records remarking that unwell infants were transferred to Duke University Hospital to receive more intensive care after desegregation. Infant transfers do not appear in the records before desegregation.

4.3.2 Stillbirth Rates at Lincoln Hospital

Between 1930 and 1970, there was a dramatic reduction in the hospital's stillbirth rate from 162 stillbirths per 1,000 total births to 23.8 per 1,000 total births. The stillbirth rate at the start of the period was extraordinarily high. The first observed period is exceptional in two ways. First, there were fewer deliveries than any other observed period. Second, the hospital was in a period of managerial disrepair. Coupling these two factors with the hospital's high stillbirth rate implies that the hospital was receiving desperate patients and that many of these deliveries were high-risk deliveries. Moreover, this period is before the introduction of sulpha drugs, making caesarean sections riskier for the life of the mother. This narrowed the choice of obstetrical intervention to only forceps for many of the difficult births. These findings agree with earlier research from Thomasson and Treber (2008) that found that pre-sulpha drugs birth outcomes within hospitals were extremely poor for Black patients.

FIGURE 4.1: Stillbirth Rates at Lincoln Hospital

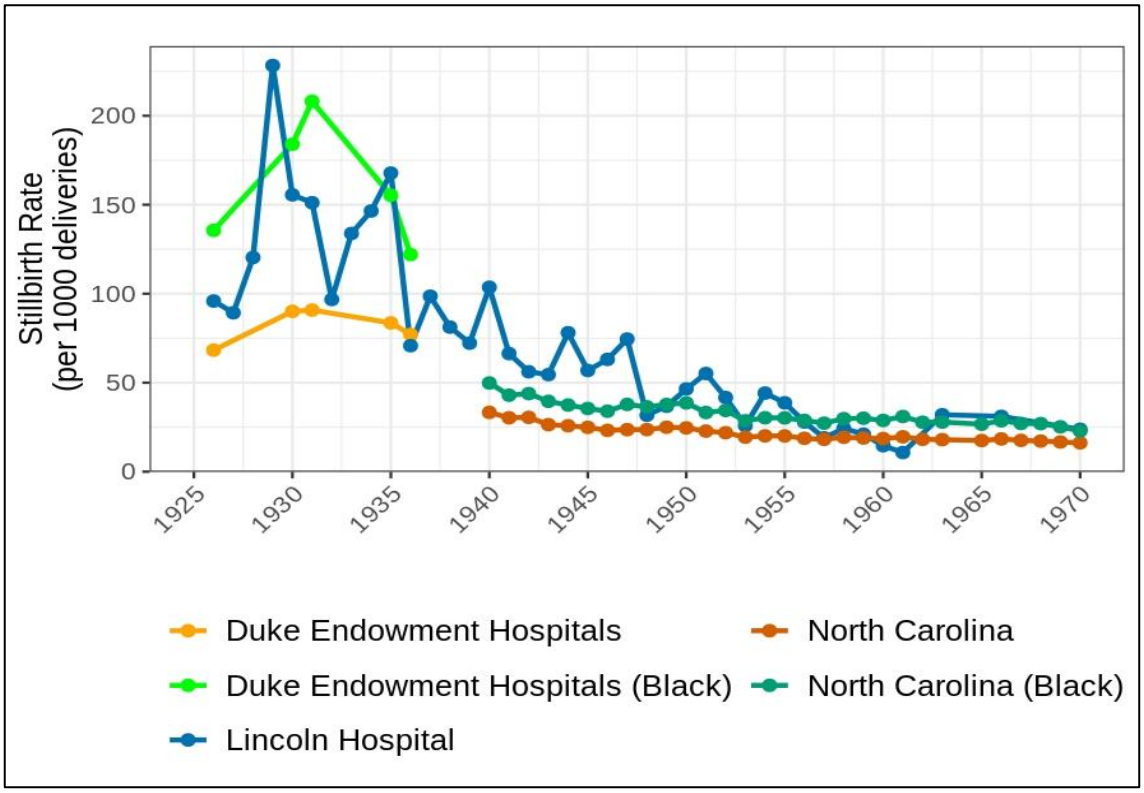


Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

By the 1935-36 period, the stillbirth rate had fallen to 68 stillbirths per 1,000 total births. This is remarkable since this decline is prior to the introduction of sulpha drugs. The 1935-36 period marked the beginning of reforms carried out by the Duke Endowment's hand-picked Hospital Superintendent. Some of these managerial changes might have played a role in decreasing the stillbirth rate. However, total births were still lower than all the following periods, so the statistical error on this period's stillbirth rate is too high to draw strong conclusions.

After a slight rise in the 1940-41 period, the stillbirth rate fell precipitously across the antibiotic era. From 1955-56 to 1960-61 the hospital reached its peak number of deliveries as well as its lowest stillbirth rate (18 per 1,000 total births). It is also important to note that the hospital received Hill-Burton funding during this period, which increased the capacity of the hospital by upgrading equipment and increasing the number of hospital beds. The stillbirth rate rise to 31 and 24 stillbirths per 1,000 total births in 1965-66 and 1968-70, respectively.

FIGURE 4.2: Comparison of Stillbirth Rates between Lincoln Hospital, Duke Endowment Hospitals, and North Carolina



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records; Duke Endowment Annual Reports of the Hospital and Orphan Sections, 1926-1936; North Carolina rates are from US Vital Statistics 1940-1970

How do these rates compare to state averages? For comparisons, FIGURE 4.2 plots data from the Duke Endowment Annual Reports for Black hospitals and all other hospitals from 1930 to 1936. Then, I relied on state-level statistics from 1940 to 1960. The Duke Endowment Black hospitals and state-level Black stillbirth rates are plotted as North Carolina (Black), while the other Duke Endowment hospitals and state-level averages are plotted as North Carolina.

The Lincoln Hospital stillbirth rate fairs better than the Black hospital data for all years between 1930 and 1936, except for 1935. Despite the poor stillbirth rate, the Lincoln Hospital was outcompeting many of its peer Black hospitals during this period. Moreover, the stillbirth rate for 1936 is remarkable for the fact that it dips below the overall state average. From 1940 to 1955, the hospital's stillbirth rate remained above the state's Black stillbirth rate. Then, as Hill-Burton funds flow into the hospital, the stillbirth rate falls below the state's Black stillbirth rate, reaching below the state average for the second instance in 1960 and 1961. After 1961, there is a

rise in the stillbirth rate up to the state's Black stillbirth rate where the hospital's rate stayed until 1970.

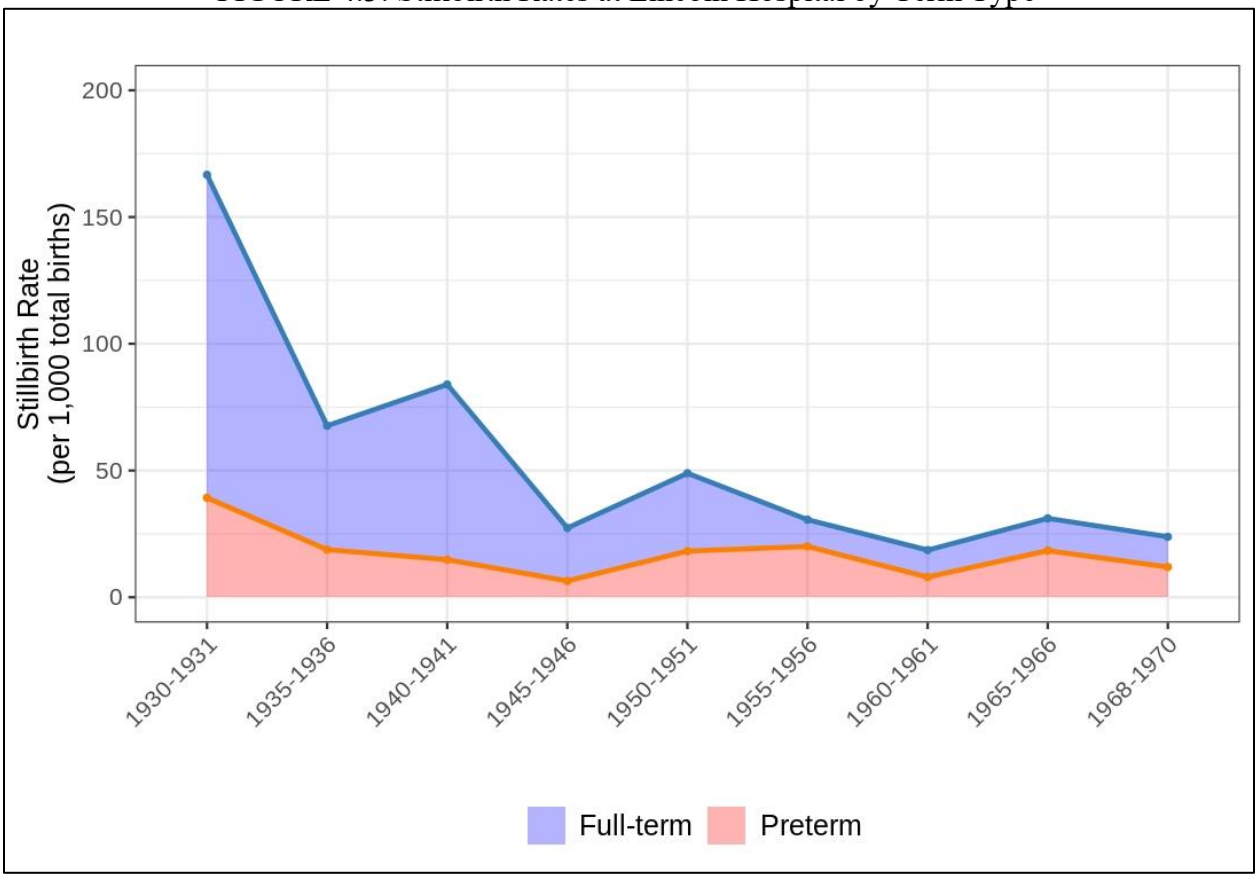
Overall, plotting the comparison rates against the Lincoln Hospital's rates revealed that the hospital performed slightly better than the average Black hospital prior to 1940. Then, the hospital's population experienced a fifteen year stretch of having mostly higher stillbirth rates than the state's Black population. Finally, from 1955 to 1970, the hospital's stillbirth rate matched or outperformed the rate for the state's Black population. These results fit the general idea that the hospital was a top-performing Black hospital across the period. Even the fifteen-year stretch of an elevated stillbirth rate can be seen as a reflection of the state's Black population's over-reliance on the hospital during a pre-Hill-Burton period where alternative hospital options were limited.

4.4 Prematurity at Lincoln Hospital

Costa (2004) studied birth outcomes within the Johns Hopkins Hospital in the early- to mid-20th century and linked Black-white stillbirth disparities to the higher prematurity rates within the Black population. Given the role that prematurity plays in birth outcomes, I wanted to review prematurity trends within the Lincoln Hospital to see how they evolved over time and to what extent changes to prematurity rates are impacting the hospital's stillbirth rates. There are two ways to analyse prematurity rates at Lincoln Hospital. One way is to examine preterm birth rates. The other is to examine infant's birth weight. I will start with preterm rates since the data covered the entire period. Birth weights are only available from 1955.

FIGURE 4.3 shows the stillbirth rate in Lincoln Hospital by gestational age. Births after 37 weeks are full-term births, while those before 37 weeks are preterm births. The striking takeaway is the decline in the share of stillbirths that are full-term. Mechanically, this means that the share of stillbirths that are preterm increases. The share of stillbirths that were preterm grew from a range of 10-25 percent between 1930 and 1941 to a range of 42-65 percent between 1955 and 1970.

FIGURE 4.3: Stillbirth Rates at Lincoln Hospital by Term Type



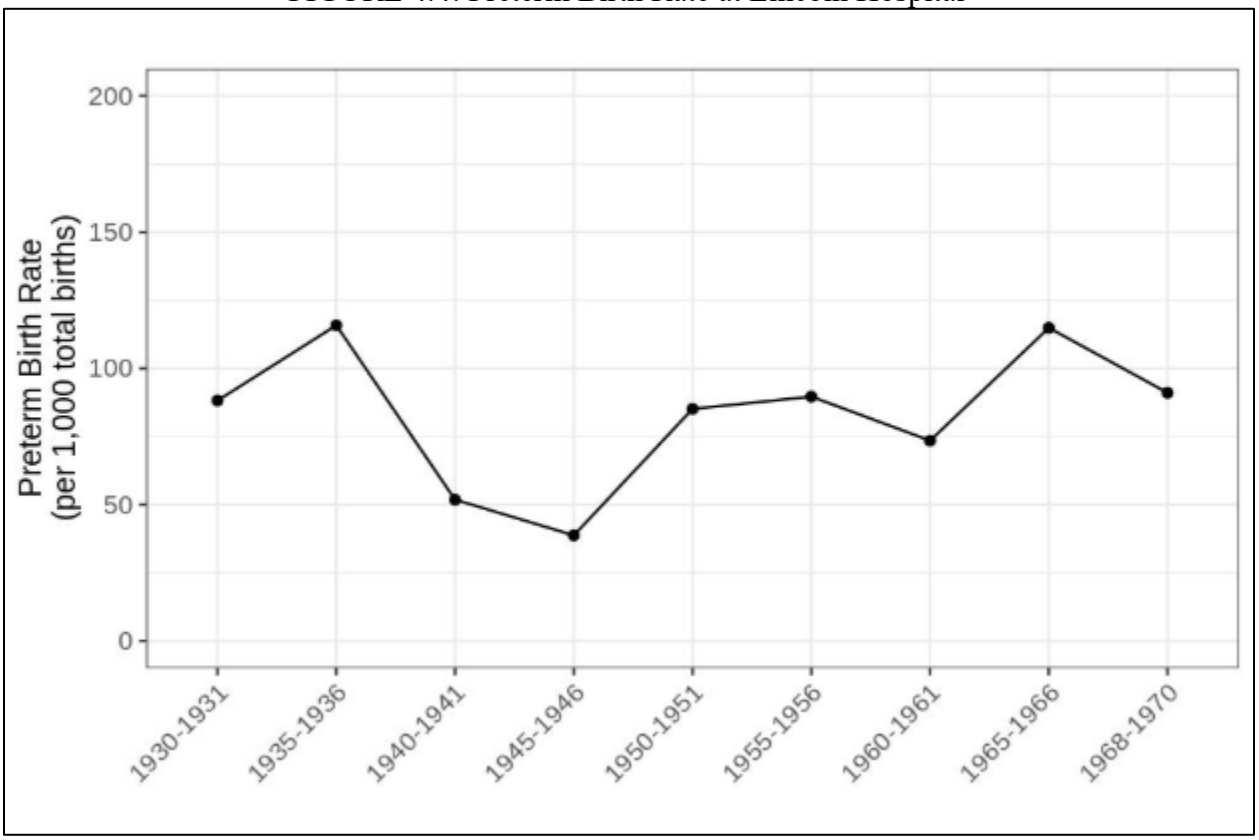
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

The declining share of full-term stillbirths can be thought of as evidence for two different phenomena: pregnancies are becoming healthier over time or healthcare during pregnancy and labour is improving. The main hypothesis of this paper relies mostly but not exclusively on the latter being the case. I say not exclusively since the Løkke framework does capture the fact that some improvement to birth outcomes will occur after the introduction of penicillin due to the improved cohort health of pregnant women. The clearest illustration of this is the reduction of syphilis rates. Syphilis was prevalent within the southern Black population and directly affected maternal health (Costa 2004 & Parran 1937: 161-174). The death rate from syphilis was around 16 per 100,000 in 1930. By 1951, this had fallen to 4.1 per 100,000 and fell to 1.6 per 100,000 by 1960 (Peterman et al., 2015 & US Department of Health, Education, and Welfare, 1963). Thus, cohort health improvements undoubtedly played a role in stillbirth reductions. Obstetrical care started to play the predominant role by the 1950s, at the latest.

The other avenue through which full-term stillbirths were declining was through better healthcare during pregnancy and labour. Intra-partum complications, such as placental abruption, placenta previa, umbilical cord prolapse, dystocia, or foetal-pelvic disproportion, increase the likelihood of delivering a stillbirth, especially if obstetrical care is unskilled. The Løkke framework argues that antibiotics increased the practice of aggressive obstetrical interventions since obstetricians were no longer inhibited by concerns for the mother's health. Certainty that the mother would survive interventions led to an increase in the rate of interventions and a fine-tuning of obstetrical technique, resulting in less intra-partum stillbirths overall.

One possible implication of this theory is that the preterm birth rate will increase since many of these interventions will require emergency caesarean sections before full term. However, the Lincoln Hospital's preterm birth rate has a U-shape between 1930 and 1970 (FIGURE 4.4). The higher rate to start the period is likely due to adverse selection. As I mentioned earlier, the first two observed periods have fewer births than all other periods. Furthermore, the reputational hit to the hospital during this period meant that mothers with means would prefer home births. These two early observational periods include more low-income births, which had a higher likelihood of prematurity.

FIGURE 4.4: Preterm Birth Rate at Lincoln Hospital



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

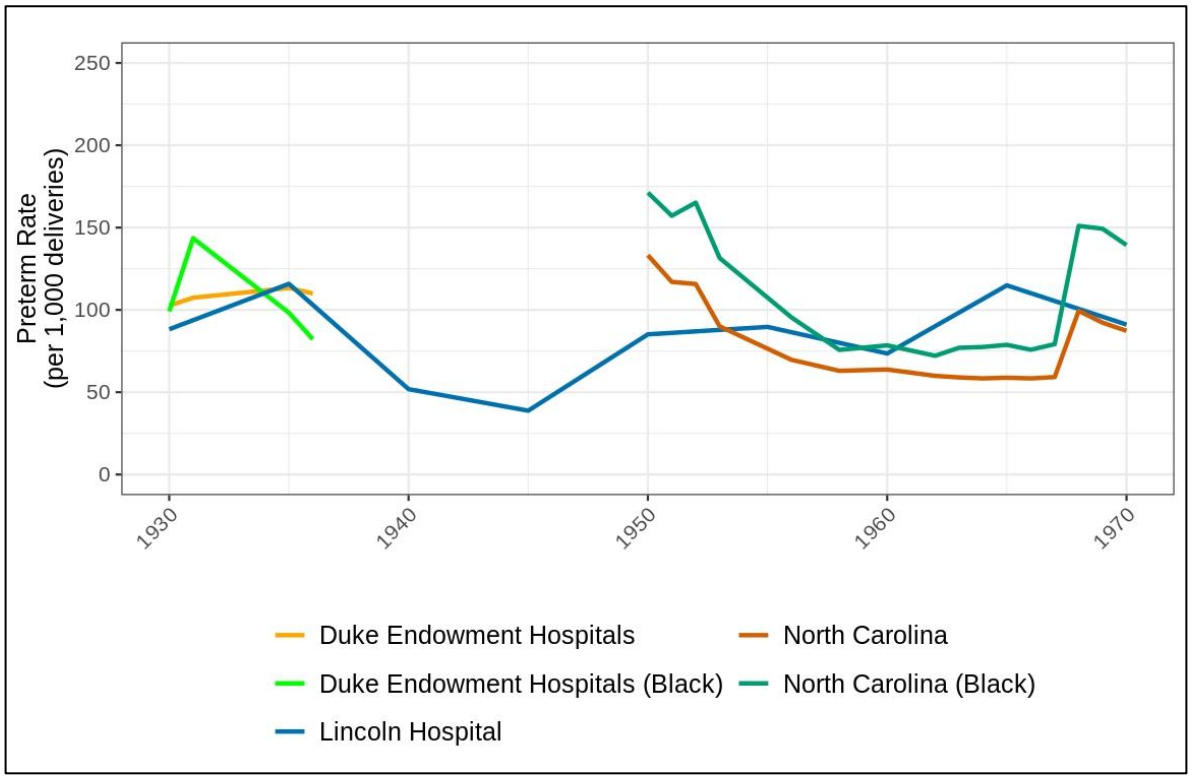
The preterm rate fell to 50 per 1,000 births by 1940-41 and fell further still in 1945-46. The decline in the 1940s could be due to the decline in the birth rate—the crude birth rate fell from 22.48 in 1930 to 19.02 in 1940 (UN DESA and Gapminder, 2019). However, the birth rate alone is unlikely to explain the entire decline in preterm births since the crude birth rate increase to 21.36 by 1945 while the preterm rate continued to fall to below 50 per 1,000 births.

Another factor could be the establishment of government welfare programs targeting maternal and infant healthcare needs. Major reform had occurred here during this period with the Aid to Families with Dependent Children, part of the Social Security Act of 1935, and the Emergency Maternal and Infant Care Act of 1943. The former applied only to military families but covered all enlisted members of the armed forces. Durham was only 15 miles away from Camp Butner, so Lincoln Hospital saw some inflow of maternal cases from the wives of Black soldiers stationed there. The combined impact of falling birth rates and better prenatal care and

nutrition provisions for mothers represent the two largest drivers of the dip in preterm births during the 1940s.

The hospital's preterm birth rate climbed steadily after 1945-46 from below 50 per 1,000 births to a peak rate 114 per 1,000 births by 1965-66. The gradual rise of preterm births post-1945-46 reflected changes in obstetrical practices. These changes were the result of the introduction of antibiotics into the field of surgical obstetrics and the gradual adoption of more interventional practices to save high-risk foetuses. Since some share of these interventions occurred by intervening on pregnancies before term, these changes to obstetrical practices placed upward pressure on the preterm birth rate. Modern preterm rates have risen well above the rates found in Lincoln Hospital in the mid-20th century. In 2013, the US Black population was found to have a preterm rate of 162.7 per 1,000 births (Martin et al. 2017).

FIGURE 4.5: Comparison of Preterm Birth Rates between Lincoln Hospital and North Carolina



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records; Duke Endowment Annual Reports of the Hospital and Orphan Sections, 1926-1936; North Carolina rates are from US Vital Statistics 1940-1970

FIGURE 4.5 above plots data from the Duke Endowment Hospital Section Annual Reports between 1930 and 1936 and state-level data from US Vital Statistics between 1950 and

1970 to contextualize the Lincoln Hospital preterm rates. When the comparison is to other Duke Endowment Hospitals (1930-1936), the Lincoln Hospital's preterm birth rate begins around 40 percent lower than other hospitals. However, by 1935-36, this trend is reversed to where Lincoln Hospital has a higher preterm birth rate than other Black hospitals and has a rate equal to or slightly higher than the white-serving and biracial Duke Endowment hospitals.

In 1950, North Carolina's Black preterm rate is over 2.5 times the rate delivered in Lincoln Hospital. However, this advantage soon declines so that by 1960-61 the preterm rates within Lincoln Hospital are only marginally lower than that of the state's Black population. By 1965-66, Lincoln Hospital's rates are higher than the state-level figures for both the white and Black populations. The state-level rates after 1967 increase dramatically due to a change in the vital statistics rules for measuring prematurity. US health officials standardized gestational age measurements to a last menstrual period (LMP) format in 1967 (Chase and Byrnes, 1972). The inconsistency of the state-level data makes me hesitant to draw a strong conclusion from comparisons post-1950. This is a feeling shared by contemporary analysts as well. The 1972 report on national prematurity trends stated:

> "The data are confounded by changes in reporting practices which limit their usefulness in quantifying the changes in gestation distributions which occurred over the entire period 1950-1967."
> (Chase and Byrnes, 1972, pages 16-17)

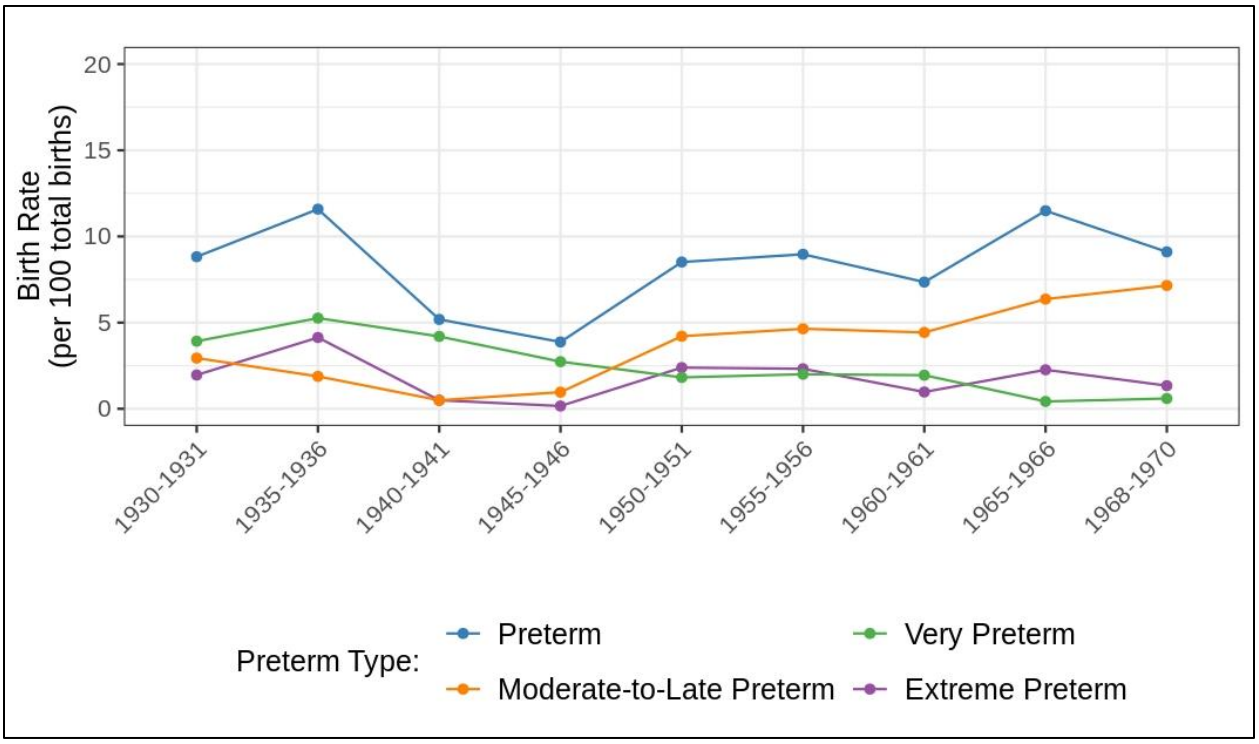
In lieu of drawing any strong conclusion, I find the comparison evidence supportive of a claim that the Lincoln Hospital's patient population was not entirely different from the patient population within the Duke Endowment's Black hospitals in the 1930s. As for the hospital's population compared to the state population, there is some bias towards lower preterm rates compared to the state overall. The fact that the hospital was in an urban centre makes this claim not particularly surprising.

4.4.1 Preterm Births by Severity

Below is a graph of the share of preterm birth in Lincoln Hospital broken down by the type of preterm births. All births before 37 weeks are considered preterm. These births can be further categorized into three sub-groups: a) Extreme preterm (less than 28 weeks), b) Very preterm (28 to less than 32 weeks), and c) Moderate to late preterm (32 to 37 weeks).

The breakdown of preterm births from 1930 to 1970 shows that the share of preterm births that are very preterm (28 to 32 weeks) has decreased over time from its peak of 44.5 percent of all preterm births in 1935-36 to 3.6 percent of preterm births in 1965-66. On the other hand, the share of moderate-to-late preterm births (32 to 37 weeks) has increased from 16.2 percent to 55.4 percent of all preterm births. The final category of preterm birth, extreme preterm, declines from 44.4 percent to 14.7 percent of all preterm births.

FIGURE 4.6: Preterm Birth Rates by Severity



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

This shifting composition of preterm births provides evidence for the two channels of the Løkke framework. First, the decline in extreme and very preterm deliveries is a sign that overall maternal health is improving. In particular, the decline of extreme preterm births is a boon of foetal health (see Appendix 4.A.2). Across the period, neonatology considered 28 weeks to the threshold of foetal viability (Schaffer and Avery, 1971). Thus, these extreme premature births all resulted in foetal deaths regardless of obstetrical capacity. Second, the fact that moderate-to-late preterm births are driving the increase in preterm births from 1945-46 onward is a sign that

obstetricians at the Lincoln Hospital are growing more interventionist in their approach to childbirth.

4.4.2 Birth Weight

Another measure of maturity is birth weight. 2500 grams or less is considered low birth weight (UNICEF & WHO, 2019). TABLE 4.2 below shows the share of births above and below 2500 grams for live births. The share of births below 2500 grams delivered in the Lincoln Hospital rises from 12.5 to 14.6 between 1955-56 to 1968-70. This finding aligns with the previous trends of increasing preterm birth rates across this same period, and it correlates with a slight rise in the hospital's stillbirth rate between 1955-56 and 1968-70. The Lincoln Hospital had a marginally lower share of low-birth-weight births than North Carolina's Black population. Again, this finding concurs with the results stated in the previous section on preterm birth rates during this period.

TABLE 4.2: Birth Weights for Live Births

Year	**Percent below 2500 g**
1955 - 56	12.5
1960 - 61	13.2
1965 - 66	14.5
1968 - 70	14.6
North Carolina Black Population (1968)	14.7

Source: Committee to Study the Prevention of Low Birthweight; Division of Health Promotion and Disease Prevention; Institute of Medicine. Preventing Low Birthweight. Washington (DC): National Academies Press (US); 1985 Jan 1. Appendix B, Data on Selected Low Birthweight Trends.

TABLE 4.3 below displays the share of low-birth-weight stillbirths for the four observed periods from 1955 to 1970. Most stillbirths are under the low-birth-weight threshold of 2500 grams, and the share rises constantly across the period. The results here restate the finding that stillbirths are becoming concentrated in premature deliveries as the overall stillbirth rate declines over time.

TABLE 4.3: Birth Weights for Stillbirths at Lincoln Hospital

Year	**Percent below 2500 g**

1955 - 56	57.7
1960 - 61	60.0
1965 - 66	61.9
1968 - 70	75.0

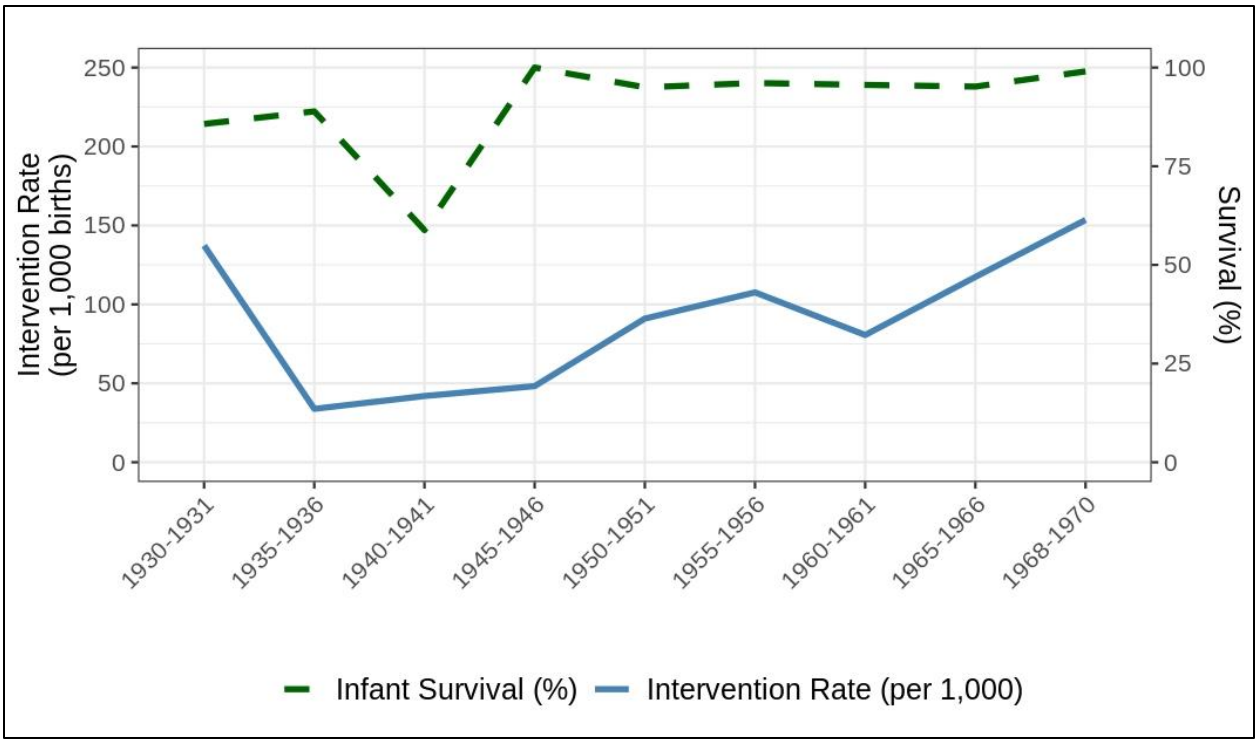
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

In sum, the trends in birth weight mirror the patterns observed in prematurity, reinforcing the central claim that stillbirths at Lincoln Hospital became increasingly concentrated among preterm and low-birth-weight deliveries over time. While these outcomes point to improvements in maternal health and antenatal care, they also suggest that remaining stillbirths were clustered in higher-risk pregnancies requiring more sophisticated interventions. Understanding how Lincoln Hospital addressed such cases requires a closer examination of the obstetrical techniques employed. The next section turns to the role of direct medical interventions in shaping birth outcomes over time.

4.5 Obstetrical Interventions: Forceps and Caesarean Sections

The interventions included in my analysis were forceps and caesarean sections. Aside from episiotomies, these two interventions were the most common obstetrical interventions reported in the delivery room records. Episiotomies, a surgical procedure where a small incision is made in the area between the vagina and anus during childbirth, are left out of my main analysis. Contemporary obstetricians argued that episiotomies "[shortened] the labour and delivery process" (Myers-Helfgott and Helfgott, 1999, p. 307). In cases of prolonged labour, forceps were often paired with episiotomies (See Appendix 4.A.6). Therefore, any impact that episiotomies might have had on stillbirths is already captured by the forceps rate. External cephalic versions, a method used to turn a breech baby to a head-down position during pregnancy, were also left out of the analysis. I chose to exclude these events because there were only 8 cases of external cephalic version across the 5729 deliveries. For the rest of the paper, interventions are defined as forceps use and caesarean sections.

FIGURE 4.7: Intervention Rate and Infant Survival at Lincoln Hospital



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

FIGURE 4.7 above plots the intervention rate as well as the percentage of infants surviving delivery. The survival percentage includes deliveries that were not reported as stillborn or as expired soon after birth. The figure illuminates three things about intervention rates and their impact on infant survival. First, interventions rates were high at the start of the period. The intervention rate started off by making up 13.7 percent of all deliveries in the 1930-31. After 1930-31, the rate fell to between 3.3 and 4.8 percent of all deliveries up until 1950. The intervention rate in this initial period is almost entirely comprised of forceps use.

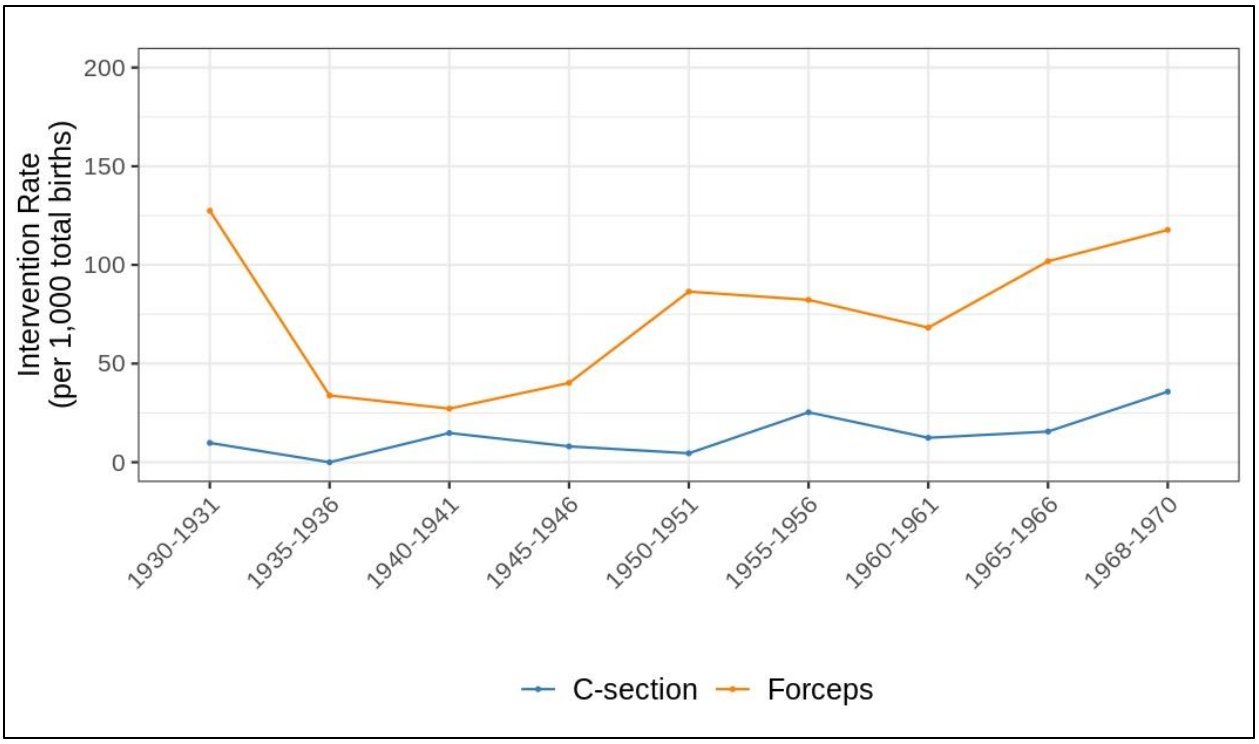
Second, the share of intervened births increases steadily after the introduction of antibiotics—first with sulpha drugs in 1937 and then penicillin in 1944. This trend is aligned with earlier literature that connected the mass production of antibiotics with a rise in obstetrical interventions (Løkke, 2012 & Sherrod, M. M., 2017). The uptick in intervention rates at Lincoln Hospital lagged the introduction of these antibiotics by a few years. The largest increase in intervention rates occurred in the 1950-51 period. This lag is different than the trend found by Løkke for the National Hospital Copenhagen. In that context, interventions overall increased after the introduction of sulpha drugs. It was forceps usage that drove the rise in interventions

between 1937 and 1947. Only after 1947 did Løkke find that the share of caesarean sections overtook the share of forceps deliveries. At Lincoln Hospital, the intervention rate rise begins in 1950-51 and continues until 1968-70—at which point over 15 percent of deliveries involved an intervention.

The third takeaway from the FIGURE 4.7 is that infant survival improved in the post-antibiotic period. Moreover, the improvement preceded the rise in obstetrical interventions. The chronology suggests that the ward's physicians took a conservative approach to obstetrical practices. Waiting to see positive results on minimal amounts of intervened births before adopting more interventionist practice guidelines. All intervened births in 1945-46 had infants surviving. In the period post-1950, as the intervention rate rose the survival rate hovered between 95 and 99 percent. This survival rate was higher than survival rates achieved between 1930 and 1941. The fact that it was not 100 percent implies that interventions are targeting riskier births than before.

Next, I want to breakdown the intervention rate into its two components—the forceps and caesarean section rate. Below in FIGURE 4.8 I plot out the two rates over time. The hospital had a persistent preference for forceps use over caesarean sections. Based on the Løkke framework, this trend is unsurprising in the pre-antibiotic period. But it is not what would be expected from the post-antibiotic period. In the following sub-sections, I will draw on intervention rates from hospitals in the US to contextualize the Lincoln Hospital rates within American obstetrical trends to show that even in that context Lincoln Hospital displayed a stronger preference for forceps use than peer hospitals.

FIGURE 4.8: Intervention Rates by Type at Lincoln Hospital

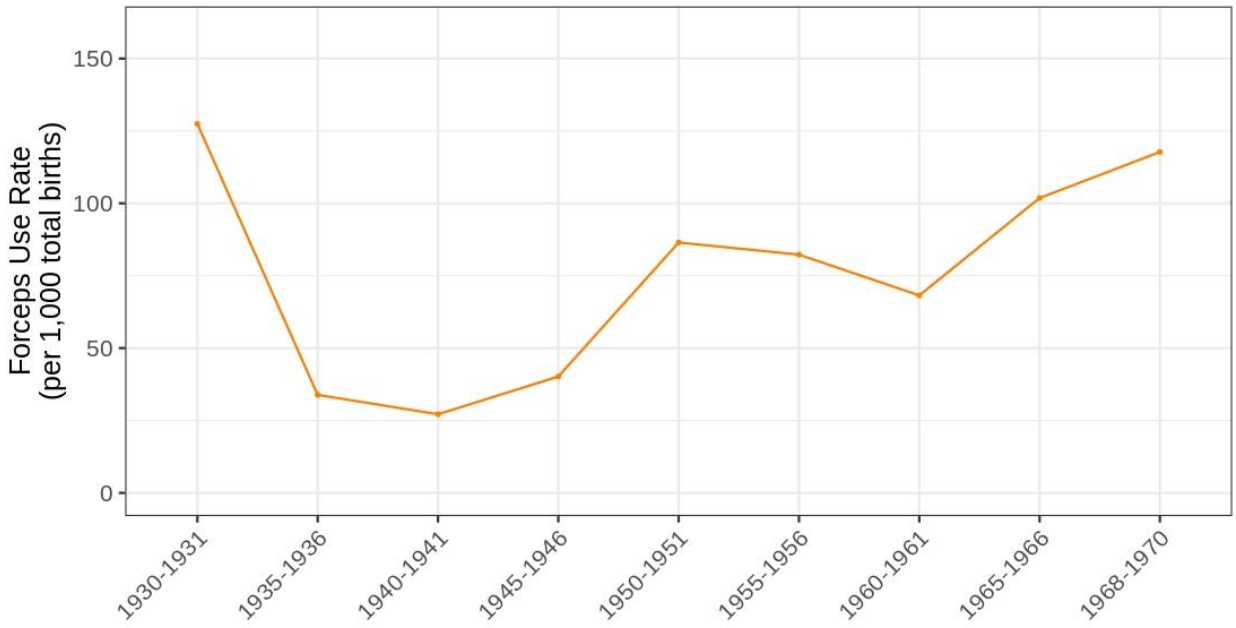


Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

4.5.1 Comparing Forceps Rates Across Hospitals

At Lincoln Hospital, the use of forceps follows a U-shape (FIGURE 4.9). The forceps rate started at 13 percent of births in 1930-31, then declined to 2 percent in 1940-41 before steadily rising from 1945-46 onward.

FIGURE 4.9: Forceps Rates by Type at Lincoln Hospital



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

TABLE 4.4 reports the survival rate of forceps deliveries within Lincoln Hospital. In the pre-antibiotic period, 1930-1936, the survival rate is between 84.6 and 88.9 percent. Interestingly, the worst period is the first era after the introduction of sulpha drugs. Forceps deliveries had a success rate of 54.55 percent in 1940-41. The forceps rate reached its nadir during this period. Later, I show that caesarean sections increased during this period, though they also had a low survival rate—only 2 out of the 6 caesarean sections resulted in healthy births. Thus, the 1940-41 period offered evidence of adjustments to obstetrical practices after the introduction of antibiotics with limited success.

Survival rates for forceps interventions improved from 1945-46. While increasing their share of births from 4 to 11.77 percent of births, forceps births maintained a survival rate between 94 and 100 from 1945-46 to 1968-70.

TABLE 4.4: Forceps Use in Lincoln Hospital			
Period	*Count*	*Share of births*	*Survival Rate*
1930-31	13	13.1	84.62
1935-36	9	3.8	88.89
1940-41	8	2.2	54.55
1945-46	25	4.0	100.00
1950-51	76	8.7	94.74
1955-56	78	8.2	96.15
1960-61	77	6.8	98.70
1965-66	72	10.2	100.00
1968-70	79	11.8	100.00
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University			

I relied on two sources to create relevant comparison rates for Lincoln Hospital. The first source is the Duke Endowment Annual Reports, which include all hospitals receiving Duke Endowment funds across North and South Carolina (Duke Endowment Annual Reports of the Hospital and Orphan Sections, 1926-1936). The Annual Reports recorded obstetrical intervention counts across hospitals from 1925 to 1936.[5] Reporting is broken down by hospital type (e.g. white, biracial, and Black). The forceps rate across all hospitals averaged between 14 to 16 percent, with a survival rate of 90.77 percent. Survival rates were higher (94 percent) in white-only hospitals than in biracial hospitals (89 percent). The Duke Endowment's Black hospitals had lower rates of forceps use, ranging from 8 percent in 1926 to 3.7 percent in 1936. Black hospitals also had a much lower survival rate (69.87 percent) than the other hospitals.

The Lincoln Hospital in this pre-antibiotic period exhibited forceps use practices that were at least in line with its peer Black hospitals for the day. The hospital experienced much better survival rates from forceps births than other Black hospitals. While their survival rates never matched that of white-only hospitals, Lincoln Hospital's forceps survival rates were on par with the Duke Endowments biracial hospitals. Undoubtedly, variations in the patient population biased the Black hospitals' as well as the Lincoln Hospital's results when compared to white and biracial hospitals. A similar type of bias existed between the Lincoln Hospital and other Black hospitals, since Durham was a relatively well-off Black community. This makes it difficult to

[5] Reports covering years after 1936 do not report obstetrical intervention rates.

disentangle the effects of healthier patients and obstetrical skill. Still, it is safe to assume that patient population difference does not comprise all of the differences in outcomes. The other Black hospitals were in urban areas not dissimilar from Durham. The evidence here suggests that Lincoln Hospital provided above-average care for the pre-antibiotic period.

For comparison in the post-antibiotic era, I used the Government Accounting Office's (GAO) review of obstetrical practices which included forceps rates for the 1960s and 1970s. The report cited surveys from the Commission on Professional and Hospital Activities that place the forceps rate at 34.6 percent in 1961. The report also cited the National Natality Survey in 1972, which placed the rate at 36.8 percent (GAO, 1979, page 36).

The GAO reported noted that forceps rates exhibited an enormous range across hospitals. Data from 12 hospitals shows a range from 10.3 to 90.5 percent for white patients and from 18.0 to 61.6 percent for Black patients. One contemporary obstetrician commented that the variance in rates was due to non-medically indicated forceps deliveries rather than medically indicated forceps deliveries. The former he argued remained relatively constant across hospitals (Pearse, 1965). He stated that the main drivers of variation were the physician's belief in preventive forceps use and on the use of regional anaesthesia.

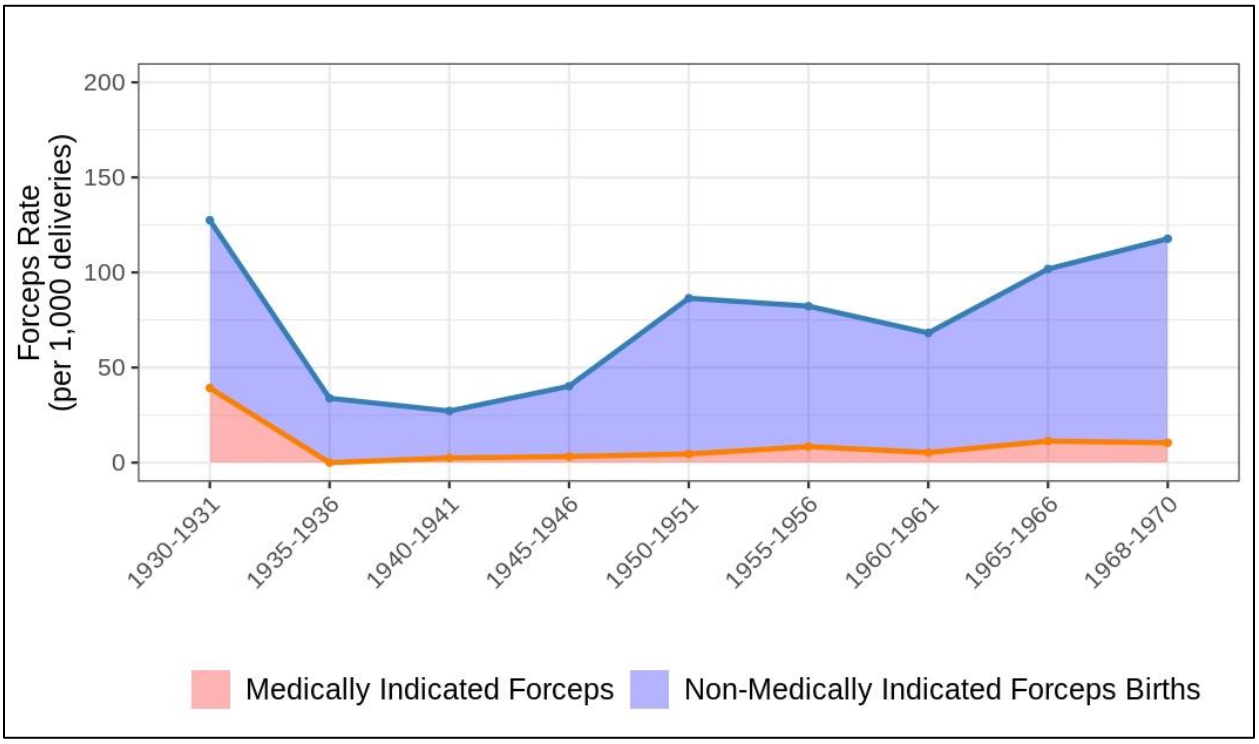
Lincoln Hospital appeared to have intervened with forceps at a lower rate than the comparison statistics available. Across the 1960s, Lincoln Hospital's forceps rate sits closer to the lower range found for white patients than any other statistic.

I used the maternal health and birth complication data found in the delivery room records to create a dummy variable for medically indicated forceps births. The list of complications I use to proxy medical indication for forceps are very preterm (birth before 32 weeks), preeclampsia, gestational diabetes, premature rupture of the membrane, prolonged labour, and breech or other complex presentations (See Appendix 4.A.3 for more on medically indicated births).

FIGURE 4.10 below shows the forceps rate broken down by indicated and non-indicated deliveries. The figure suggests that most of the forceps deliveries are not for medically indicated births. Indicated forceps deliveries made up less than 10 percent of all forceps deliveries in every observed period except for the 1930-31 period where they made up around 30 percent of all forceps deliveries. The fact that the earliest period represented the highest rate of medically

indicated forceps births confirms prior knowledge that in a pre-antibiotic era forceps could be considered the safer alternative to caesarean sections when obstetricians were faced with high-risk births. However, it is still surprising to see such a large share of non-medically indicated forceps births being performed within an institution that was previously shown to have forceps rates that were at the lower end of the national range.

FIGURE 4.10: Forceps Rate by Medical Indication



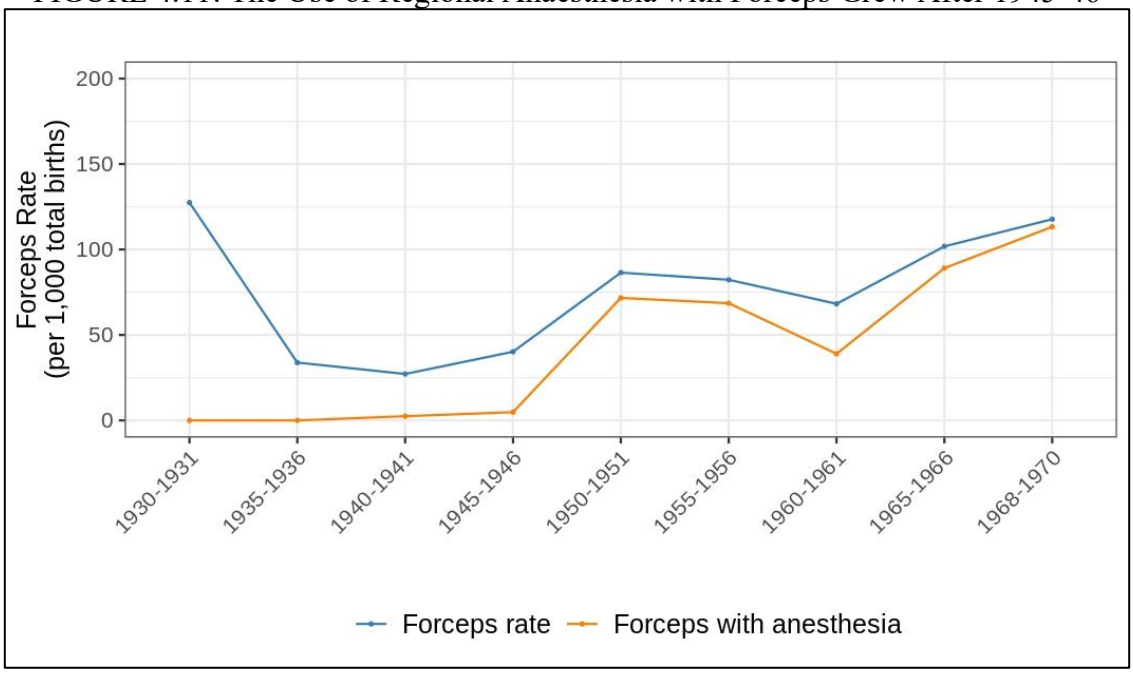
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

If forceps births were not being done for medical reasons, what was driving their rise after 1945-46? The proliferation of regional anaesthetics coincided with the rise in forceps use. Specifically, saddle nerve block and pudendal nerve block, which became widely adopted within obstetrics in 1948 and 1953, respectively (Andros et al. 1949 & Klink 1953). These new regional anaesthetics were simple to administer—an injection into the nerve. Earlier regional anaesthetics, such as continuous caudal anaesthesia, required complicated equipment, increased nursing care, and the requirement of skill and attention from trained physicians. Obstetrical journals claimed that pairing a pudendal nerve block with forceps was 'satisfactory for the spontaneous or low

forceps delivery of multipara or primigravida' (Klink 1953).[6] Moreover, these regional anaesthetics and forceps were the best practice when no skilled anaesthesiologist was available (Kobak et al. 1956).

The two figures below reveal how interconnected the forceps rate was with the introduction and proliferation of these simple to use regional anaesthetics. After 1945-46, the rise of non-medically indicated forceps use is intertwined with the use of regional anaesthestics. Importantly, regional anaesthetics were considered best obstetrical practice for low-capacity settings. Thus, Lincoln Hospital's obstetricians were not using forceps unwarrantedly. They were choosing the intervention tailored to their skillset and environment.

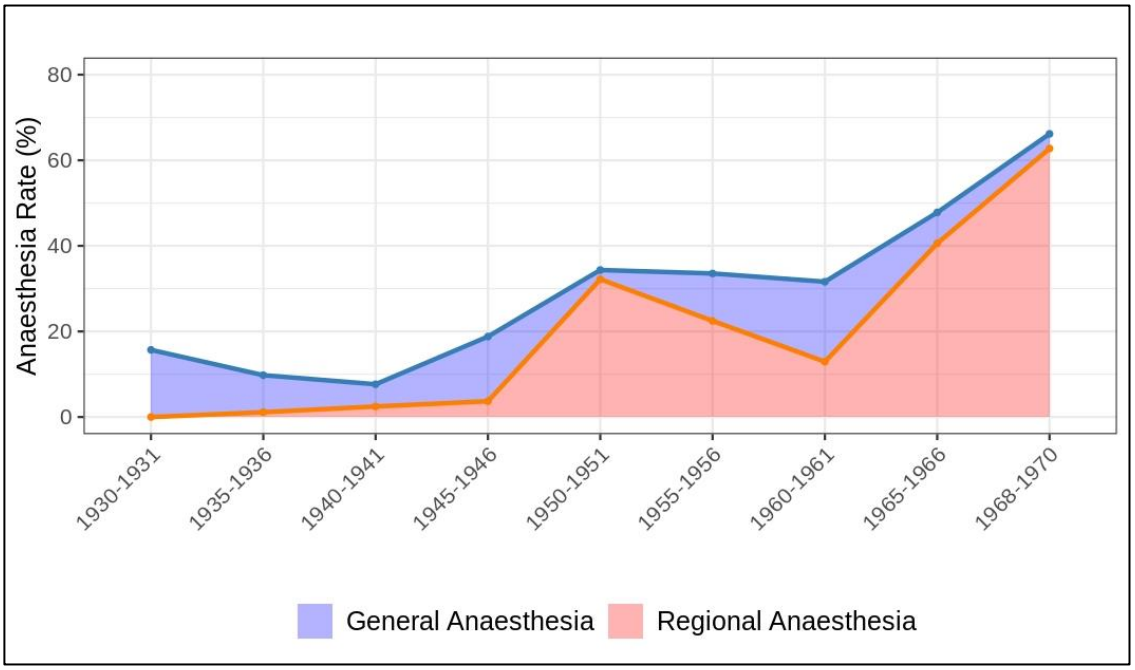
FIGURE 4.11: The Use of Regional Anaesthesia with Forceps Grew After 1945-46



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

[6] Low forceps are a type of forceps that are generally considered a low-risk obstetrical instrument. See Appendix A.4 for a discussion on forceps type.

FIGURE 4.12: Regional Anaesthesia Dominate Anaesthesia Use After 1945-46



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

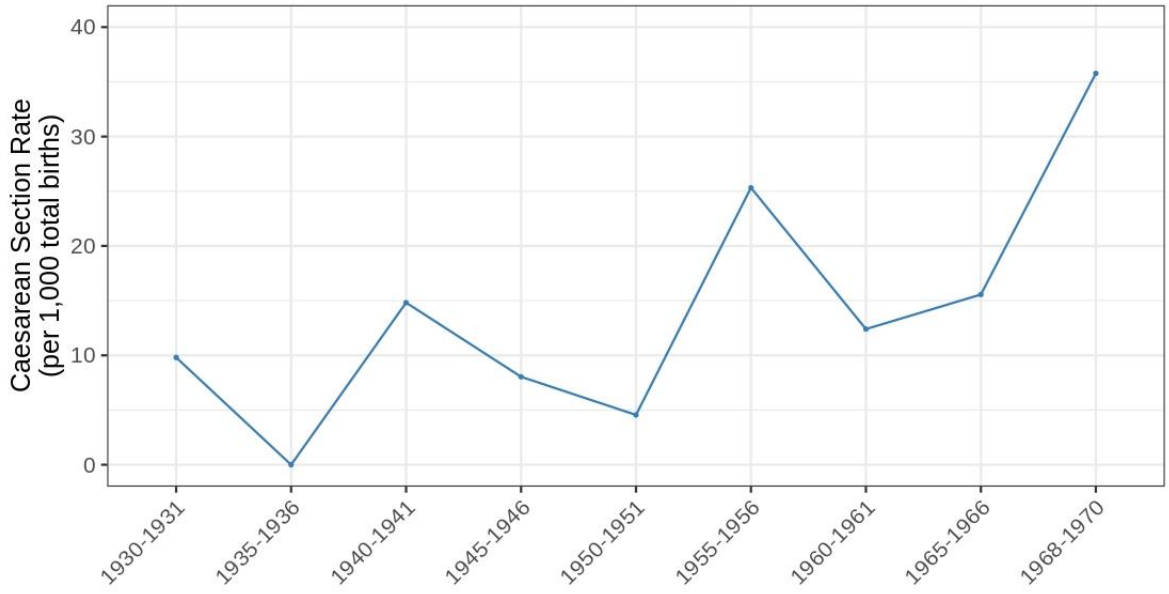
The data on forceps use at Lincoln Hospital reveals a strong institutional preference for this method, especially in the post-antibiotic period, when its pairing with new regional anaesthetics made it an attractive option for lower-capacity settings. While most forceps cases did not involve clear medical indications, this trend likely reflected broader clinical practices of the era, and the practical advantages forceps offered within the hospital's staffing and resource constraints. To better understand how Lincoln Hospital managed high-risk deliveries, the next section examines the use of caesarean sections—an intervention that gradually expanded during the same period but remained relatively limited in this setting.

4.5.2 Comparing Caesarean Section Rates Across Hospitals

Lincoln Hospital's caesarean section rates were lower than their forceps rates but do show a steady increase across the period. The introduction of antibiotics had spurned higher caesarean section rates. Rates were at 9.8 and 0 per 1,000 deliveries in 1930-31 and 1935-36,

respectively. Then, in the first period observed after the introduction of sulpha drugs, rates increased to 14.8 per 1,000 deliveries. TABLE 4.5 below shows that this spike in the caesarean section rate coincided with the hospital's lowest survival rate from the operation. This result affirmed findings by Løkke that the antibiotic revolution did not at once lead to improvements in surgical efficacy (Løkke, 2012, p. 218-220).

FIGURE 4.13: Caesarean Section Rates at Lincoln Hospital



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

TABLE 4.5: Caesarean Section in Lincoln Hospital		
Period	*Count of Caesarean Sections*	*Success Rate (%)*
1930-31	1	100
1935-36	0	NA
1940-41	6	66.7
1945-46	5	100
1950-51	4	100
1955-56	24	95.8
1960-61	14	78.6
1965-66	11	72.7
1968-70	24	95.8
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University		

Caesarean section rates declined after 1940-41 to 8.0 and 4.5 per 1,000 deliveries—survival rates during this period were 100 percent. Then, in 1955-56, rates increased to 25.3 per 1,000 deliveries and remained above their earlier level until closing at 35.8 per 1,000 deliveries. Survival rates from 1955-56 to 1968-70 sat in the range of 72.7 to 95.8.

Caesarean section rates remaining lower than forceps rates across the period is a distinct difference from what Løkke found to be the trend for the National Hospital Copenhagen across the 20th century. However, American obstetrical practices differed from European practices in many respects (Loudon, 1992 & Notzon et al. 1987 & Nyirjesy and Pierce, 1964). For the pre-antibiotic era, white and biracial Duke Endowment hospitals had caesarean section rates around 40 to 50 per 1,000 deliveries. Black hospitals had a higher rate of caesarean sections, reaching as high as 160 per 1,000 deliveries in 1925. The rate fell to around 80 per 1,000 deliveries in 1930 then to 32 per 1,000 deliveries in 1936. The Lincoln Hospital in the pre-antibiotic era was performing between 1/9 to 1/4 as many caesarean sections as its peer hospitals.

In the post-antibiotic era, comparison data on caesarean section rates is not comprehensive. A 1952 academic survey of 12 hospitals revealed wide variation, with rates ranging from 10 to 97 per 1,000 deliveries. Duke University Hospital, a biracial-serving hospital

in Durham, North Carolina, was included in the survey and reported a rate of 18 per 1,000 (Williams et al., 1952). According to a GAO report, the national average had risen to between 50 and 56 caesarean sections per 1,000 deliveries by 1970 (GAO, 1979). While regional variation persisted, it had narrowed considerably. By the 1970s, the difference between the highest and lowest regional rates was just 2.6 percentage points. The US South, where Lincoln Hospital was located, was near the national average—only 0.1 percentage point below.

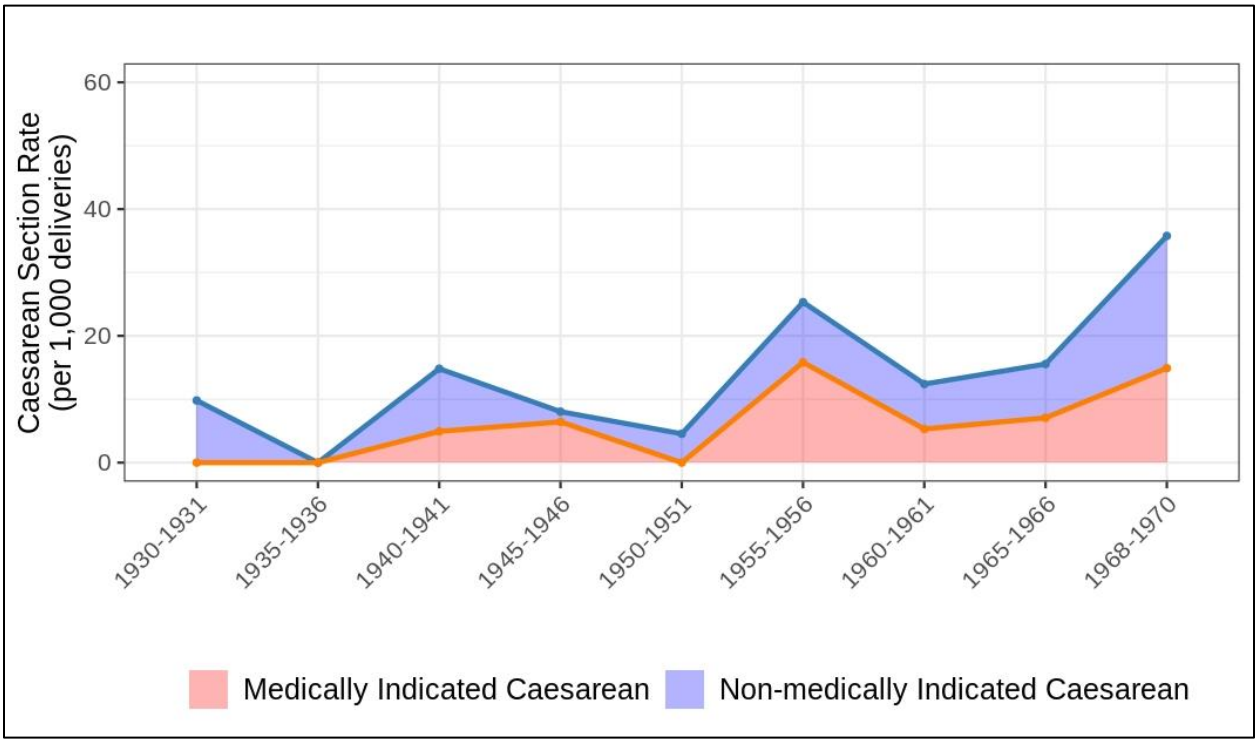
Lincoln Hospital's rates fall below any of these comparisons across the entire post-antibiotic era. Compared to Duke University Hospital in 1952, Lincoln Hospital performed 75 percent fewer caesarean sections in 1950-51. By the 1968-70 observed period, Lincoln Hospital performed between 30 and 37 percent fewer caesarean sections than the national average.

It is also important to contextualize Lincoln Hospital's caesarean section rates within a broader historical perspective. The national caesarean section rates of the 1970s in the United States are well below today's levels, which have surpassed 300 per 1,000 deliveries. The acceleration in caesarean section rates in the United States occurred over the 1980s and 1990s (Placek and Taffel, 1988). However, these rates have received scrutiny from public health officials for being excessive and having potential negative consequences for maternal and neonatal outcomes (Steer and Modi, 2009). Nevertheless, Lincoln Hospital's peak rate of 35.8 per 1,000 deliveries (in 1968–70) was not only below national averages at the time but also fell short of the World Health Organization's later consensus that caesarean section rates between 10 to 15 percent (i.e., 100 to 150 per 1,000 births) are optimal for improving maternal and newborn health without introducing unnecessary surgical risk (World Health Organization, 2015). This comparison further underscores Lincoln Hospital's constrained surgical capacity and the challenges it faced in managing complex obstetrical cases.

Were the relatively low rates of caesarean sections at Lincoln Hospital targeting high-risk births? I defined a medical indicated birth in a similar way to forceps deliveries with the addition of placenta previa, placental abruption, cord prolapse, and foetal-pelvic disproportion. These complications are strong indicators for caesarean sections. Along with breech presentation and previous caesarean sections, they formed the most common medical indicators for caesarean section (Singh et al. 2020).

FIGURE 4.14 plots out the caesarean section rate by medical indication. A far greater share of caesarean sections was medically indicated than the share of forceps births. The greatest share of indicated caesarean sections was in 1945-46 when 80 percent of caesarean sections had a medical indication. The lowest share was in 1940-41 at 33 percent. This low share corresponded with the worst infant survival rate from the operation. From 1955-56 to 1968-70, the share of medically indicated caesarean sections started at 63 percent before declining to between 41 and 45 percent for the end of the period. The rising share of non-medically indicated caesarean sections from 1960 to 1970 is in part driven by a rise in the number of repeated caesarean sections. Before 1960, only 5 percent of non-medically indicated caesarean sections noted previous caesarean sections as a reason. Between 1960 and 1970, 18 percent of non-medically caesarean sections used previous caesarean sections as a justification.

FIGURE 4.14: Caesarean Section Rates by Medical Indication



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

The analysis of caesarean section rates at Lincoln Hospital underscores a key institutional constraint: while the procedure became increasingly common nationally, its use remained limited in this setting, even in medically indicated scenarios. Compared to both peer and national trends,

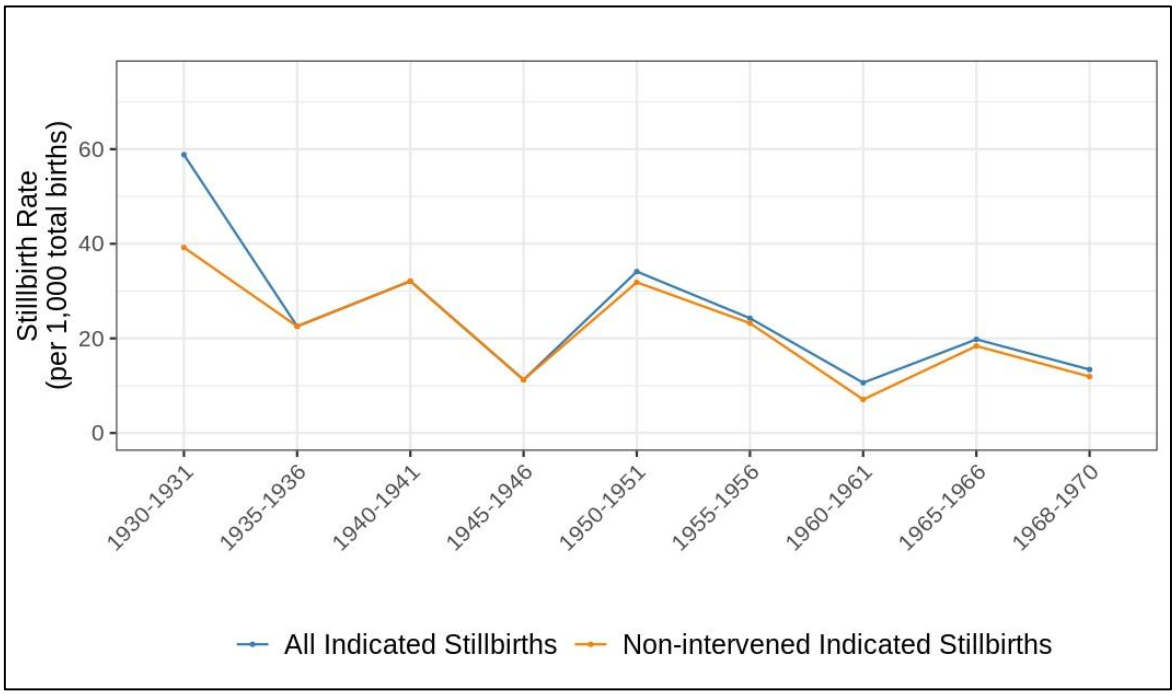
Lincoln Hospital lagged significantly, with most high-risk births receiving no surgical intervention. These findings raise critical questions about the consequences of limited surgical capacity and the structural forces that shaped clinical decision-making. The discussion section that follows explores these consequences in depth, evaluating how intervention patterns influenced stillbirth rates and what they reveal about racial disparities in access to life-saving obstetrical care.

4.6 Discussion

4.6.1 Would More Caesarean Sections Have Mattered?

The results so far have demonstrated that the Lincoln Hospital, while performing obstetrical interventions at a lower rate than peer hospitals, the hospital consistently favoured forceps use over caesarean sections. Based on the Løkke framework, caesarean sections should have risen in the post-antibiotic period and the stillbirth rate from medically indicated deliveries should have consequently fallen. FIGURE 4.15 shows the medically indicated stillbirth rate as well as the rate for medically indicated stillbirth that received no intervention. Remarkably, the observed period with the greatest share of indicated stillbirths receiving some form of intervention was in 1930-31. The persistent trend afterwards is that most indicated stillbirths went without receiving any form of obstetrical intervention.

FIGURE 4.15: Most Medically Indicated Stillbirths Did Not Receive Intervention



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

The most common identified complications in cases of stillbirth after 1950 were preeclampsia, problems of the placenta (placenta previa and placenta abruption), and breech presentation. TABLE 4.6 shows the share of stillbirths attributed to each of these complications. The most striking finding in the table is the large share breech stillbirths. This was a complication that was a clear indicator for caesarean sections and easily identifiable by any trained obstetrician.

TABLE 4.6: Share of Stillbirths by Complication					
Years	1950-1951	1955-1956	1960-1961	1965-1966	1968-1970
Preeclampsia	18.60	13.79	19.05	0.00	12.50
Problems of the Placenta	6.89	24.14	9.52	13.64	12.50
Breech	13.95	17.24	9.52	18.18	18.75
Other /Unknown Cause	48.84	51.72	52.38	68.18	56.25
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University					

A National Hospital Discharge Survey found that breech births made up 6.1 percent of caesarean sections in 1970 despite making up only 3 percent of all deliveries (Placek and Taffel, 1980). Meanwhile, in the 1968-1970 period, breech births made up 3.3 percent of all deliveries at Lincoln Hospital but only 4.1 percent of caesarean sections. The decision not to intervene in these births with a caesarean section had considerable consequences. From 1955 to 1970, only 4 percent of breech births received a caesarean section. None of these resulted in a stillbirth. All 14 breech stillbirths during this period did not receive caesarean sections.

4.6.2 Staff Capacity and Obstetrical Interventions

Unlike forceps use, a caesarean section is an intervention tailored to a high-capacity medical team. Caesarean sections typically had a lead physician, one to two physicians as assistants, and a physician handling anaesthesia listed in the delivery room records. Using this information, I analysed how changes in the physician(s) in attendance affected the choice of obstetrical procedures.

There were over 185 physicians attending deliveries across my sample. Since Lincoln Hospital was a training hospital, many of these physicians only covered a few births and then never appear again in the record. TABLE 4.7 shows the top six physicians by births attended. Together, these physicians attended 37 percent of all births. The two columns on the right of the table show that Physician B had the highest caesarean section rate and performed 55 percent of all caesarean sections.

TABLE 4.7: Physician-level Breakdown of Deliveries			
Physician Code (Tenure)	Total Deliveries Attended (Deliveries as Lead-Physician)	Caesarean Section Rate (per 1,000 births)	Percentage of All Caesarean Sections
A (1965 – 1970)	696 (23)	34.5	27.0
B (1940 – 1969)	506 (404)	96.8	55.1
C (1961 – 1970)	318 (299)	3.1	1.1
D (1960 – 1966)	188 (168)	5.3	1.1
E (1965 – 1970)	178 (172)	16.9	3.4
F (1955 - 1956)	151 (122)	72.8	12.4
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University			

Physician B's tenure at the hospital lasted from 1940 to 1969. If I limited the period to only the years during his tenure at the hospital, Physician B covered 58 percent of the caesarean sections that occurred. He was also the only hospital obstetrician that was also a member of the American College of Abdominal Surgery. Membership required passing a comprehensive exam that evaluated a surgeon's skill and judgment. Physician B's presence in the delivery ward meant an expert was on call.

Some of the other top physicians performed a notable share of caesarean sections. Physician A and F stand out in this respect. Physician F was only on staff for two years but took part in 11 caesarean deliveries. In all these cases, Physician B was involved as either the lead or an assistant physician. This suggests that Physician F was likely training under Physician B. Physician A, by contrast, overlapped with Physician B for four years but co-attended only one delivery. Moreover, Physician A was rarely listed as the lead physician, which suggests they may

have been a resident in obstetrics and gynaecology. Given these patterns, I focus on the impact of Physician B, who consistently held a senior clinical role, rather than on Physicians A and F.

To assess the impact of Physician B on the obstetrical care delivered in the delivery ward, I looked at the years of Physician B's tenure that were after the mass production of penicillin—1950 to 1969—and compared days when Physician B was attending births to days when there is no record of his attendance. On days where Physician B was attending births, the caesarean section rate was 53 per 1,000 total births. On days without Physician B the caesarean section rate was 8 per 1,000 total births.

TABLE 4.8: Days with and without Physician B Had Different Practices and Outcomes

	Caesarean Section Rate (per 1,000 births)	*Share High-risk Births that are Stillbirths (%)*	*Share of Breech Births that are Stillbirths (%)*
Physician B in Attendance	53	16.2	3.3
Physician B Not in Attendance	8	18.9	16.3

Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University
Note: "In attendance" was defined as appearance in the delivery log as lead, assistant, or anaesthetist.

The stillbirth rate on days with Physician B in attendance was higher than days without—39.8 versus 28.2 per 1,000 total births. However, the overall stillbirth rate says nothing about the risk of each delivery. High-risk births are more likely to fall on days with Physician B in attendance, since he could have been on-call given his senior status within the obstetrics ward. To correct for this bias, I refined the measure to the share of high-risk births that were stillbirths. On days with Physician B in attendance the share of high-risk births that were stillbirths was 16.2 percent versus 18.9 percent when Physician B was not in attendance. The share of high-risk births that received a caesarean section was seven times higher with Physician B in attendance (21 percent) than without (3 percent).

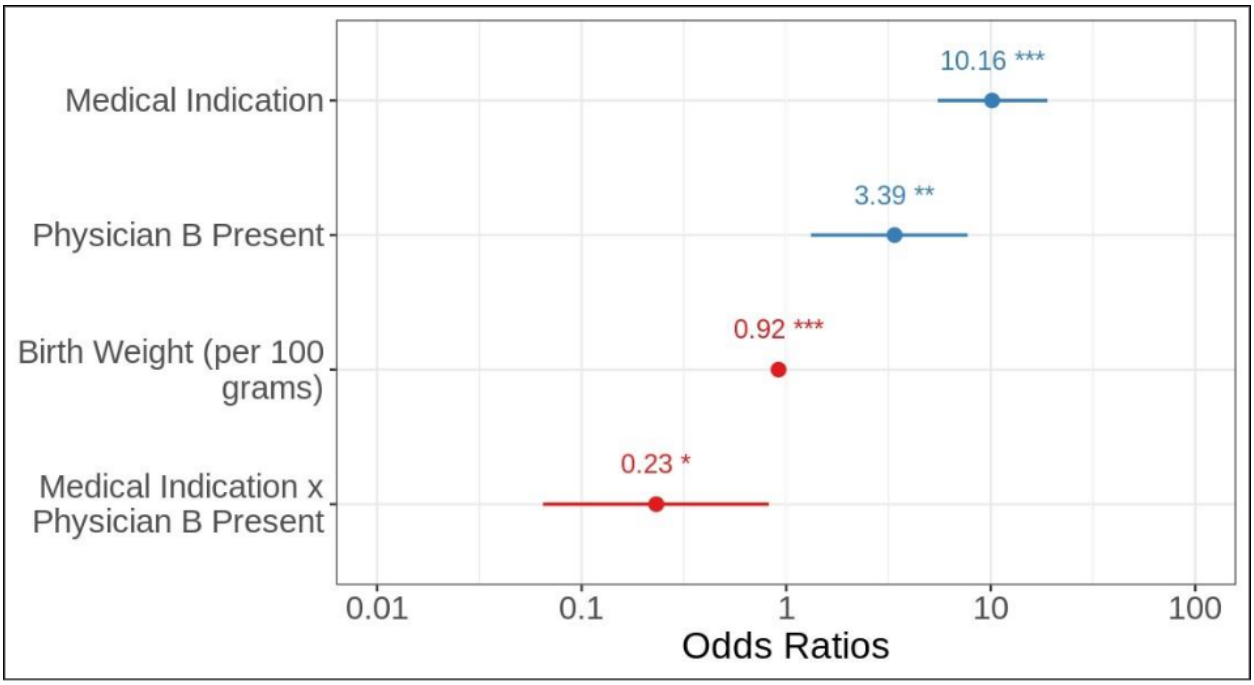
Even more striking is the change in the share of breech births that were stillbirths. On days with Physician B in attendance the breech births made up 3.3 percent of stillbirths. When Physician B was not in attendance breech births made up 16.3 percent of stillbirths. This change in share of stillbirths occurred even though the breech birth rate was similar between days with

and without Physician B in attendance (3.6 percent of births with Physician B versus 3.4 percent of births without Physician B). The share of breech births resulting in a caesarean section was 2.48 times higher when Physician B was in attendance.

To assess the impact of Physician B further, I estimated a logistic regression predicting stillbirths using medical indication, Physician B's attendance, and the interaction of those two variables. Birth weight was used as a control variable. FIGURE 4.16 plots the odds ratios based on the estimated coefficients from the logistic regression.

Medically indicated deliveries had significantly higher odds of stillbirth (OR ≈ 10), while higher birthweight reduced risk. A 500-gram increase in birthweight lowered the odds of stillbirth by 34 percent. Physician B's presence, in general, was associated with higher odds of stillbirth (OR ≈ 3.4), likely reflecting assignment to higher-risk cases. However, the interaction term shows that among medically indicated deliveries, his presence reduced the odds of stillbirth by approximately 77 percent.

FIGURE 4.16: Odds Ratios for Stillbirth by Clinical Risk and Physician Presence



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

Note: 'Physician B present' defined as lead, assistant, or anaesthetist. Medical indication took the same specification as stated earlier for caesarean sections.

This interaction effect supports the hypothesis that limited staff capacity shaped the hospital's ability to intervene effectively. Physician B's presence appears to have provided a critical buffer in high-risk deliveries, substantially lowering the excess risk associated with medical complications. These results provide empirical support for the broader argument that changes in staffing—particularly the availability of a skilled practitioner—had a material impact on maternal and foetal health outcomes.

The analysis of Physician B's impact underscores how individual expertise could significantly shape clinical outcomes. Caesarean sections were a necessary intervention to manage some high-risk deliveries, but performing such an intervention depended on the availability of a trained obstetrician. This dependence points to a deeper institutional constraint: the limited staff capacity at Lincoln Hospital. To understand why such capacity remained constrained, the following section explores the broader structural barriers—particularly segregation in medical training—that restricted the development of a robust specialist workforce.

4.7 Constraints on Staff Capacity

While there is evidence that the introduction of antibiotics caused a shift toward more obstetrical interventions over time at Lincoln Hospital, staff capacity played a critical role in shaping the evolution of obstetrical care at the Lincoln Hospital. Staff capacity underpinned the persistent preference for forceps use. Technologies and techniques tailored to lower capacity environments were readily adopted by the obstetricians at Lincoln Hospital. The rate of Caesarean sections, on the other hand, grew over time but was limited. Staff capacity capped the growth of caesarean section rates, creating bottlenecks in the ability of obstetrical interventions to decrease stillbirths in the case of medically indicated high-risk births.

Lincoln Hospital's reputation, by the post-antibiotic era, had recovered to being a preeminent Black hospital in the US South. So, why was staff capacity low at Lincoln Hospital? The medical training marketplace was still highly segregated. In the US South, 96 percent of residencies and fellowships remained closed to Black physicians prior to the Civil Rights Act (Cornely, 1956, p. 1079). Things were not much better in the US North, where 90 percent of residencies and fellowships remained closed to Black physicians. The bifurcation of medical education stunted the rate of diffusion of new techniques and knowledge, creating bottlenecks in staff capacity for even the more reputable southern Black Hospital.

Restricted training structures within the labour market led to an underdeveloped specialist workforce. Medical residencies and fellowships are the training channels through which American physicians enter specialties and sub-specialties. For example, a medical school graduate would attend a residency in obstetrics and gynaecology, then a fellowship in a specific surgical field of obstetrics and gynaecology.[7] The lack of specialist physicians was the downstream effect of a persistent gap in medical training between Black and white physicians in training programs. A 1967 study of the Black physician workforce found that only 9 percent of Black physicians were in training programs compared to 16 percent of all physicians (Haynes, 1969). Black obstetricians made up only 2 percent of all obstetricians in 1967, despite the Black population being around 11 percent of the overall population. Haynes (1969) also found that

[7] The American Board of Obstetricians and Gynaecology was founded in 1930. The training accreditation process has grown more complex over time, but the general role of medical boards is to regulate a specialty field of medicine through training and examinations

fewer Black obstetricians were board certified than obstetricians in the overall population—36 percent of Black obstetricians versus 46 percent of all obstetricians.

Segregated healthcare delivery placed more constraints on Black physicians. Since demand was constrained to Black populations, competition for patients caused Black specialists 'to restrict or abandon work in their specialty area for general practice' (Gray, 1977, p. 524). Nowhere was this truer than in the US South where *de jure* segregation ruled until 1964 and pervaded in more subtle ways afterwards. Racial discrimination limited the ability of Lincoln Hospital's staff to increase its capacity through two channels—the labour market and demand for services. Limiting the capacity of the obstetricians meant that high-skill obstetrical practices were not used at rates equal to national averages.

4.8 Conclusion

The results from Lincoln Hospital show that differences in the quality of care offered to Black patients were not just a matter of resources or institutional reputation but reflected real differences in clinical capacity. The presence or absence of one physician on the ward had material consequences on the ward's stillbirth outcomes. Most obstetricians at Lincoln Hospital relied heavily on lower-skill interventions, using forceps and avoiding caesarean sections even in cases where surgical intervention was medically indicated. These patterns were not due to a lack of will or awareness, but rather to structural barriers in training and staffing.

These findings add nuance to our understanding of the impact of antibiotics on obstetrical practices. The diffusion of antibiotics alone did not guarantee improved foetal outcomes through more aggressive interventions. Where access to higher-trained physicians was limited, the potential gains from medical innovation were not fully realized. Through applying the Løkke framework to a new social context, I show that the framework holds valuable insights but must be amended to account for unequal access to surgical capacity.

This chapter also highlights how structural racism within medical education and labour markets contributed to enduring racial disparities in birth outcomes. Even as the technologies of care advanced, discriminatory barriers continued to shape who received life-saving interventions. This conclusion underscores the need to address not only material inequalities but also the

institutional legacies of educational segregation that limited clinical capacity and perpetuated racial health inequities. In doing so, this study offers new insight into why the Black-white stillbirth gap persisted through a period of rapid medical progress.

Chapter 5: Conclusion

This thesis examined how racial disparities in maternal and infant health were produced, sustained, and, occasionally, mitigated in the Jim Crow South. Exploring the maternal and infant health outcomes in three settings—Florida's Midwife Program, the Hill-Burton Act, and Lincoln Hospital in North Carolina—this thesis has argued that the persistent inequalities in outcomes were the result of patterned failures in how public health reforms and biomedical innovations interacted with a racially segregated society. Though maternal mortality, infant mortality, and stillbirth rates declined in absolute terms from 1930 to 1960, in relative terms disparities between racial groups did not decrease. Black mothers and infants in the South experienced slower, stalled, or even reversed gains compared to their white counterparts. At their core, these disparities reflected structural issues. Racial discriminations shaped policy, access, capacity, and outcomes in each of the three settings examined in the three previous chapters.

Each chapter of this thesis illuminated a different mechanism through which institutional structures mediated the uneven distribution of childbirth-related improvements. Chapter 2 showed how Florida's Midwife Program successfully transmitted hygienic knowledge and reduced maternal deaths from puerperal sepsis but ultimately failed to integrate midwifery services into the medical system in a way that would prevent racial disparities from escalating. The bridging ties between midwives and physicians eroded as hospitals expanded and physicians as well as healthcare coverage plans undermined midwifery services. The exclusion of Black midwives from accessing biomedical innovations like antibiotics and providing more effective continuity of care led to diverging outcomes between births attended by midwives outside the hospital and those attended by physicians at a hospital.

Chapter 3 examined the Hill-Burton Act's impact on hospital access and early-life health outcomes. While the Act led to an increase in hospital births and declines in stillbirth rates for Black mothers in counties receiving a new hospital, it did not reduce racial gaps in infant mortality within those counties. Instead, infant mortality for Black infants stagnated or worsened in southern counties, while white infant mortality continued to decline. This divergence reflected the Act's limitations. It expanded physical infrastructure without addressing the broader social

determinants of health or the entrenched segregation that shaped the quality of care received. Moreover, the chapter highlighted the fact that outcomes relating to childbirth were improving during this period, but major health inequalities remained in the post-neonatal period.

Chapter 4 moved inside the clinical space to analyse delivery room records from Lincoln Hospital. The obstetrical care evolved over time, and intervention rates grew. However, intervention rates remained lower than most other hospitals, and the favoured interventions required less technical skill. These rates were the result of bottlenecks in surgical capacity. Caesarean sections were rarely performed unless a specific physician was present, leaving many breech births to result in stillbirth. This case study revealed that medical technologies like antibiotics and surgical techniques could only reduce disparities when supported by trained labour.

Together, these chapters support the overarching argument of the thesis: that the persistence of racial disparities in maternal and infant health was a function of how policies and innovations were filtered through racially stratified institutions. Medical progress did occur, but it was neither linear nor neutral. Instead, it was conditioned by unequal systems of access, authority, and accountability.

5.1 Contributions

This thesis has made three principal contributions to the interdisciplinary literature on racial health disparities.

First, it introduced social capital theory as an analytical lens to evaluate historical public health interventions. The framework of bonding, bridging, and linking ties used to assess Florida's Midwife Program highlighted the importance of relationships not just policies in determining the reach and durability of reform. Rather than treating public health success as a matter of policy design alone, the chapter showed how institutional connections, interpersonal trust, norm enforcement, and inter-occupational cooperation shaped outcomes.

Second, the thesis provided an empirical evaluation of the Hill-Burton Act using a difference-in-difference approach on county-level data from six southern states. Chapter 3 offered one of the first race-disaggregated assessments of the Act's impact. It found that while

the Hill-Burton Act closed gaps in hospital access, it failed to close gaps in health outcomes, particularly in post-neonatal infant mortality. This evidence challenges more optimistic readings of the Act as a tool for equity and highlights the importance of pairing infrastructure with structural integration and follow-up care.

Third, the thesis extended Løkke's framework on obstetrical transition by situating it within a racially segregated labour market. Using 40 years of delivery room records from Lincoln Hospital, Chapter 4 demonstrated that advances in obstetrical techniques like caesarean section only improved outcomes when staff capacity was sufficient. This finding reframed technological change not as a standalone driver of improvement, but as one dependent on equitable human capital investment. This was the first study to apply Løkke's framework to a US context and used original, case-level clinical data from a southern Black hospital.

5.2 Limitations

While the thesis drew on a rich array of archival sources, health statistics, and institutional data, it also faces several limitations. First, despite the use of newly digitized data from Lincoln Hospital and midwife record cards, some relevant sources—particularly personal narratives from mothers and midwives—remain underrepresented. Oral histories and ethnographic perspectives would enrich the institutional and statistical findings with more direct accounts of lived experience. Moreover, the Lincoln Hospital delivery records are limited to the events of childbirth. This does not allow me to have a clear picture of the prenatal care received by the mothers or the post-partum outcomes of the infants.

Second, the causal interpretations in Chapters 2 and 3, though carefully framed and methodologically robust, remain partly constrained by data quality and availability. For instance, race-disaggregated health outcome data at the county level is patchy, and the completeness of hospital records varies over time. While these gaps were mitigated through triangulation with state reports and archival documents, they do limit precision in some areas.

Third, the study is regionally specific to the US South. Although this choice is deliberate given the region's centrality to Jim Crow and Black childbirth, it necessarily narrows the applicability of the findings to other parts of the United States or to contemporary settings.

Future research could compare these dynamics with outcomes in northern or urban hospitals to better understand regional variation in policy implementation and professional practices.

5.3 Future Directions

Several avenues for future research emerge from this thesis. One priority is to build on the Lincoln Hospital case by expanding the dataset to include other Black hospitals across the South. Comparative case studies could illuminate whether the patterns found in Durham were unique or part of a broader regional trend. They could also assess how differences in staffing models, funding structures, and institutional affiliations shaped the use of obstetrical interventions.

A second direction lies in exploring the long-run effects of midwifery exclusion. Chapter 2 shows that midwives were marginalized from hospital-based care, but the consequences of this exclusion—particularly for rural maternal health—are only beginning to be understood. Follow-up studies could examine whether areas with more active midwife networks experienced different health trajectories in the 1960s and beyond, when hospital births became the norm. Also, a study of what childbirth experiences were like from Black migrants from rural, midwifery-dense areas when they migrated out of the US South during the Great Migration and if exposure to midwifery reforms impacted the birth attendant choice of migrants would be informative for understanding the broader impact of southern midwifery reforms on American healthcare.

Third, while this thesis focused on outcomes during childbirth and infancy, there is a need to trace how disparities in early-life health evolved into disparities in adulthood. Life-course approaches could reveal whether communities with higher intrapartum stillbirths or maternal mortality rates in the 1940s and 1950s also experienced worse adult health or educational outcomes decades later.

Finally, future work could apply the relational and institutional frameworks developed here to other areas of health reform beyond childbirth. For example, how did structural exclusion shape access to mental health services, vaccinations, or chronic disease management in the Jim Crow South? Were similar patterns evident in War on Poverty programs?

5.4 Closing Reflections

This thesis set out to understand how medical care, public policy, and institutional design interacted to shape one of the most consequential domains of public health: childbirth. Its findings show that while improvements in technology and infrastructure did save lives, they did so unevenly. Where relational trust, staff capacity, and equitable access were absent, disparities persisted or deepened. In this way, childbirth did not merely reflect the inequalities of the Jim Crow South it reproduced them.

By recentring childbirth as both a clinical event and a social process, this thesis invites new attention to the everyday mechanisms through which inequality is maintained or challenged. For scholars, it offers a methodological template for combining social theory with historical and institutional data. For policymakers, it underscores a simple but powerful lesson: health equity is not achieved through reform alone, but through reform that is attentive to the structures and relationships that enable it to matter.

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Appendix

2.A.1 Midwife Record Cards

The Midwife Records Cards are a part of the Midwife Program's archival record held at the State Archives in Tallahassee, Florida. The record cards were a means for the program staff to document demographic details and track the performance of the state's licensed midwife population. Each record card contains information related to one midwife. The cards track performance within the program for between one to six years. After the card is filled out a new card picks up where the old car left off. Once I set each record card next to its chronological pair, the record cards form a decent longitudinal record of each midwives' experience within the Midwife Program. By matching names, location, and year first licensed, I compiled a dataset of 577 midwives.

The midwives in the dataset became licensed midwives at some point between the years 1932 and 1965. The geographic coverage of the record cards is not complete. The records cover 37 of Florida's 67 counties. I ran t-tests for each of the following sample variables and found no variable had a mean significantly different than the overall population. Below is a table comparing the means for various variables from the counties present in the record cards to those not present.

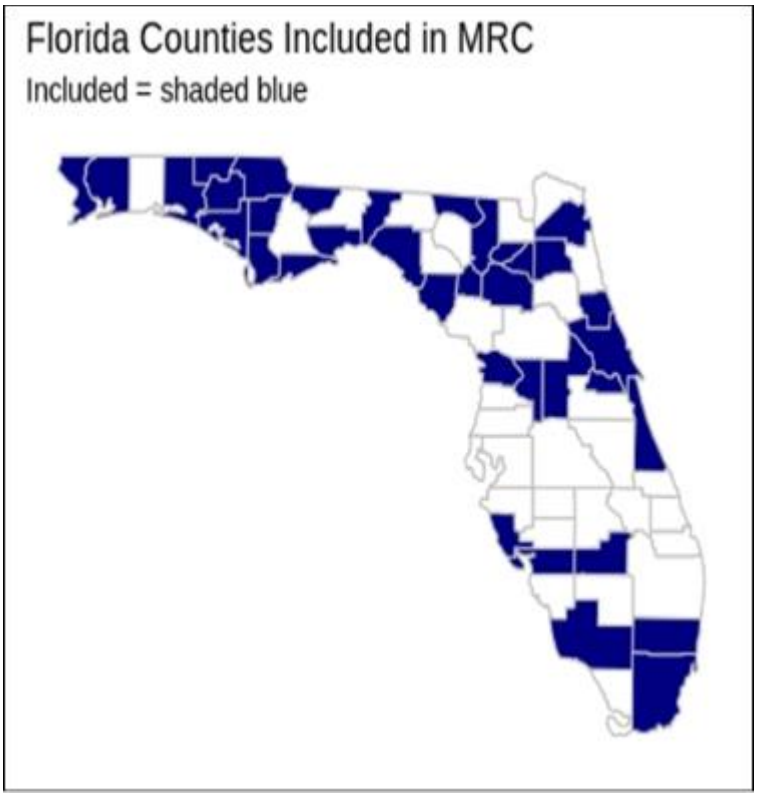
TABLE 2.A.1: In- and Out-Sample Summary Statistics

Variable	IN SAMPLE (Black population mean)	OUT OF SAMPLE (Black population mean)
Population	23,000 (7050)	25,600 (6900)
Births	411 (136)	427 (124)
Maternal Mortality Rate (per 10,000 births)	7.7 (7.9)	10 (11.2)
Infant Mortality Rate (per 10,000 births)	68.9 (92)	61 (84.1)
Midwives per 100 births	8.9 (25.4)	6.7 (17.9)

Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904 and Ruggles et al. (2025) 1930 and 1940 Full-Count US Census. IPUMS.

Below is a map of Florida with the in-sample counties shaded (blue) and the out-sample unshaded. The positive take away from the map is that there is strong spatial diversity in the extant record cards. A negative would be that the sample does not include Hillsborough and Leon counties. These two counties were active in the program and contained two out of Florida's seven large metro areas: Tampa (Hillsborough) and Tallahassee (Leon). That said, from a statistical point of view, their absence is not a threat to representativeness.

FIGURE 1.A.1: Map of Counties Included in Midwife Record Card Sample



Source: Florida State Board of Health, Midwife Record Cards, Midwife program files, 000894. S 904

From the record cards, I transcribed eighteen variables. The record cards contained biographical data, like the midwife's name, address (town and county of residence), race, year of birth, marital status, years of practice, literacy, and highest grade of schooling. If the individual attended a midwife/nursing school, it is stated here–though as shown in the analysis this was uncommon.

The first page also lists who the midwife was taught midwifery by, which class of licence the midwife received from the state, and the midwife's licence start date and licence end date.

For the taught by variable, the record card listed physicians, midwife, school, or self as categories. Licences were of three classes: Class A midwives held a graduate degree from an accredited midwifery school, class B midwives had completed a formal training course at a hospital or with a physician, and class C midwives had no formal training but had extensive, unsupervised experience. Pairing the licence's start and end date with the year of birth and years of practice, I calculated the age at start of licensing, length of licensing, and years of practice prior to licensing variables for each midwife.

Other information on the record cards pertained to the midwife's activity within the Midwife Program. These variables included the midwife's attendance at Midwife Institutes (up to 1936) and the names of the physicians recommending the midwife for licensure. The program tried to enforce a rule at the start of the program that each midwife needed to have two physicians recommending them for a licence. The program's staff was always lenient on this policy though and had reduced it to a single recommendation from the head of the county health department by the late 1950s. Therefore, I coded this variable as binary, taking the value of 1 if a midwife had at least one recommending physician listed.

The cards also noted the average births attended per year and if the midwife was in attendance during any type of death event (mother, stillborn, and infant). I transcribed the average births attended per year data, but they are inconsistently reported throughout the records. Only 111 midwives have data for average births per year. I need to analyse the records where the data are reported closer to see how much weight can be attributed to findings related to that variable.

3.A.1 Example of Hill-Burton Act's Funding Formula

The allocation formula for Hill-Burton funds tried to weigh a state's income per capita in a way that ensured poorer states received a larger share of available funds. Below is a hypothetical example looking at three states, one rich state, one average state, and a poor state. As shown, the act's formula allocated the most money to the poorest state and the least money to the richest state.

TABLE 3.A.1: Hypothetical Example of Hill-Burton Funds to States

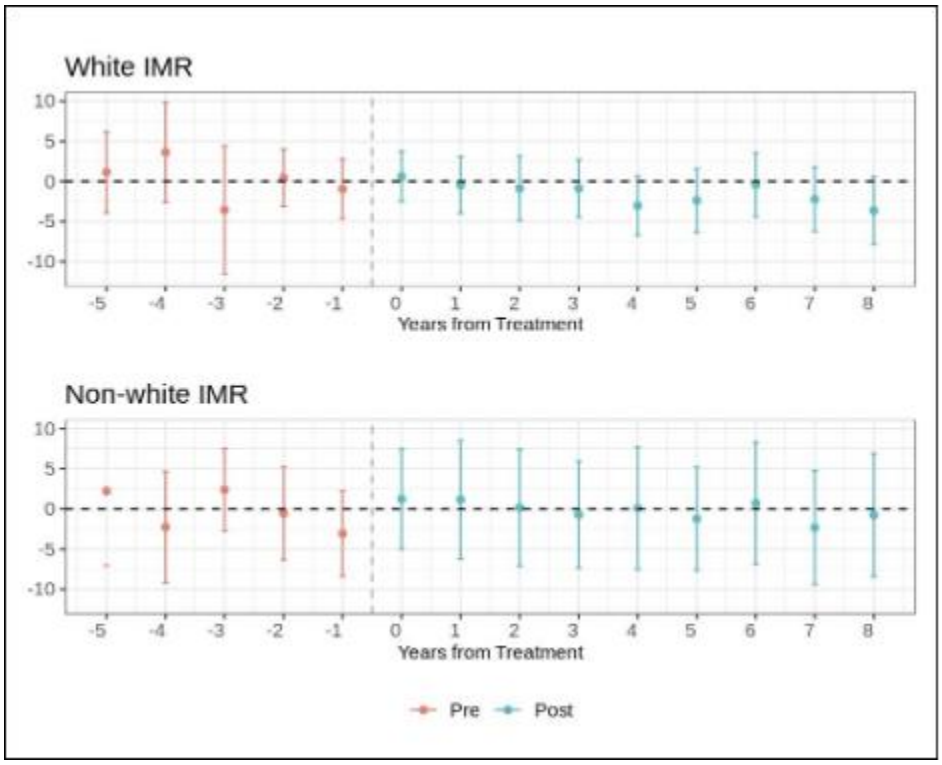
State	*Per Capita Income*	*Index of Per Capita Income*	*Half of Index of PC Income*	*Allotment (%)*	*Allotment (%) squared*
Richest	$2,000	1.33	0.667	0.333	0.1109
Average	$1,500	1.00	0.500	0.500	0.2500
Poorest	$750	0.50	0.250	0.750	0.5625

Source: Replicated from Brinker and Walker 1962. Adapted from: US Congress, House Committee on Interstate and Foreign Commerce, Hearings on H.R. 7341, 83d Cong., 2d Sess., February 4 and 5, 1954, 88.

3.A.2 Event Study Plots for IMR and SBR for 'New' and 'Upgrade' Treatments

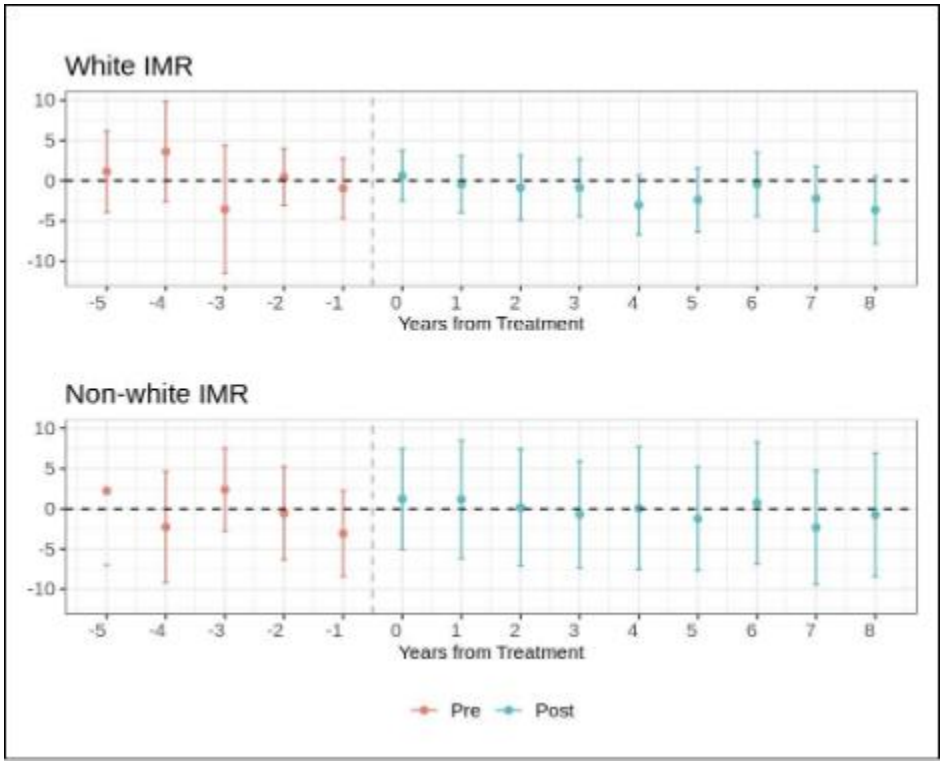
FIGURES 3.A.1 to 3.A.4 plot out the event studies for white and non-white infant mortality and stillbirth rates under the treatment types 'New Hospital' and 'Upgraded Hospital'. No plot shows any signs that pre-treatment trends between treated and untreated counties differ in a concerning way.

FIGURE 3.A.1: Event Study for White and Non-white Infant Mortality Rates (IMR) with Treatment Type as 'New Hospital'



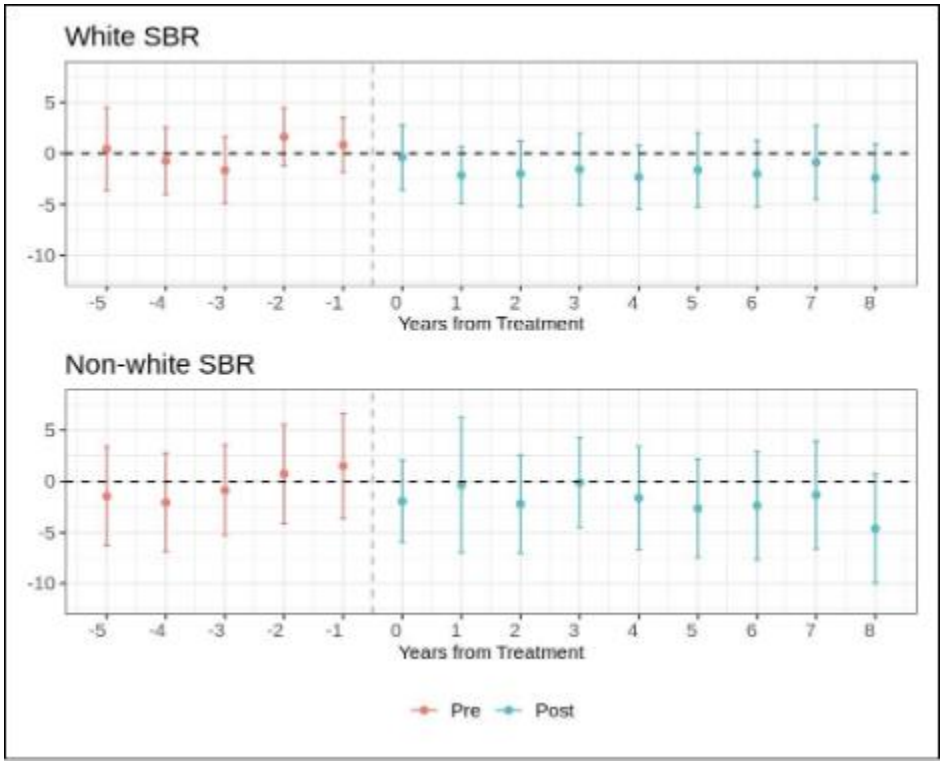
Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level SBR transcribed from US Vital Statistics 1940-1959

FIGURE 3.A.2: Event Study for White and Non-white Infant Mortality Rates (IMR) with Treatment Type as 'Upgrade Hospital'



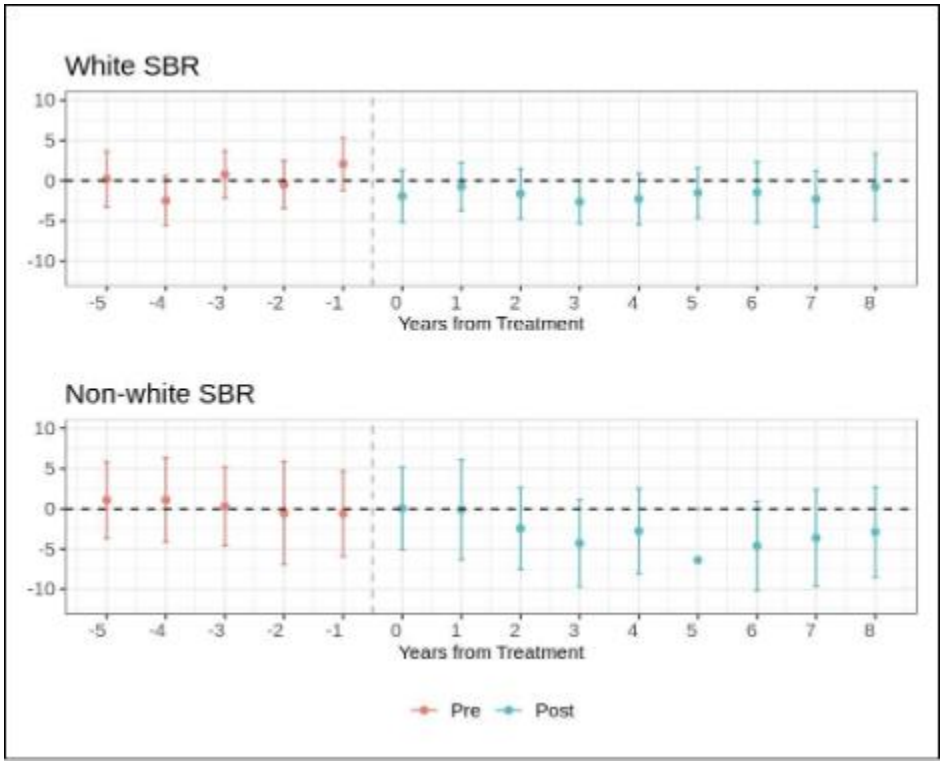
Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level SBR transcribed from US Vital Statistics 1940-1959

FIGURE 3.A.3: Event Study for White and Non-white Stillbirth Rates (SBR) with Treatment Type as 'New Hospital'



Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level SBR transcribed from US Vital Statistics 1940-1959

FIGURE 3.A.4: Event Study for White and Non-white Stillbirth Rates (SBR) with Treatment Type as 'Upgraded Hospital'



Source: Hill-Burton Project Register. (1947-1971). US Department of Health, Education, and Welfare, US Public Health Service and county-level SBR transcribed from US Vital Statistics 1940-1959

4.A.1 Notes on Stillbirths and Pregnancy Complications

The definition of a stillbirth is a death of a foetus after 20 weeks from the last menstrual period. The spontaneous loss of a foetus prior to the stillbirth threshold is considered a miscarriage.

Definitions for stillbirths have changed through time and across space based on the knowledge and technology available to assess maternal-foetal health as well as the cultural consensus on defining edge cases. For example, the modern Internation Classification of Diseases 10 uses a dual system of classification for stillbirths that looks at both birthweight and gestational age. Under this system, stillbirths are split into early and late foetal deaths. An early foetal death covers foetuses weighing between 500 and 1,000 grams or ones occurring between 22 and 28 weeks. Late foetal deaths cover foetuses weighing over 1,000 grams and after 28 weeks. This dual threshold criteria complicates health accounting since the birthweight and

gestational age thresholds do not give equivalent results. One study of stillbirths in the US found that using the birthweight threshold reduced the stillbirth rate by 40 per cent compared to the gestational age threshold (Lawn, Blencowe, Waiswa, et al. (2016)). Additionally, tracking birthweight requires an equipped healthcare system that can reliably weigh the foetus when foetal deaths occur. Gestational age, on the other hand, requires a minimal level of healthcare capacity and is not time sensitive. For these reasons, most historical sources use gestational age as a threshold metric for stillbirths.

The prevalence of stillbirths is due to the mother's state during pregnancy, her environment, and the quality of care she receives. As such, major risk factors for stillbirths include maternal infections—such as syphilis, malaria, and tuberculosis—non-communicable diseases, nutrition, and maternal age older than 35 years. Prolonged pregnancy, one that has extended beyond 42 weeks or 294 days from the first day of the last menstrual period also contribute to stillbirths.

The most common causal pathway for a stillbirth involves impaired placenta function (NICHD. (2011). Placental, pregnancy conditions account for most stillbirths. US Department of Health and Human Services, National Institutes of Health.). The placenta provides oxygen and nutrients to the developing baby via the umbilical cord. Impairment of this critical organ can lead to foetal growth restriction and/or pre-term labour. Complications related to the umbilical cord represent another common stillbirth aetiology. TABLE 4.A.1 lists the major causes of stillbirths.

TABLE 4.A.1: Major Causes of stillbirths

Cause	*Classification*	*Comments*
Placenta Previa	Intrapartum	Placenta implants low in the uterus, either partially or fully covering the cervix. May require an emergency delivery
Placenta Abruption	Intrapartum	Placenta separates from the womb. Requires emergency delivery
Umbilical Cord Prolapse	Intrapartum	The umbilical cord precedes the baby out of the cervix
Breech Presentation	Intrapartum	When a baby is born bottom-first or feet-first instead of head-first.

Umbilical Cord Entanglement	Antepartum/Intrapartum	Many entanglements cause a loss of blood flow to the foetus. A nuchal cord, or an entanglement around the neck of the foetus, can cause asphyxia
Preeclampsia/eclampsia	Antepartum (Late or term)	High blood pressure reduces blood supply to the foetus. Preeclampsia develops into eclampsia if the mother has a seizure. Exact causes are still unknown. May require an emergency delivery
Infections	Antepartum	Some examples include syphilis, gonorrhoea, and malaria
Source: Impey, L. and Child, T. (2012) Obstetrics & gynaecology. 4th ed. Chichester: Wiley-Blackwell.		

Stillbirths may be antepartum or intrapartum. Here, the definitions are straightforward: antepartum implies foetal death before the onset of labour, whilst intrapartum implies that death occurs during the process of labour.

Antepartum stillbirths may be caused by an array of factors from infections or toxic substances that cross or damage the placenta to random movements of foetus causing too many entanglements in the umbilical cord. The causes of intrapartum stillbirths include issues with the location of the placenta within the womb (such as placenta previa or placenta abruption), issues with the umbilical (such as prolapsed umbilical cord or entanglement including foetal asphyxia), and congenital malformations. Advancements in foetal monitoring and obstetrical surgeries across the mid-20th century caused enormous declines in the rates of the former two causes.

Hospital infrastructure and clinical care affect stillbirth rates by treating dangerous infections in the maternal body before or during pregnancy. During the period studied in this paper, the most prevalent curable infection that may have caused antepartum stillbirths is congenital syphilis. Penicillin, first mass produced in the 1940s, is the first line of treatment reached for against syphilis infections and would have been available at general hospitals from the start of my study's period.

Another way that clinical care affected stillbirths was through the improved efficacy of obstetrical surgery. Emergency caesarean sections became more effective—by this I mean that they resulted in the survival of the mother and infant—after the introduction of antibiotics. By decreasing the likelihood of bacterial infection, antibiotics freed up obstetricians to undertake more invasive procedures to save the life of the mother and infant.

Bob Woods, in his book *Death before Birth*, which examines the history of stillbirth rates across Europe, noted that prior to the early-20th century trends for stillbirth rates did not follow in tandem the gradual decline that infant mortality rates had. In fact, it is hard to describe much of a clear trend with stillbirth rates up to the early-20th century. What changes to stillbirth rates that occurred were largely the result of augmentations to maternal and environmental factors such as nutrition, infection, and birth rates. Midwifery and obstetrical advancements may have had some affect but nothing like what appears in the post-1930s era.

In the years post-1930, stillbirths declined rapidly, and across different national settings from the Scandinavian nations to the US. (Woods, 2009, Chapter 4). Using turn-of-the-century sources, Woods documented that the most prevalent cause of stillbirths was 'complications of labour' (Woods, page 162). Furthermore, the rapid decline in stillbirth rates coincided with the introduction of technological advancements focused on improving likelihood of mother and foetal/infant survival during labour. Some of these advancements included "ante- and postnatal care, blood transfusion, the incubator, ultrasound, foetal surgery techniques, and antibiotics" (Woods, page 152). Building on this observation, Anne Løkke proposed a mechanism that expounds on the vital role antibiotics played in the rapid decline of stillbirths. Antibiotics, beginning with sulpha drugs and later penicillin, transformed the efficacy of obstetrical care by decreasing the risk of infection to the mother and baby during highly invasive surgeries. Obstetrical interventions in emergent or risky pregnancies were more likely to result in a live birth than they ever had been previously (Løkke, 2012). Løkke's mechanism explains how such a rapid decline in stillbirths occurred within an environment in which social and maternal factors were not changing dramatically.

4.A.2 Are ‘moderate-to-late preterm’ births more likely to survive?

TABLE 4.A.2 shows the survival rate for each of the preterm birth types by computing the ratio of preterm births of a severity that were not stillbirths or neonatal infant deaths to the total number of preterm births of the same severity.

TABLE 4.A.2: Preterm Survival Rates (%)

Year	*Preterm Overall*	*Moderate-to-late Preterm*	*Very Preterm*	*Extreme Preterm*
1930-31	55.6	33.3	100	0
1935-36	80.0	40.0	92.9	81.8
1940-41	81.3	None	81.3	None
1945-46	83.3	100	76.5	100
1950-51	78.4	91.9	87.5	47.6
1955-56	56.5	81.8	36.8	22.7
1960-61	72.3	86.0	68.2	18.2
1965-66	70.3	91.1	33.3	18.8
1968-70	80.3	89.6	75.0	33.3

Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

The chance of survival is at its worst for the extreme preterm births (20 to 28 weeks). Miscarriages, which were dropped from my sample, describe foetal loss before 20 weeks. Twenty-four weeks was the viability threshold from 1930 to 1970. Thus, infants that survived extreme preterm births would have been born between 24 and 28 weeks. The data confirmed the grave danger most of these births were in. Survival rates for extreme preterm births were between 18.2 and 47.6 percent from 1950 to 1970. The highest survival rates occurred in 1935-36 and 1945-46. The survival rates are remarkable, but there is reason to doubt the veracity of gestation age calculations at this historical point. First, many births received little to no prenatal care. Second, gestation age calculations were not formalized until 1967.

Between ‘very’ and ‘moderate-to-late' preterm births, very preterm births have a lower survival rate for all periods except the earliest two periods—these early results might be the result of a lack of observations during that period or of faulty gestation age calculations. FIGURE 4.A.2 plots the survival rates for ‘very’ and ‘moderate-to-late' preterm births from 1950 onwards. ‘Moderate-to-late' preterm births have a survival advantage over ‘very’ preterm births.

The shift of preterm births from ‘very’ preterm to ‘moderate-to-late' preterm underlies the improved birth outcomes across the period. The bulk of this change occurred after 1950—after the largest decline in the stillbirth rate. Therefore, healthier preterm births played a small role in the declines to the stillbirth rate that occurred after 1950.

FIGURE 4.A.2: Moderate-to-late Preterm Births Have a Better Chance of Survival Than Very Preterm Births

Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

In tension with this idea is evidence that preterm births were rising during the period after 1950. This supports the view that greater foetal monitoring and stronger confidence in obstetrical interventions to prevent deteriorating pregnancies drove up preterm births. FIGURE 4.A.1 offers some support for this view since the chances of survival for moderate-to-late preterm births decreased from 1945-46 to 1968-70. Most of these foetal or infant deaths were likely to have been the result of medical efforts to save infants' lives, which in earlier decades would have been stillborn at term.

4.A.3 Medically Indicated births

I defined medical indications for an obstetrical intervention as any birth with at least one of the following characteristics: prematurity before 32 weeks, preeclampsia, gestational diabetes, placenta previa, placental abruption, premature rupture of the membrane, prolonged labour, cord prolapse, foetal-pelvic disproportion, intrauterine growth restriction, puerperal infection and breech or other complex presentations. The medical indication calculations should be treated as conservative guesses. I am only going from the data report, which lacks a full maternal health history. Additionally, I do not have reporting on the time length of labour, so only cases reported as 'prolonged labour' were treated as prolonged.

There were 592 medically indicated births across the entire sample. That is equivalent to 10.3 percent of births. The share of medically indicated births in a year period ranged from 5.3 to 14.7 percent. The greatest volatility in the share of medically indicated births was from 1930 to 1946. From 1950 onwards, the range is between 9.4 and 13.0 percent. Of the medically indicated births, 13.9 percent received an obstetrical intervention. Overall, these were split evenly between forceps (6.8 percent) and caesarean sections (7.1 percent). Once the births are disaggregated by year, caesarean sections as an intervention for medically indicated births became common only after the introduction of antibiotics (See TABLE 4.A.3).

Lincoln Hospital's obstetricians often performed forceps deliveries on births that were not medically indicated as risky. Over the entire sample. Only 9.1 percent of forceps deliveries were on medically indicated births. On the other hand, caesarean sections were medically indicated in 47 percent of deliveries. The share of medically indicated forceps deliveries fell from 18.2 percent in the pre-antibiotic period to 6.3 percent in the post-antibiotic period. However, the share rose to 9.5 in the post-Hill-Burton period. The share of medically indicated caesarean sections was 0 in the pre-antibiotic period, then rose to 40 and 49.3 in the post-antibiotic and post-Hill-Burton period.

TABLE 4.A.3: Medically Indicated Births (MIB) and Obstetrical Intervention Shares by Medical Era

Medical Era	Share of MIBs Receiving an Intervention	Share of Forceps Deliveries on MIBs	Share of Caesarean Deliveries on MIBs
Pre-Antibiotic	7.7	18.2	0

Post-Antibiotic	7.9	6.3	40.0
Post-Hill-Burton	17.3	9.5	49.3
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University			

4.A.4 Induction Rates at Lincoln Hospital

Induction rates were non-existent up to 1950 and remained low until 1965-66 (see TABLE 4.A.4). Forty to forty-seven percent of births were medically induced in 1965-66 and 1968-70, respectively. The rise in induction from 1950 onwards is undoubtedly due to key discoveries in the production and use of synthetic oxytocin that occurred in the 1950s. In 1953, the French biochemist Vincent du Vigneaud produced the first synthetic oxytocin. Afterwards researchers found more synthetic routes, making synthetic oxytocin abundant and cheap to acquire by the 1960s.

Forceps deliveries made up between 11.1 and 14.6 percent of induced deliveries. Most induced deliveries did not result in forceps interventions. However, this did not mean that induction limited the medicalization of deliveries. Half of induced deliveries received episiotomies.

TABLE 4.A.4: Induction Rates

Years	*Induction Rate (per 1,000 births)*	*Share of Inductions Paired with Forceps (%)*
1930-1946	0.0	0.0
1950-51	4.6	0.0
1955-56	19.0	11.1
1960-61	22.1	0. 0
1965-66	408.8	14.5
1968-70	470.9	14.6

Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

4.A.5 Forceps Types

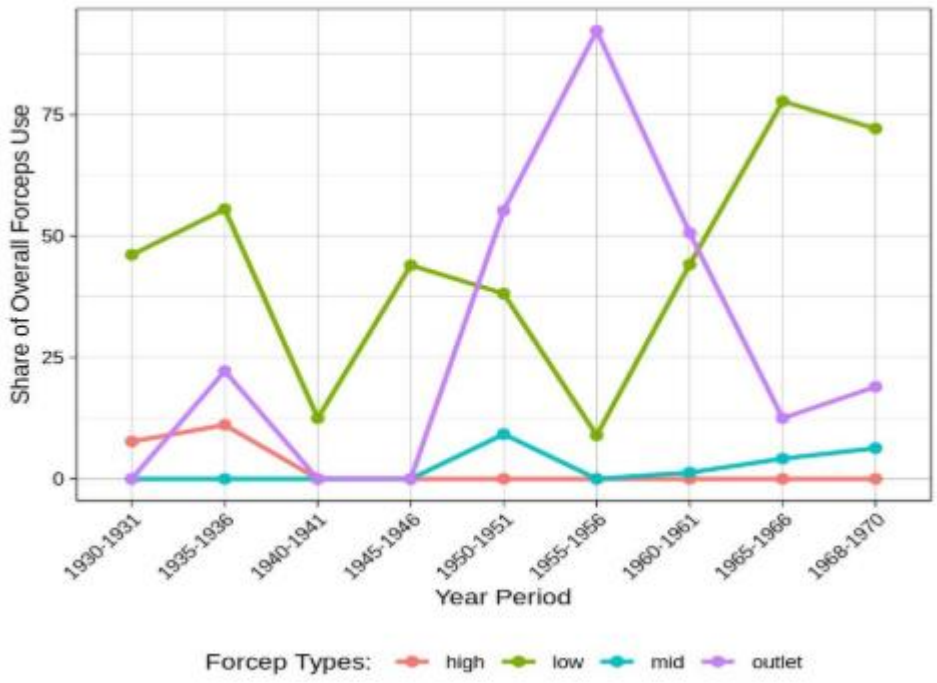
One way to examine the riskiness of forceps use is by the type of forceps used. Forceps can be classified into four types: outlet, low, mid, and high. This classification system uses the ways in which forceps are used as the classifier, and classifiers are defined by the station of the baby's head at the time of forceps engagement. High forceps denotes forceps used before the

baby's head has reached the pelvic cavity. This type of forceps use is no longer performed in modern obstetrics practice—the data only show a couple cases in the early observed periods. Mid forceps delivery denotes engagement of the baby's head more than 2 centimetres from the ischial spine (medically this is called above the +2 station). Low forceps delivery denotes engagement of the baby's head at +2 station or lower. Outlet forceps delivery denotes engagement of the baby's head after it has reached the perineal floor and its scalp is visible.

FIGURE 4.A.5 shows the share of total forceps deliveries for each of the four main types of forceps use cases. The shares do not add up to 100 always since there were cases not classified within the four common categories (such as piper forceps, or Simpson's forceps) or where the type of forceps used was not specified.

The Delivery Room Records show that the hospital had a clear preference for the least risky types of forceps—low and outlet. Moreover, there is almost no record of high forceps deliveries except for in the earliest period. The evidence suggested to me that the hospital was following best practice guidelines around forceps use and attempted to be as conservative as possible.

FIGURE 4.A.5: Share of Forceps Type for Forceps Deliveries



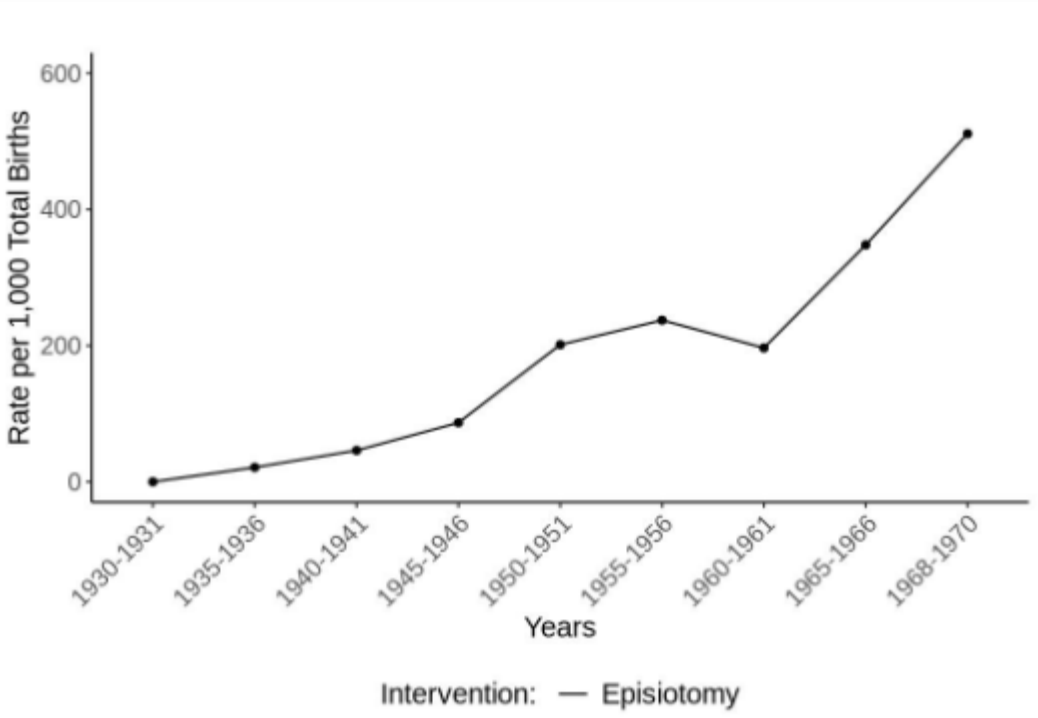
Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

4.A.6 Episiotomies

Episiotomies were the most common intervention in the dataset. However, they were typically used for births that should no sign of maternal or foetal risk. The rate of episiotomies rose considerably from 1930 to 1970, starting from 0 and rising to 51 percent of births. In the 1950s, obstetricians "began to espouse the use of episiotomies to shorten the labour and delivery process" (p. 307 Myers-Helfgott and Helfgott, 1999). Rates at Lincoln Hospital reflected the adoption of this new practice around the same time. Prior to 1950, episiotomies occurred in between 0 and 8 percent of all deliveries. Between 19 and 24 percent of cases received episiotomies from 1950 to 1961. The trend increased into the 1970s—over half of births received episiotomies in the 1968-70 period.

Episiotomies made access to the birth canal for forceps deliveries easier. (Myers-Helfgott and Helfgott, 1999). The connection between forceps births and episiotomies is clear in the data. The share of forceps cases that included episiotomies was 0 in 1935-36, 36 percent in 1945-46, 85 percent in 1955-56, and 90 percent in 1965-66.

FIGURE 4.A.6: Rates of Episiotomies in Lincoln Hospital



Source: Delivery Room Records, Lincoln Hospital (Durham, N.C.) records, David M. Rubenstein Rare Book & Manuscript Library, Duke University

This connection does not appear to be the only thing driving the sharp rise in episiotomies. The share of episiotomies that also included forceps use never exceeded 29 percent across the entire data set. Thus, the rise of episiotomies can be viewed as an independent change in obstetrical practices that had some influence on forceps use rather than the other way around.

The rates at Lincoln Hospital, high as they are, are below some of the averages found in survey literature. One thorough survey stated the episiotomy rate in US hospitals was 62.5 percent by the 1970s and was between 70 and 90 percent on first-time births (Thacker and Banta 1983). Other literature believes the rate peaked at 80 percent (Ghulmiyyah et al. 2020). So, while obstetricians at Lincoln Hospital intervened in births with episiotomies at an increasing rate, they did not do so more than other places. The hospital's episiotomy rates reflect the rise in childbirth medicalization that was occurring across obstetrics.